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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JULY 2, 1869.

THE FRENCH ATLANTIC CABLE.

THE operations in connection with this great enterprise are now in their most interesting phase, and so far as the work has been carried on, it is due to our readers that some description of these operations should be given, in order to continue the history from the point we left off at in a recent number. The movements of the "Great Eastern" have daily been chronicled since she left Sheerness and arrived off Brest, on the 21st, after a comfortable passage from Portland, which place, having taken on board the necessary amount of coal and all her passengers, she left on the morning of the 19th. Prior to her leaving Portland, accompanied by the "Scanderia," the "Chiltern" had arrived at Brest, and on the 17th had successfully laid from the shore 5½ miles of the heavy shore cable. The landing place was at Minou Creek, near Brest, where the cable end was laid in a deep trench to the small cable house. After paying out the length, which occupied but a short time, the end was let go with a buoy attached to it, ready for the "Great Eastern" on her arrival to splice on to.

The "Great Eastern," on her arrival on Sunday afternoon, anchored close to the buoy, which was lifted up by the "Chiltern" and the end passed on board. It having been decided to commence paying out at daylight in the morning, the splice between the shore end and the similar heavy cable on board was commenced immediately after the electrical tests proved the cable to be in good condition. The splicing of a heavy compound cable, such as this shore end, is a matter of considerable time, and occupied the whole night; by daylight, it was, however, accomplished, and lowered to the bottom; the anchor was then weighed, and the "Great Eastern" commenced her third submarine cable voyage across the Atlantic, weather fine, and everything promising success. The following tabulated statement, compiled from the telegrams received from the ship up to the latest date, will show the progress made :—

STATEMENT OF PAYING OUT.

Date. Noon.	Lat.	Long.	Distance run. Nautical miles.	Nautical miles payed out	Rate per hour.	Slack per cent.
June 22	48·30	8.55	174	—	5·5	—
" 23	—	—	294	310	5·5	5·5
" 24	48·30	13·53	377	405·7	4·0	7·6
" 25	48·34	17·06	497	542	5·7	9·0
" 26	48·37	18·57	574	635·9	3·9	10·8
" 27	48·32	22·01	697	775	5·8	11·2
" 28	48·22	25·11	823	916	6·0	11·3
" 29	48·6	27·50	920	1038	5·1	13·0

From this statement will be seen the gradual manner in which the water has deepened, a fact made perceptible by the increase in the amount of slack necessarily payed out. It will be noticed that between the 23rd and 24th the rate of paying out was much decreased; from what cause we cannot yet know, but the change which would take place about that time from the main tank to the fore tank would undoubtedly cause some delay. In the submerging of cables in deep water, this, to all on board, is the most anxious time, and is an operation requiring great skill and special attention. The difficulty is, however, reduced to its minimum by the employment of skilled hands—men who have been accustomed for years to similar work; and the principal foremen on board the "Great Eastern" are those who successfully managed these critical times in the old Atlantic cables.

All went well with the paying out until four in the morning of the 26th, when indications of a slight fault appeared, the insulation, or what is termed the "gutta-percha resistance," having fallen. The fault was of so minute a nature that it was impossible to localize it; so minute, indeed, as not to interfere in any way with the signalling, and it was wisely determined to proceed with the paying out. On the same day, in the forenoon, a second fault was found inboard and removed, the telegram stating "A fault was removed from cable inboard this forenoon." A third fault, however, appeared on the same morning, which was discovered in such time that it had only just passed out of the ship. It may be imagined how close it was when the telegram states "delayed this morning three hours cutting out a third fault close to ship." On the following day, the 27th, a most satisfactory telegram was forwarded from Sir D. Gooch :—"The 'Great Eastern.' Electrical condition perfect; I am glad to relieve you from all anxiety about the supposed fault. Weather very fine, and all well and hopeful." The original fault had evidently disappeared, and in all probability was in the ship. Since the above telegram, all has been going on well, and we trust that as telegram succeeds telegram their tenor may be precisely similar to the end of the chapter, "Electrical condition perfect."

It may not be uninteresting to show how, should a fault occur, immediate notice of the fact is given. Various plans of testing submarine cables during paying out have been tried, but all have their disadvantages. None, however, are in any way to be compared to the plan now adopted. This is the invention of Mr. Willoughby Smith, a gentleman of very great experience, the electrician engaged during the paying out of the old Atlantic cables, and who is again in charge of the electrical arrangements on board the "Great Eastern." This plan was first adopted in paying out the 1866 cable, and then in subsequent cables. It may be well to note here that the present system of working the Atlantic cables is due entirely to Mr. Willoughby Smith. In the old form of testing, the official at the shore end had to insulate the cable when any test was taken, and consequently was unaware of what was going on. In the present plan, a constant test can be kept up, with the knowledge of both ship and shore. The cable is attached at the shore end to a very high resistance through a galvanometer to earth. This resistance is so high that, on the ship keeping up a current from a large battery, the resistance is so great that a readable deflection can be obtained. A galvanometer is also inserted in the circuit on board the ship. If the current were maintained, the deflection on the two galvanometers would remain constant, and, during the paying out, these deflections would be constantly watched. If they remained constant, the cable remained in the same electrical condition; but, if they altered, they would show at once, both to ship and shore, something was wrong—to ship, by the increased deflection, that through a fault there was less resistance, and, consequently, more current flowing in to cause the increased deflection. On the shore, the effect would be different, as there being another method of escape, less current would arrive. By this means, we see how the appearance of a fault would be instantly detected.

The system of speaking or exchanging signals is very simple. By means of a condenser attached to the cable, which is charged with the same potential or opposite potential as the cable, the deflection is slightly altered in one direction or the other, and communication can be readily exchanged without interfering with the constant test. In addition, there are several arrangements for obtaining the measurement of the insulation and of the conductor, and also electrometers for measuring the potential, both on board ship and on shore, but space prevents our entering further into this question.

The strain in paying out is very small—less than one ton—although so long a length as seventeen miles will be in suspension in the deepest water, the resistance of the water itself to a cable of so light a specific gravity taking off the strain. The rate of sinking is estimated at three-quarters of a knot per hour.

The next occasion when we resume the history of this enterprise will, it is to be hoped, be on its successful completion; and as, in all probability, when this meets the eyes of our readers, more than one-half of the deep-sea cable will be submerged, we trust that our *resumé* will not take place until the whole is successfully and satisfactorily submerged.

Since the above remarks were written, an interruption to the successful paying-out of the cable has occurred. Something happened on the morning of the 30th, which necessitated the immediate cutting and buoying of the cable without any further warning being given than a simple notice of the fact. Unfortunately, the reason for doing so was not given, and we are quite in the dark as to what *contretemps* could have occurred. The place where the cable is now buoyed is under 2,000 fathoms of water, the ship, fortunately, having passed over the deepest part. No uneasiness is felt at Minou, and knowing the comparative ease and facility of repairing such cables, we must simply rest quiet with the conviction that in a few days all will be well.

The following telegrams are the latest to hand :—

THE FRENCH ATLANTIC CABLE.

The following telegrams have been received from Sir William Thomson :—

"Minou, Wednesday morning.

"Tests in Minou continue satisfactory up to present hour, 6.45, Greenwich time, Wednesday."

"Minou, June 30.

"Arrived here (Minou), from Brest, with Captain Osborn, noon. Telegram from Gooch of 9 a.m., Greenwich time, awaited him, saying they intended to cut the cable and buoy. This has probably been done, as no signals have come since then. We do not know the reason; the tests here up to 6·30 gave no cause for suspicion. Despatched 12.25, Greenwich time."

The following telegrams have been received by Reuter's Telegram Company (Limited), from Captain Sherard Osborn :—

"Minou, Brest, June 30.

"This morning, at 9 a.m., Greenwich time, 'Great Eastern' telegraphed to us :—'We are going to cut cable and buoy.' This has evidently been done, for no signals have passed since. A careful watch is being kept for a renewal of signals. The first sign of something being wrong in the electrical condition of the cable occurred early this morning, but nothing of a definite character until the above message reached us. We had a very long message at 11.34 p.m., Greenwich time, last night, from the 'Great Eastern,' at which time the signalling was reported by Mr. May to be most perfect. Despatched 12.10, Greenwich time."

"Minou, Brest, June 30.

"I see no reason for slightest alarm at what the 'Great Eastern' is doing. It was evident from the resistance of G. P., reported last night, that the slight fault of 25th was improving. Mr. May agrees with me in thinking they have buoyed in shoal water, and are returning to remove the fault. Delay is the only inconvenience."

NITRO-GLYCERINE AGAIN.

IT is now some time since we heard anything about this fearfully dangerous compound, and we thought that the warnings which have been given in the shape of fatal explosions—both at home and abroad—had led to the abandonment of its use in this country, and the substitution of the comparatively safe and equally efficient material—dynamite. It is not so, however, as a terrible explosion at Cwymglo, at the foot of Snowdon, on Wednesday afternoon, testifies. From various reports which have reached us, we gather that on Tuesday, a vessel, laden with nitro-glycerine, arrived at Carnarvon Bar, the cargo being conveyed in boats to Carnarvon Pier. Next day, five cartloads were dispatched, two for Assheton Smith's Llanberis Quarries, and three for Lord Penrhyn's Bethesda Quarries. When the former two were near Cwymglo, the nitro-glycerine exploded, blowing the horses and three men to atoms. The village, which is nearly a quarter of a mile off, was greatly injured, roofs and windows blown off, and, at the spot where the carts were, two round holes six feet deep and seven feet diameter were made; the railway station, forty yards off, was blown to pieces. The whole valley at the foot of Snowdon and two large lakes suffered a severe shock, the damage done all round the valley being very great. The shock was felt at Bangor, which is about nine miles from the scene of the accident. There has been, of course, hardly time for details yet, but up to the time of our going to press it had been ascertained that four deaths had resulted from the explosion, and that twelve persons were severely and seven slightly injured. An investigation into the cause of the explosion was opened yesterday and adjourned. We shall have more to say on this matter in our next.

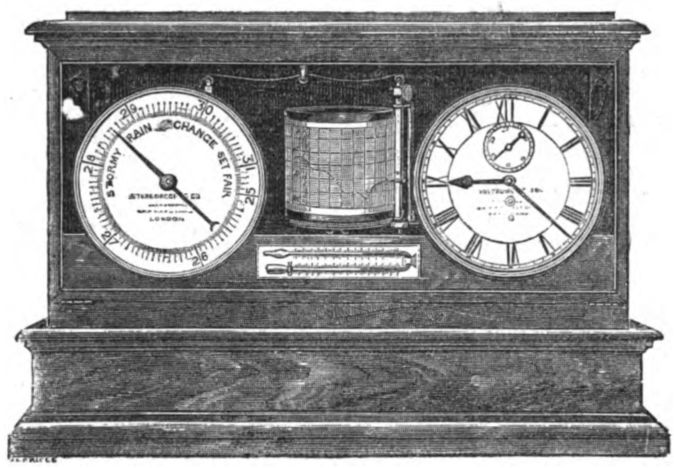
STEAM BOILER INSURANCE IN AMERICA.

HOWEVER unfortunate we in England may be in the matter of steam boiler explosions, no one can fail to have observed that our friends in the United States are still more so. The annual loss of life and property there from this cause must appear very large, even to the casual observer, whilst to those whose attention is frequently drawn to the subject, the results are really startling. It will be sufficient for the present purpose to allude to the record for the past two years, as it found its way into the papers. Such a record is of course a very incomplete summary of the number of lives lost, and the amount of property destroyed by boiler explosions in the time specified. Many explosions of a more or less serious nature are never reported by any newspaper, or, if reported, fail to meet the eyes of those interested in preserving an account of them. Incomplete, however, as it is, when we note the fact that, during two years, upwards of 800 lives have been lost in America by boiler explosions, and an immense amount of valuable property destroyed, ranging—in the various instances where any estimate was given—from 500 to 50,000 dollars, it demonstrates very conclusively the need of such a system of boiler insurance and inspection in that country as we have in our own. This necessity has been recognized—somewhat tardily, perhaps—by the Americans, who took a leaf out of our book, and in 1866 started "The Hartford (Conn.) Steam Boiler Inspection and Insurance Company," about which Association we have to say a few words. We are induced to do this from the fact that our journal finds favour in many parts of the States, where our persistent advocacy of boiler inspection is well known, and where the advantages of the system are admitted. If, then, the correctness of the principle be allowed, and if we point out to those who may not be aware of it, that American steam users have the same opportunities of making themselves safe as we in England have, there remains no excuse if they do not avail themselves of the means offered.

The Hartford Association is the pioneer company of the United States, and from particulars recently forwarded by a correspondent, we find that during the two years and a-half it has been in operation, it has extended its business by a system of well-appointed agencies over a great part of the country. Many of the largest manufacturers hold its policies, and its rapidly increasing business attests the value of its work. Its business is confined to no particular form of boiler, nor to any special class of manufacturers. It embraces ironworks, mines, cotton and woollen mills, saw mills, locomotives, steamboats and steam tugs, and, in short, all establishments where steam power is used. All boilers under its care are carefully inspected internally and externally by competent practical men four times a year. Steam gauges are tested, safety valves properly adjusted and weighted, boiler connections carefully examined, and information given relative to setting and management. The end and aim of all this, be it remembered, is economy in the use of fuel and safety to life and property. As a matter of course, the work of the company has brought to light many and dangerous defects; and there can be little or no doubt that disastrous explosions have been prevented. We know that where boilers are left unexamined for months and years together, incrustation, internal and external corrosion, burned plates and blisters, shorten their working age, and render them positively dangerous. The usual mode of inspection, applying the hydraulic test, takes no cognizance of these defects, and does but little towards insuring safety. The policy of insurance which the company issues, covers damage to boilers, buildings, stock and machinery, arising from explosions, and is a guarantee that the inspection has been thoroughly effected. It stands to reason that self-interest would cause the work to be properly done, inasmuch as the party making it has a pecuniary interest in its issue.

The company imposes no arbitrary conditions; it is interested in no patented appliances, but on receipt of the proposal for insurance, together with the inspector's report, the boilers are classified and accepted at a proper rate per cent., unless they are found on inspection absolutely unsafe, in which case the applicant is furnished with a written statement of their condition. Information relative to the management of steam boilers, monthly reports of the inspectors of the company, a list of explosions, so far as they can be obtained, for each month, and other valuable information, is disseminated amongst the policy-holders by means of a monthly paper called "The Locomotive." From what we have advanced, it will be seen that the Hartford Association is conducted upon equitable principles. The present remarks are penned with the view of promoting the interests of those steam users who are indifferent to them themselves, and of increasing public safety. We, therefore, trust that they may lead those who may read them, and who have hitherto held back, either from ignorance or obstinacy, to avail themselves of the manifest advantages of inspection and insurance. It is an old and oft reiterated opinion of ours, that it is due to the State that every man should adopt every precaution in his power to protect the life and property of his fellow subjects. A persistent disregard of this principle is a flagrant violation of the moral law which the State will not always permit with impunity to the offender.

SELF-REGISTERING ANEROID.



SELF-RECORDING ANEROID.

THOSE who have been in the habit of watching the barometer from day to day, and of recording its indications at stated hours, know that between the intervals of making the record, fluctuations in the index take place, which, if recorded, would furnish valuable data regarding the atmospheric pressure, important alike for immediate use and future investigations. Isolated observations are insufficient for many purposes. It is desirable to know also whether the pressure is increasing or decreasing, and the rate at which change is taking place. The hourly self-recording aneroid barometer is designed to supply this information, and the manner in which it does so will be best understood by a consideration of the construction of the instrument. It consists, in the first place, of a large and powerful aneroid barometer, with 8-inch dial, which, although the same in principle as those in general use, is specially constructed for this instrument, being furnished with a vacuum chamber of much larger area, thus securing increased sensibility, besides insuring the necessary amount of mechanical force to work the pencil connected with the hourly self-recording portion of the instrument. This arrangement consists simply of a light wheel, about 2in. in diameter, fixed on the centre arbor, to which is attached a length of light chain such as works round the fuzee of an ordinary watch. This chain is carried along the top of the instrument, over guide pulleys, until it reaches the pencil carrier which works on the guide rod. The pencil falls by its own weight, and is raised by an increase in the pressure of the atmosphere. This instrument was exhibited at the last meeting of the Meteorological Society by Mr. James Martin, of the London Stereoscopic Company, Regent-street.

We have examined one of these instruments (which is represented in the annexed engraving), and have also inspected a record made by it. A specimen vacuum chamber and wheel for winding the chain were also submitted to us. All the parts show evidence of sound workmanship. An eight-day clock, with 8-inch dial of special construction, having a pendulum 10in. in length, beating half seconds, furnishes the means of making an hourly record. Between the clock and the barometer revolves a vertical cylinder 4in. in diameter, having a paper attached to it, and near to this paper is fixed the guide rod supporting the pencil, which, by simple mechanism connected with the clock, marks its own position at every hour. The paper, besides being ruled horizontally into inches and tenths, to correspond with the barometer scale, is divided vertically into seven principal and seven minor divisions, indicated by darker and lighter lines. The light lines represent the noon, and the darker lines the midnight, of each twenty-four hours; the paper thus lasts one week. By these means, a black dotted curved line is produced, showing the height of the barometer, whether it is falling or rising, for how long it has been doing so, and at what rate the change is taking place—whether at the rate of 1-10th per hour, or 1-10th in twenty-four hours—facts which could only be obtained by very frequent and regular observations from an ordinary barometer, but which are nevertheless essential to a reliable "weather forecast," to say nothing of the ulterior uses to which these records may be applied in meteorological investigations.

There are two conditions upon which the scientific value of this instrument will depend, namely, the goodness of the clock and the accuracy with which the aneroid is compensated for temperature, and correctly graduated to allow for the effect upon the index, due to the work to be performed in moving the additional wheel, chain, and marker. It may be found advisable to diminish the length of chain by placing the marking mechanism by the side of the aneroid. There ought to be no difficulty with respect to the clock, which can easily be made to keep time within three or four minutes per week—a sufficient degree of accuracy for the purpose. With due care, the aneroid could be brought to sufficient perfection to show on the record the barometric pressure at the standard temperature —32deg. Fah.—correctly to within 0·01 or 0·02 of an inch. The degree of accuracy, however, can only be ascertained by proper comparisons with a standard barometer. It would be desirable to determine whether the error of indication is constant, not only throughout the scale but both when the marker is rising and when it is falling. These points we indicate for the guidance of the manufacturers as well as of observers who may use the instrument. The former should direct their attention to them because the demand for the instrument will, doubtless, depend upon the degree of accuracy which can be imparted to its records. We have had no means of testing its accuracy ourselves, but shall be glad to give publicity to any authentic verifications which may reach us.

MANUFACTURE OF CAPS AND CARTRIDGES.

No. VIII.

THE cartridge cases being completed and ready to be filled, are despatched to have this final operation accomplished. The gunpowder is supplied by the war authorities, who forward it to the premises in casks, containing about a couple of hundredweights. These casks are carefully stored in a powder magazine, which is isolated from all neighbouring buildings, and surrounded by four massive walls, constructed of earth and stone. A small tramway is laid down for the transport of the powder to and from those parts of the establishment where it is needed. The building in which the filling of the case is conducted is also separated from its neighbours, and divided into a number of interior compartments. The powder is conveyed to one end of an apartment containing a weighing machine, in which the cask is placed, having been previously opened with a bronze chisel. This instrument is employed instead of the ordinary one of iron, for fear of a spark being generated by the violent contact of the latter implement with a nail or other hard foreign substance that might by accident be present. The weighing machine is furnished with a leather funnel, which conducts the powder into large copper jugs. Similarly to all the other workshops where the manipulation of the powder is carried on, the floor of this apartment is covered with oilcloth, in order to facilitate the complete removal of what escapes in the various operations it undergoes, and all projections of the walls are papered to prevent it adhering to them. Although there is not much danger with this as with the fulminating powder, yet it is wisely considered that too much precaution cannot be taken to obviate the chance of accident. In order to guard against the accumulation of too large a quantity of powder in the interior of the workshops, a number of hoppers are ranged in a corridor running parallel to the wall of the workshops. These hoppers are protected by shields of wrought iron, which are pierced with holes communicating with the interior of the workshops. It is into these hoppers that the foreman empties the copper jugs containing a charge of about nine pounds. The principle of "division of labour," which is carried into universal practice throughout the whole establishment, does not permit the same workman to begin and finish a job. Thus, the women who fill the cartridges never leave their place. The empty ones are supplied to them and the full ones taken away by a special provision, with which they have nothing to do. There is one entire apartment devoted solely to placing the empty cartridge cases into frames pierced with holes to receive them. These frames, resembling a hand in shape, and holding half a hundred cartridges each, are subsequently transported by a small lorry into the charging rooms.

In each of these rooms there are two tables ranged along the sides, behind which women are seated, and another in the middle, at which a woman stands up. Upon this central table the frames, with the empty cartridge cases, are deposited, the opening being upwards. The woman seizes each of them by the smaller end—technically speaking, by the wrist—and pushes them through the hole in the wall communicating with the hopper, at the same time pressing upon a piece of mechanism similar to that which distributes the fulminating powder in the caps, as already described. After withdrawing the frame with the charged cases, she passes them to the other tables, where the wad and the ball are introduced, and they are ultimately conveyed away from the room by the same means by which they were transported thither.

Before continuing the description of filling and finishing the cartridges, it is necessary that some notice be taken of the balls and the manner in which they are cast. We have long since renounced the primitive spherical ball, and engineers, both civil and military, have taxed their inventive powers to the utmost to improve these warlike missiles. For a long time, the solid conically-cylindrical grooved ball was the favourite projectile, but under certain circumstances it has been found that it is sufficient to make the conical part only solid, provided the cylindrical portion was strong enough to take the rifling. It was, therefore, proposed, in the case of converted guns, to introduce into the hollow of the ball a small cylindrical core or cut plug, out of a roll of compressed paper. The balls in the cartridges intended for converted guns are of lead, solid in the conical part and hollow in the cylindrical, for the purpose of receiving the core. This latter is of paper, and cut by means of circular knives. The section gives a cylinder, which is placed under the action of a machine furnished with a punch and die, and is reduced to the exact form of the cavity it is destined to fill. The balls are cast in a mould, closely resembling that used for casting type in. A cistern or copper, supported by brick foundations, contains the lead in a state of fusion, around which the workmen are gathered. They ladle out the molten metal into the moulds, and the balls are subsequently drawn out in bunches, being held together by a strip of lead. They are then plunged into a melted mixture of fat and wax, in order to cover them with a coating of grease sufficiently compact, when cooled and coagulated between the grooves, to preserve the edges. The next step consists in cutting off the balls one by one from the bunches, and in handing them over to a gang of boys, who place the core in the cavity and transfer them to another gang, who fix it by a blow from a machine, which, at the same time, compresses the metal, shortens the ball by increasing its lateral dimensions, and increases the density of the solid conical part. Previous to these operations, all the balls that are badly and imperfectly cast are rejected; so also are those which fail in the stamping and forging of the core, and there is a considerable percentage when both operations are taken into account. The rejected balls are thrown into a furnace, where the core or plug is consumed and the metal run into ingots, ready for future use. All the balls that fulfil the required conditions of size and shape are despatched to the filling premises described above, where they are inserted in the cartridges.

It must not be supposed that the manufacture is quite completed yet. The cartridges have still to be tested, gauged, and the ball securely fixed, so as to avoid all chance of its getting loose from the case containing it. This last operation is accomplished in a very ingenious manner. The cartridge is placed with the copper end downwards in a socket, and quickly submitted to the grip of a description of pincers with four arms, the joining of which by an encircling ring produces a circle. Between these arms the ball is placed. A blow from a lever causes the ring to descend to close the arms of the pincers, and make an indented circle round the ball, while at the same moment it compresses the paper and the tinsel of the cartridge case in the first groove of the ball, thus firmly fixing it to the case. In fig. 1 is represented a

FIG. 1.

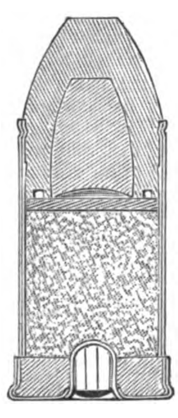
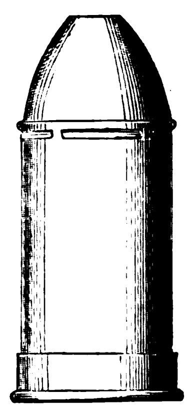


FIG. 2.



longitudinal section of the finished cartridge, showing the ball and the core; and in fig. 2 an elevation of the same, where the junction between the ball and the case is distinctly visible. The cartridge is now completed.

They are made up in packets of six, and stowed in cases well packed with hemp. A permanent commission is deputed to take at hazard every day five hundred of these cartridges and fire them off; and if more than one in a hundred miss fire, it is sufficient to cause the rejection of the supply tendered. There is never a missfire oftener than one in a thousand, although, in the converted gun, the point driven by the hammer only strikes the cartridge obliquely. It is the little anvil that insures a freedom from missfires, for it always opposes a hard surface to the point striking upon the priming, at whatever angle the blow may be made.

THE ROYAL INSTITUTION.

THE lecture by Mr. H. C. Fleeming Jenkin, F.R.S., on Submarine Cables, was delivered on May 21, and has already been published by us. At the close of the lecture, Messrs. O. and F. H. Varley, telegraph apparatus manufacturers, exhibited in the library some interesting specimens of corals and oysters, gathered from the Malta and Cagliari cable, during the picking up from depths varying from 60 to 300 fathoms. They also exhibited some newly invented apparatus now in use on board the "Great Eastern," for the testing of the French Atlantic cable, including a double slide and subdivider, the joint invention of Sir William Thomson, Mr. Fleeming Jenkin, and Mr. Cromwell F. Varley. The double slide comprises a series of 101 coils, the resistance of each being adjusted to equal 1,000 British Association units or Ohms. The second slide or subdivider comprises 101 coils of 20 Ohms each. The coils of the double slide and the subdivider are connected to separate terminal plates, by which contact is made through a strong spring attached to a carriage, made to travel on two parallel rails. The position of the carriage read off on a divided scale determines the value of the potential. The subdivider is a looped circuit, and subdivides the reading of the double slide 100 times. When the double slide and subdivider are joined together, the resistance of the double slide is reduced from 101,000 to 100,000 Ohms, 1-100th of the current flowing through the subdivider; and as this has 100 divisions, a reading to five places of figures to be obtained, this transferred to a table of reciprocals, gives the value of the potential.

Another piece of apparatus for testing the French Atlantic cable was a new electric balance, the invention of Mr. C. F. Varley, C.E. This balance has a slide capable of multiplying from 1-1,000,000th to 1,000,000 times, without altering the resistance in circuit, or affecting the actual potential when obtaining a reading. It can with great facility be made to measure a very small amount of resistance—for instance, that of the conductor of a cable—and then without any change of connections in the balance, give the value of a very large resistance; for example, that of the insulator of the cable, which frequently in good cables amounts to from 300 to 8,000 millions of British Association units. This instrument is capable of giving the most extended range for electrical determinations, and the results are read off direct without any further arithmetical process than one of simple subtraction.

On Saturday, May 22, Professor Seeley gave another lecture at the Royal Institution on "Roman History"; and on Tuesday, May 25, Professor Grant delivered his eighth lecture on "Stellar Astronomy," in which he called special attention to the nebulæ. On Thursday, May 27, Professor Tyndall delivered his eighth lecture upon "Light." In it, he described the different methods of polarizing light, and closed by examining the light transmitted by Iceland spar.

NOTICES OF BOOKS.

THE name of Mr. Thomas Box will be familiar to many of our readers as the author of two very useful treatises—one on hydraulics and the other on heat. He has now given students and beginners another equally useful work on mill gearing,* which treats of the subject generally, including wheels, shafts, riggers, &c. Here the student will find himself made easily familiar with all the puzzling details of the forms, proportions, powers, &c., of wheels, as well as shafting, with its bearings, couplings, cranks, and strains. Riggers and pulleys, and the various methods of keying, are also described, the whole being illustrated by eight clearly drawn lithographed plates. Like Mr. Box's other treatises, the one under notice possesses the recommendation of being clearly and simply written, whilst, at the same time, it is thoroughly practical.

An attempt to solve the old question, "What is matter?"† has been made by an Inner Templar, in a volume full of theory and speculation, but still, doubtless, interesting to those who pursue the study of physical science to the utmost limits of conception. Our author admits the many unsuccessful attempts which have been made in all ages by philosophers to solve the problem of the world's existence. He has read deeply upon the subject, absorbing into his mind the heterogeneous ideas of every eminent man from Thales to Kant, and then, as he tells us, without making a single experiment, and with only a ruler and a pair of compasses, he has constructed "an edifice which, harmonizing in all its parts, will defy all the insidious workings of time, with all the power that either talent can produce or ingenuity afford." For the details of construction of this "harmonious edifice" we refer our readers to the work itself, merely observing that, as a rule, we find true genius less boastful and defiant than the genius of the Inner Temple.

We have received two books from Messrs. Atchley and Co., the architectural publishers. The first is a volume of carefully prepared illustrations of Kettering Church, and which have just been revised by the author. The plates are twenty in number, and comprise plans, elevations, sections, and details of this interesting specimen of ecclesiastical architecture. They are preceded by descriptive matter and some historical remarks. This church is one of a class peculiar to the district in which it is situated. It has a lofty spire, whilst the body is comparatively stunted, although on examining the interior views of the edifice its capacious character is at once apparent. There are some points of detail about the church well worthy the notice of the professional architect, whilst, at the same time, there are others which are to be avoided.

The other book to which we have referred is "The Architect's Guide" (Atchley and Co.), which is the production of Mr. W. Davis Haskoll, Mr. R. W. Billings, Mr. F. Rogers, and Mr. P. Thompson; the late Mr. George Rennie having contributed the results of numerous experiments. It is a book full of information relating to building, surveying, and similar matters, the value of which is guaranteed by the names of the authors. It will be found a most useful office or pocket companion to engineers, architects, surveyors, builders, and all who are connected in the work of construction. It contains some practical wrinkles well worth knowing.

"The Ruthven Hydraulic Propeller *v.* the Screw and Paddle" is the title of a pamphlet (Haddon and Co., 29, Budge-row), in which the former is proved to have attained a great superiority over the latter. Mr. Ruthven's system of hydraulic propulsion has been fully described and illustrated by us in a previous volume, and its performances have been recorded. The proof of superiority over the screw lies in the fact that the "Waterwitch," at the Maplin Sands measured mile, attained a speed of 9·9 knots with 834-horse power, whilst the "Viper" and the "Vixen"—double screws—competing vessels, attained a speed of only 9·1 and 9·2 knots with 707 and 751-horse power respectively. For the interesting details of these and numerous other trials we refer our readers to the pamphlet under notice.

An epitome of the progress of the trade in coal to London since the year 1775, has just been published by Mr. J. R. Scott, 32, Coal Exchange, London. It contains a great deal of information which cannot be otherwise than acceptable to those engaged in the coal trade. It is accompanied by a map of the coal duty district, and includes returns of imports, averages of prices, yearly summaries, yearly tonnage of vessels, &c. This useful little book is to be re-issued, with additions, in January every year, so that our coal merchants may annually post themselves in the statistics of the trade at an early period. As an example of the information conveyed, we extract the following table of the quantity of coal which entered London during the last ten years, which also shows the progress made by the railways:—

Year.	By sea. Tons.	By railway. Tons.	Price per ton. s. d.
1858	3,266,446	1,190,521	18 5
1859	3,299,170	1,191,169	18 4
1860	3,573,377	1,477,546	20 1
1861	3,567,002	1,642,502	19 6
1862	3,442,402	1,513,296	17 7
1863	3,335,174	1,775,487	18 2
1864	3,166,703	2,342,440	20 1
1865	3,161,683	2,733,056	20 2
1866	3,033,193	2,969,896	20 1
1867	3,016,416	3,295,652	20 8
1868	2,931,230	2,979,333	18 7

The Health Committee of Liverpool have issued the report of their engineer, Mr. James Newlands, which contains a vast array of facts and figures of special interest to the inhabitants of the borough. Besides this, however, there are many things well worthy the attention of boards in other cities and towns. Tramways, sewerage matters, steam road-rolling, &c., are items to the point. The report is printed by Tinling and Co., 44, Cable-street, Liverpool.

The principles of book-keeping are popularly explained, and the theory of double entry analyzed, in a small volume just published by Lockwood and Co., 7, Stationers' Hall-court. It is written by an experienced book-keeper, late of H.M. Civil Service, and will be found useful by young men commencing business, candidates for civil service appointments, and students generally. The author lays down the principles of book-keeping so simply, and illustrates them by such clear examples, that he cannot fail to be understood and appreciated.

Mr. Henry Laxton has compiled a most useful series of tables for workmen's wages, published by Letts and Co., Royal Exchange. The tables are easy of reference, and contain upwards of 7,000 calculations for the use of mechanics and others. Rates of wages are shown at per year, half-year, quarter, calendar month, lunar month, week, day, and hour. From the same publishers we have some samples of sectional drawing paper which they have lately introduced, and which will prove very useful to engineers, architects, surveyors, &c. They do not claim for them any superior merit or mathematical exactness, but put them forward rather as a cheap paper, on which rough plans can be drawn to scale, and coloured without the ruled lines showing objectionably through the work. Messrs. Letts have also issued a book of labels, useful for shelves, books, flowers, &c. They are gummed on the back, and are torn

* "A Practical Treatise on Mill Gearing." By THOMAS BOX. London: E. and F. N. SPON, 48, Charing Cross. 1869.

† "What is Matter?" By an INNER TEMPLAR. London: WYMAN and SONS, 74, Great Queen-street, Lincoln's Inn-fields. 1869.

‡ "Architectural Illustrations of Kettering Church Northamptonshire." By ROBERT BILLINGS, architect. ATCHLEY and Co., 106, Great Russell-street, W.C. 1869.

out of the book and from each other in the same way that checks are, being perforated on the postage stamp principle.

Mr. R. Brandon has issued a second edition of his pamplet on cheap railway fares (Bell and Daldy, York-street, Covent Garden). Mr. Brandon shows that fares for any distance of 1s. first class, 6d. second class, and 3d. third class (existing fares below these rates remaining as at present) would be remunerative to the shareholders, beneficial to the public, and profitable to the State.

Intending emigrants to Canada should read a pamphlet describing the soil, climate, resources, institutions, &c., of the province of Ontario. It is issued by the Government of Ontario, and we believe it is to be obtained from Mr. W. Dixon, 11, Adam-street, Adelphi, London.

The "British Workman," the "Band of Hope Review," and similar publications, come to hand every month from Messrs. Partridge and Co., 9, Paternoster-row. We cannot too warmly commend them to the notice of those who are interested in elevating the moral standard of our working classes. They contain matter of interest to all classes. Take, for instance, the last number of the "British Workman," which contains a beautiful page engraving of our sea birds, by Harrison Weir, and an interesting notice of them. The bill recently introduced into Parliament for the preservation of sea birds forms the text of some excellent remarks, in the course of which we read that the diminution of the birds on our coasts is something astonishing to those who can remember their numbers a few years since, before the multiplication of railroads and steamboats brought crowds of pleasure seekers to the seaside. Around the South Stack Lighthouse, near Holyhead, the birds are protected on account of their services to sailors; but on Puffin Island, also on the Anglesey coast, the birds which gave their name to the rock are almost extinct. On the Great Orme's Head sea-fowls formerly abounded in such numbers that guns were fired from steamboats when passing the promontory, that those on board might see them rise in crowds when startled by the noise; now they are few indeed. On the Yorkshire coast they bear the name of "Flamborough Pilots." Were the fashion of decorating hats with the feathers of our native birds to become obsolete, one great cause of their devastation would cease to operate. Some years ago, the beautiful kingfisher, the gayest and most tropical-looking of our feathered compatriots, was threatened with extinction; and now the denizens of our cliffs are in danger. An order was lately given to the keeper of Ailsa Crag for 1,400 kittiwakes. If this demand is a sample of what occurs in other places, the wonder is that any birds are left. We are glad to find that through the exertions of some gentlemen in Yorkshire, who are interested in natural history, an influential association has been formed for the protection of sea birds during the breeding season. Contributions and suggestions in aid of this good object will be thankfully received by the Rev. H. F. Barnes, incumbent of Bridlington, one of the secretaries of the Association. It is chiefly through the efforts of this Society that the Act of Parliament has been obtained for the protection of the sea birds.

We have received another copy of the "Aerostatic Magazine" for 1869, but inasmuch as we noticed that periodical in our issue for April 2 last, we need do no more here than acknowledge its receipt.

NOTES ON RECENT SCIENTIFIC DISCOVERIES, AND THEIR PRACTICAL APPLICATIONS.

TO OBTAIN OXYGEN WITHOUT EMPLOYING HEAT—TO GIVE A GOLDEN APPEARANCE TO STEEL PENS—TO BRONZE PORCELAIN, STONEWARE, &c.—NEW PROCESS FOR PRESERVING MEAT FRESH.

WE have already published one or two processes for getting oxygen without the employment of heat. They are necessarily expensive, and not applicable to industrial purposes. But small quantities of pure oxygen are sometimes required when cost is of no importance, and simplicity of manipulation everything. Böttger, who devised the process, takes equal weights of peroxide of barium and peroxide of lead, and having mixed them together, adds some very weak nitric acid. Active effervescence immediately commences, and it is found that the gas evolved is pure oxygen. It will be seen that, according to Schönbein's theory, one of the peroxides employed evolves ozone, and the other antozone, or oxygen in the positive and the negative states, and these combine as they are given off to form neutral or ordinary oxygen. This process is of more scientific than practical interest; but it may be useful perhaps when small quantities of oxygen are required for medicinal purposes.

Böttger also tells us how a golden appearance may be given to steel pens, which may not be new to all our readers, and which is so troublesome that the result could hardly pay. The pens are first coated with copper by means of a battery and the ordinary cyanide solution. Then a very thin coating of zinc is given by the use of a weak battery, and a moderately strong solution of sulphate of zinc. The pens are then scoured with chalk and water, rinsed and dried, and afterwards thrown into boiling linseed or cotton seed oil, where, in a few minutes, they assume a colour closely resembling that of gold. Böttger tells us that the colour comes at about 350deg. Fah. The pens have now to be cleansed from the oil, which every one knows how to do.

The same industrious technologist gives a simple bronzing process applicable to porcelain, stoneware, and composition picture and looking-glass frames. The articles are first done over with a thin solution of water-glass by the aid of a soft brush. Bronze powder is then dusted on, and any excess not adherent is knocked off by a few gentle taps. The article is next heated, to dry the silicate, and the bronze becomes firmly attached. Probably, in the case of porcelain, biscuit, or stoneware, some chemical union of the silicate will take place, but in other cases the water glass will only tend to make the bronze powder adhere to the surface. After the heating, the bronze may be polished or burnished with agate tools.

The meat supply is a question of so much importance to our industrial classes that we add another to the many processes for preserving fresh meat we have already communicated to our readers. This process is of French origin, and we borrow our account of it from a report to the Société d'Encouragement, of Paris. M. Gorges (who bears an appropriate name) first immerses the meat in a mixture consisting of 85 per cent. of water, and the remainder glycerine, hydrochloric acid, and bisulphite of soda. When withdrawn from this bath, the pieces (which may be from four to a hundred pounds in weight) are dusted over with powdered bisulphite of soda, and closely packed in tinned-iron cases, and soldered down. The meat, it is said, will keep fresh and juicy for any length of time, and, when the cases are opened, the joints will look as though they had been cut only a quarter of an hour before. The flavour of sulphurous acid they will certainly possess can, we are told, be easily got rid of by washing them with vinegar and water, and leaving them in the air, to which they may be safely exposed for eight and forty hours. However inventors may differ as to the means they employ, they all agree in telling us that meat prepared by their processes in South America can be sold at a profit in London or Paris for 2½d. or 3d. per lb. It is curious that no one seems to have the courage to speculate with a cargo. When it is certain that no cooked preserved meats will ever come into general use for home consumption, all these processes for keeping meats fresh deserve attention. The one we notice now does not, we confess, look very promising. We have no doubt the meat is kept sweet, but cannot help thinking that the taste of sulphurous acid will stick to it.

SCHOOL OF NAVAL ARCHITECTURE.

THE next examination for the admission of persons into the Royal School of Naval Architecture and Marine Engineering will commence, by direction of the Lords Commissioners of the Admiralty, on July 19. The pupils will be selected by competitive examination, the subjects for which, and the number of marks assigned for each, are as follows:—Pure mathematics, including arithmetic, mensuration, geometry (plain and descriptive), plane trigonometry, and the elements of the differential and integral calculus, 2,500 marks; applied mathematics, including mechanics and hydrostatics, 1,000 marks; practical shipbuilding, including "laying-off" (for shipwright candidates only), 2,500 marks; practical marine engineering (for engineer candidates only), 2,500 marks; French, 500 marks; elements of physics and chemistry, 750 marks; English grammar and composition, 750 marks; geography and history, 750 marks. The last four subjects, although counting in the competition, will not be considered obligatory. No candidate will be admitted who does not obtain at least two-thirds of the full number of marks in the two first-named subjects, and three-fifths of the full number either for practical shipbuilding or marine engineering.

THE PROPOSED CHANNEL TUNNEL.

YESTERDAY week, a committee of the promoters of the project for a submarine tunnel between Dover and a point near Cape Blanc-Nez, on the French coast, had an interview at the Board of Trade, Whitehall-gardens, with the Right Hon. John Bright, President of the Board. Lord Richard Grosvenor, M.P., chairman of the committee of promoters, introduced the deputation, which included Admiral Elliott, Messrs. William Hawes, Stephenson Clarke, John Hawkshaw, C.E., James Brunlees, C.E., William Lowe, C.E., Thome de Gamond, C.E., and William Bellingham, secretary. In introducing the deputation, Lord R. Grosvenor explained to Mr. Bright the steps that had been taken to promote the object. The subject had been brought under the consideration of the Emperor Napoleon and the Imperial Government of France, by whom a commission of scientific men had been appointed to examine and report. The commission had reported in favour of the scheme and its practicability. The promoters ventured to think that, in an important international work of this character, involving very large expenditure, it would not be considered unreasonable in them to look to the two Governments of England and France for a certain degree of material encouragement and support. They accordingly respectfully solicited the two Governments to guarantee each 2½ per cent. upon two millions sterling to be applied to the driving of two parallel mining headings or drift-ways from shore to shore. The French Government were waiting to see what action the English Government would take in the matter, and the object of the deputation in waiting upon Mr. Bright was to ask respectfully that Government would take the subject into consideration. Mr. Bright asked a number of questions chiefly affecting engineering points, and the practicability of the scheme. The questions were answered by the engineers and others of the deputation to the satisfaction apparently of the right hon. gentleman, who engaged to take an early opportunity of bringing the matter under the consideration of the Cabinet.

THE CRYSTAL PALACE.

THE grand musical festival and fête at the Crystal Palace, in honour of his Highness the Viceroy of Egypt, which took place last Tuesday, was unquestionably the great success of the season. It is only at the Crystal Palace with all its accessories that such a success could be achieved. The orchestra comprised about 4,000 performers, who, under the able and precise leadership of Sir M. Costa, rendered the various pieces of the programme, both instrumental and vocal, with the highest effect. The pyrotechnic fête was on a scale of unusual magnificence, and it is not too much to say that such a display was never seen elsewhere. The facilities afforded by the terraces, the fountains, and the grounds at Sydenham, are most advantageous for the development of the scenic effect obtainable by the aid of pyrotechnic art. The festival was honoured by the presence of the Viceroy, the Prince and Princess of Wales, Prince Arthur, and the Prince and Princess of Teck. The official returns show that 33,628 visitors availed themselves of an opportunity rarely offered even by the enterprising and successful managers of the Crystal Palace Company.

METHOD OF FISHING AND CATTING ANCHORS WITH ONE HOIST.

BY MR. E. S. GRIFFITHS.

Fig. 1.

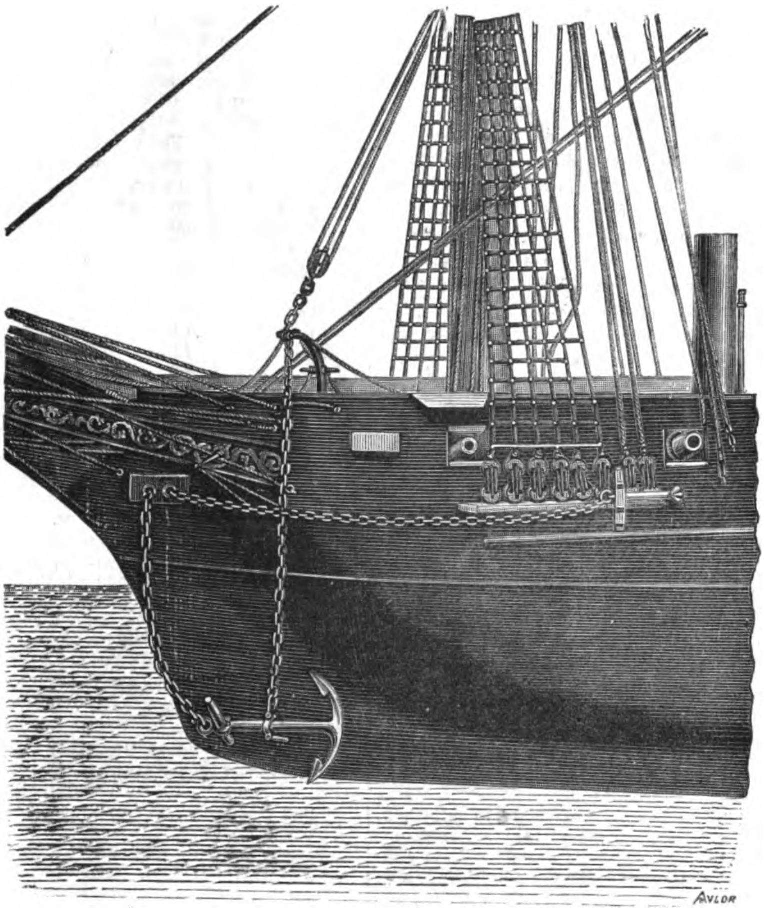
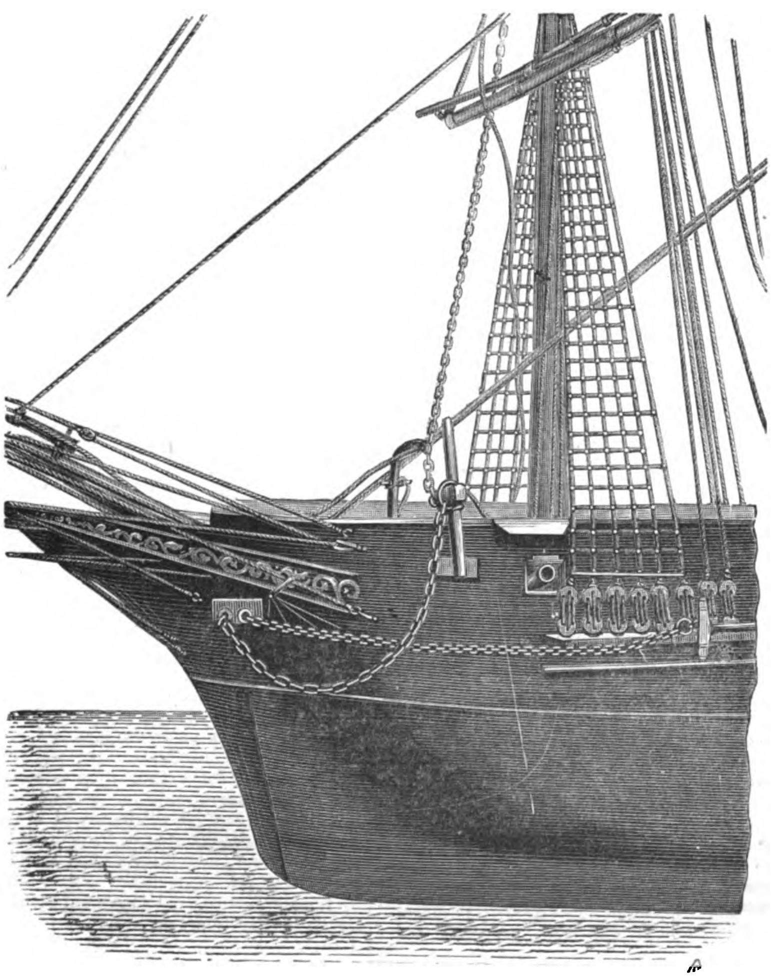


Fig. 2.



FISHING AND CATTING ANCHORS WITH ONE HOIST.

MR. E. S. GRIFFITHS, of 19, Cavour-terrace, Sheerness, has just patented the improved method of carrying anchors inboard after weighing illustrated in the accompanying engravings. Mr. Griffiths' invention is carried into effect in the following manner:—He secures to a shackle on the anchor, about the middle of the shank, one end of a pennant, the other end of which is attached by a loose shackle to the cable. When the anchor is weighed, the pennant passes through the hawse pipe with the cable. The pennant is then detached from the cable and attached to a chain passing over a block on a davit, and then led through the hawse pipe. The men then haul on the chain so as first to draw the pennant back through the hawse pipe, and then to raise the anchor up to the davit, when it can be stowed or secured inboard, the cable being slacked as required. The davit is free to turn on a vertical axis. The pennant may have a long link about the middle thereof to facilitate the lifting of the anchor if fouled.

In our engraving, we have shown Mr. Griffiths' apparatus in the several positions it occupies. Fig. 1 represents the bow of a vessel with the pennant secured to the shank of an anchor of the ordinary construction; it is secured at about the middle of the shank by means of a link or shackle. In this figure, the anchor is shown as lifted up to just below the top of the water, and, after the pennant has been roved through the eye or block of the davit, the cable being allowed to run slack to take off the strain and unnecessary pull when the pennant is lifting. Fig. 2 shows the same anchor lifted by the pennant over the gunwale and stowed inboard. It will be observed in fig. 3 that the pennant passes through the hawse hole and is in connection with the cable by means of a loose shackle, while the anchor is hanging from the bows and is ready to be cast. In some cases, the ring is fitted with a long link for attaching the pennant to.

In fig. 4 we have shown a short length of chain connecting the lower end of the shank with the cable ring; to this chain the pennant can be secured as shown, so that the anchor can be lifted in a more suitable manner for stowing. In this figure, the anchor is of the construction known as Porter's Patent. Fig. 5, which will be found on page 11, represents an anchor which has become fouled by the cable being coiled round one of the fluke arms. In accidents of this kind, Mr. Griffiths' pennant is particularly serviceable, as the anchor can be lifted by the pennant level with the gunwale of the vessel, and the fouling removed by the seamen from the deck, in addition to preventing risks to the lives of the seamen engaged. The anchor can be held and suspended by the pennant, to be let go at any moment by means of a slip stopper.

The following are amongst the advantages of Mr. Griffiths' method of fishing and catting anchors:—The anchors can be lodged on the bill board in safety, and can be carried aft or inboard with much more ease than by any of the present arrangements. As soon as the pennant comes in the hawse pipe there is no further necessity of surging the cable, as the anchor is placed on the bill board without any further trouble. There is no necessity for a man to go over the bow to hook the cat or fish, thus doing away with the hazard of human life, more particularly with a foul anchor. On a lee shore there is the advantage in the arrangement of stowing the anchor in a much quicker time, so that the vessel's weigh shall not be obstructed. In consequence of using the pennant in connection with the davit, the anchor is prevented from fouling at the fore foot, and it is brought up clear of the ship without injuring the bow. By having a long link in the middle of the pennant, the lifting of the anchor will be facilitated in the event of fouling. The anchor can, by being brought to the davit, be carried either on the bill board and stowed or be placed on deck, if required, with much less help; and the same appliance will hoist it out where required to great advantage. The pennant, with the assistance of a back line, is brought to the purchase. The anchor being stowed and the pennant passed back through the hawse pipe and connected to the cable, it is ready for use. By taking the lashings off the anchor, it is suspended by a slip stopper ready for letting go the anchor when required, and the anchor will fall clear of the bow without damaging or fouling.

For long voyages there is no necessity for a second catting, as the anchor is at once in place If the stock of the anchor becomes defective or

damaged it can be repaired, and the same appliance that brought it in can take it out to a great advantage of labour. For all coasting vessels—such as smacks, brigs, steam colliers, &c.—it can be fitted at a much less cost than is done at present. The pennant proposed can be used at the ring, shank, flue, or span, to fetch the anchor to the bow already for stowing, by the assistance of the single pennant, which would by the same purchase land the anchor inboard. These appliances may be used athwart the deck by the assistance of a fore and aft purchase. The invention can be adopted to all sized craft and any form of anchor, bringing it inboard, if required, either with or without the cathead or davit; the same can be done without either the cathead or davit, providing they were carried away by the burton or fore tackle.

H.M.S. "INCONSTANT."

THIS fine screw frigate made her official trial trip on Wednesday last, at the measured mile in Stokes Bay. The trial was commenced at full boiler power, and two runs had been made over the mile, when it was found that the wheel ropes of the rudder had became slackened. In consequence of this, she had to be taken off the mile in order that the ropes might be adjusted. This mishap placed the machinery at a disadvantage, and as the bearings had become heated, and considerable water had been made, the trial was brought to a somewhat abrupt termination. Only five out of six runs at full boiler power were made, leaving the runs at half-boiler power and the circles uncompleted. The "Inconstant" was intended to run at the rate of fifteen knots per hour, and under the above adverse circumstances she attained a mean speed of over sixteen knots. The following is the result of the five runs made at full boiler power:—

		knots per hour.
1. 3min. 42sec.,	being at the rate of	16·216
2. 3min. 51sec.	" "	15·584
3. 3min. 28sec.	" "	17·308
4. 4min. 6sec.	" "	14·634
5. 3min. 27sec.	" "	17·391

The engines of the "Inconstant," which were manufactured by Messrs. Penn and Son, are of 1,000-horse power nominal, with 112-inch cylinders, 38-inch trunk, 104½in. effective diameter, and 4ft. stroke. She is fitted with a two-bladed Griffiths' screw propeller of 23ft. diameter, and an average pitch of 24ft. The machinery is similar to that supplied to the "Bellerophon." The draught of water forward on the recent trial was 20ft. 9in., and aft 24ft. 9in. There was considerable vibration, especially aft, but not nearly so much as on the occasion of her preliminary trial.

PATENT LAW REFORM.

ON the evening of yesterday week a conference of members and friends of the Inventors' Institute was held at the office of the institute, 4, St. Martin's-place, Lord R. Grosvenor, M.P., in the chair. The object of the conference was to consider the action to be taken in opposition to the measures now in progress for the abolition of patent rights. The chairman opened the discussion by explaining the object for which the institute was formed, and which now numbered 700 members. They held the opinion, after mature deliberation, that it was not desirable to abolish the existing patent laws, though they were willing to admit all useful and appropriate amendments. It was in the interest both of the public and the inventor that the existing laws should remain in preference to a system of remuneration by the State, and therefore they had resolved to oppose the plan for the proposed abolition of patent rights. The discussion was continued by Messrs. Imrie, Dircks, Williams, Richardson, Hemans, Potter, Connolly, and others, at the conclusion of which four resolutions were submitted to the conference, affirming that the inventor was entitled to remuneration for his labour, expenditure, and skill as much as the author or artist to copyright for his book or work of art; that capital would not be embarked in promoting inventions unless profitable return for such capital is assured by the operation of law, such as is done by the existing patent law; that a good system of patent law tends to foster the trade and industry of the country and to maintain its industrial position against the active pressure of foreign competition; that working men are especially interested in supporting the present law, by which they can not only safely exhibit their inventions in public, but reap the fruits of improved education and increased application of inventions. The above resolutions were carried unanimously.

METHOD OF FISHING AND CATTING ANCHORS WITH ONE HOIST.

FIG. 3.

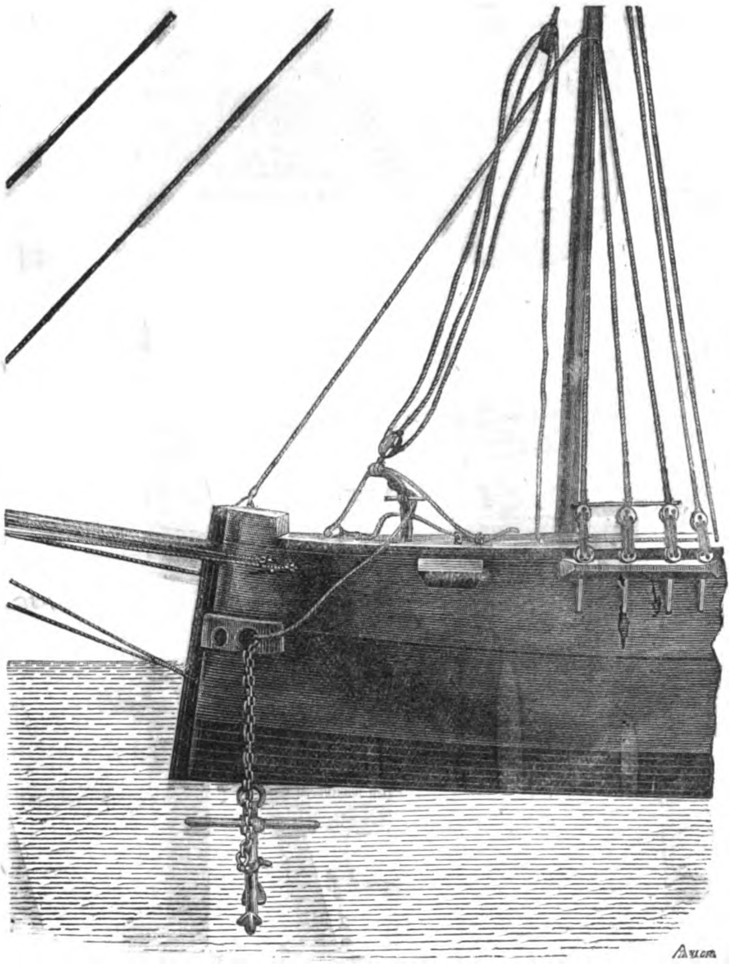
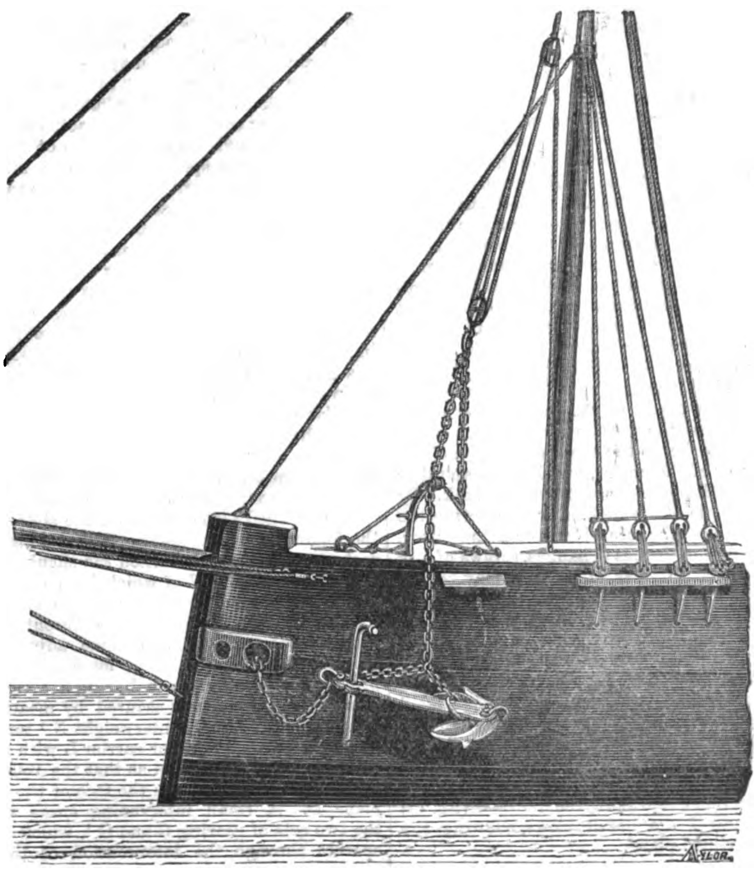


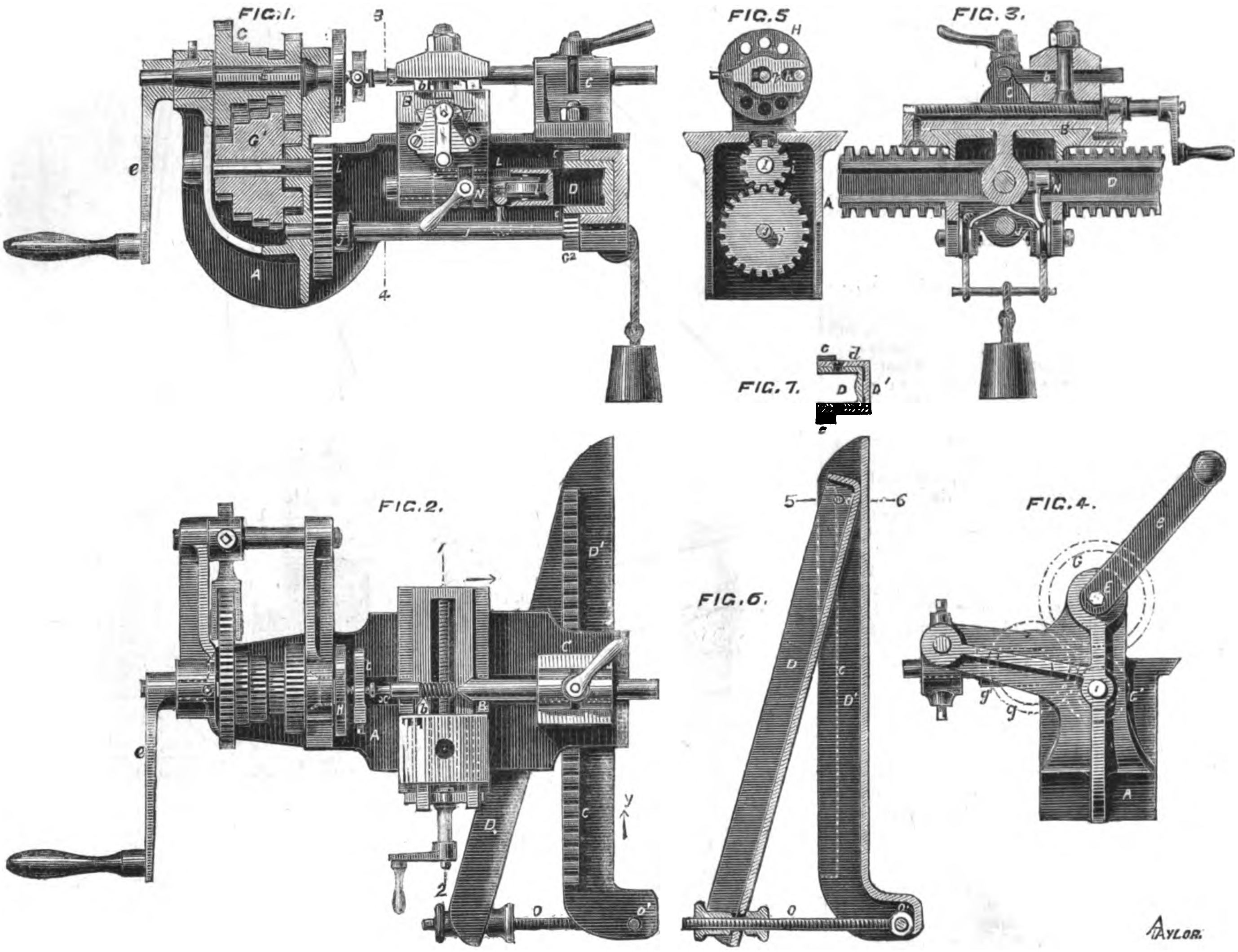
FIG. 4.



For Fig. 5, see [illegible] 11]

MACHINERY FOR CUTTING SCREW THREADS.

BY M. PAUL DE RESENER.



MACHINERY FOR CUTTING SCREW THREADS.

THE accompanying engraving illustrates an invention by M. Paul de Résener, of Paris, for cutting screw threads, whereby any variety of form of screws may be cut in the same machine by a simple adjustment, whilst the machine itself is cheaper and much more simple than those hitherto employed for screw cutting. The essential feature of novelty in this invention, which has been patented in England, is the employment of a travelling inclined plane, the angle of the incline being adjustable by means of a screw and adjusting nuts, for the purpose of imparting the necessary longitudinal traverse to the screw blank or to the cutter. The travelling incline is moved forward in a guide by means of a pinion in gear with a rack on the slide which carries the incline. This actuating pinion derives its motion from the mechanism which rotates the screw blank or the cutter, so that the rate of motion of the incline along its guide is always in proportion to the speed of rotation of the screw blank or of the cutter, and hence a spiral or screw thread will be produced upon the blank. By varying the angle of the incline, or by altering the speed of rotation of the screw blank or of the cutter, or by combining both these changes, screws of any desired pitch or number of threads may be cut without the necessity of employing the numerous change wheels requisite in ordinary screw-cutting lathes. Fig. 1 of our engraving is an external elevation and partial section, and fig. 2 a corresponding plan of a lathe, to which the inclined plane is adapted for screw-cutting purposes; fig. 3 is a transverse vertical section taken through the centre of the slide rest along the line 1—2, and looking in the direction of the arrow (fig. 2); fig. 4 is an end elevation of the driving gear; fig. 5 is a transverse section taken along the line 3—4 (fig. 1); and figs. 6 and 7 are detail views, showing the adjustable inclined plane.

The machine is composed of a frame A, carrying the whole of the mechanism, a slide rest B, the back centre C, and the adjustable inclined plane D. The main shaft E, which may be turned by hand, by means of the handle *e*, carries the gearing G and a chuck H. An intermediate shaft I carrying corresponding cone gearing G [1], actuates the lower spindle J, through the intervention of the wheels *i* and *j*. On the spindle J there is mounted a pinion *c* [2], which gears with one of two racks *c c* [1], in connection with the adjustable incline D. The adjustable incline (figs. 6 and 7) consists of a U-shaped bar, hinged at *d* into another U-shaped iron bar or guide D [1], carrying the racks *c c* [1], on its upper and under surface. At the opposite end to the hinge, these two parts D and D [1] are connected together by a screw *o* fixed at *o* [1], and passing through the adjustable incline D. The screw *o* is provided on each side of the incline with a milled headed nut, so that the distance between the plane D and the bar D [1] may be increased or diminished as required. The inclined plane thus arranged is mounted in a guide A [1] (fig. 1) formed in the frame A, so that one of the racks *c* [1] will be in gear with the pinion *c* [2] fast on the spindle J.

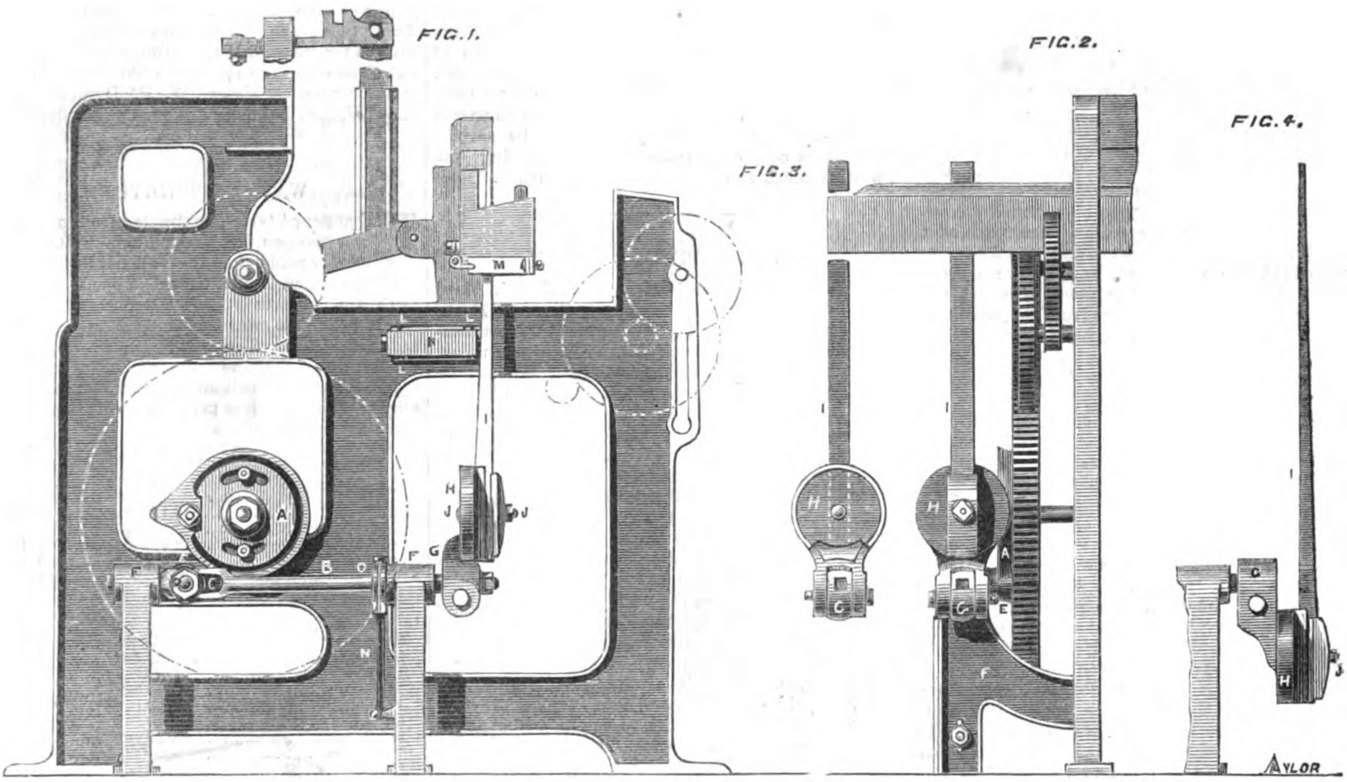
The inclined plane D acts on the slide rest B in the following manner:—The slide rest has a socket cast upon it, in which is fitted the shank of a roller carrier L, the roller *l* of which is in contact with the inclined plane, as the position of the roller has to be altered for each different pitch of screw. The carrier L is made adjustable and is maintained in its place by a gripping ring provided with a tail piece having a screw thread formed on it, which is secured by means of the hand nut N. The counterweight N [1] tends constantly to draw the roller carrier L with the slide rest B in such a direction as that the roller *l* may be always in contact with the face of the inclined plane D. A small intervening space separates the two sets of gearing G and G [1], which can only operate through the intervention of the intermediate pinion *g* mounted in an adjustable arm or carrier *g* [1], shown clearly in fig. 4, which may be moved vertically and horizontally as required. On rotating the handle *e* two wheels of the sets of gearing G and G [1] transmit motion to the spindle J, which by means of the pinion *c* [2] actuates one of the racks *c c* [1], which causes the bar D [1] to move in the direction of the arrow *y* (fig. 2), consequently the inclined plane D (the angle of which in relation to the bar D [1] has been adjusted) presses the roller *l* and with it the slide rest B, the tool *b* of which acts on the screw blank *x* secured between the centres of the machine, as in an ordinary lathe.

As the relative speeds of the shaft E and the rack *c* are the same, it follows that if the angle or inclination of the inclined plane D be varied by means of the adjusting screw *o*, the traverse of the guide D [1] being also increased or diminished, the spirals formed by the cutting tool will be at greater or less intervals, and consequently the pitch of the screw thread will be varied. The two sets of gearing G and G [1], serve to change the relative speeds of the shaft E and the rack *c*, in order to cut screws of a given number of threads. In order to cut screw threads in the reverse direction, it is simply necessary to reverse the position of the bar D [1], when the rack *c* will then be brought into gear with the pinion *c* [2] of the shaft J, and to change the direction of rotation of the shaft E. When cutting double or multiple threaded screws, one thread is first cut, after which the position of the pin *h* in the plate or chuck H, against which the dog *t* presses, is changed in order to cut a second thread, and again for a third, and finally a fourth thread; in each case of course the inclined plane D with its guide D [1] is brought back to its starting point again.

M. de Résener has also applied his adjustable inclined plane to a portable tool or screw stock, which may also be employed as a universal screw-cutting machine by attaching it to a work bench.

METHOD OF WORKING UNDER-PICK LOOMS.

BY MESSRS. J. GREGSON AND W. MONK.



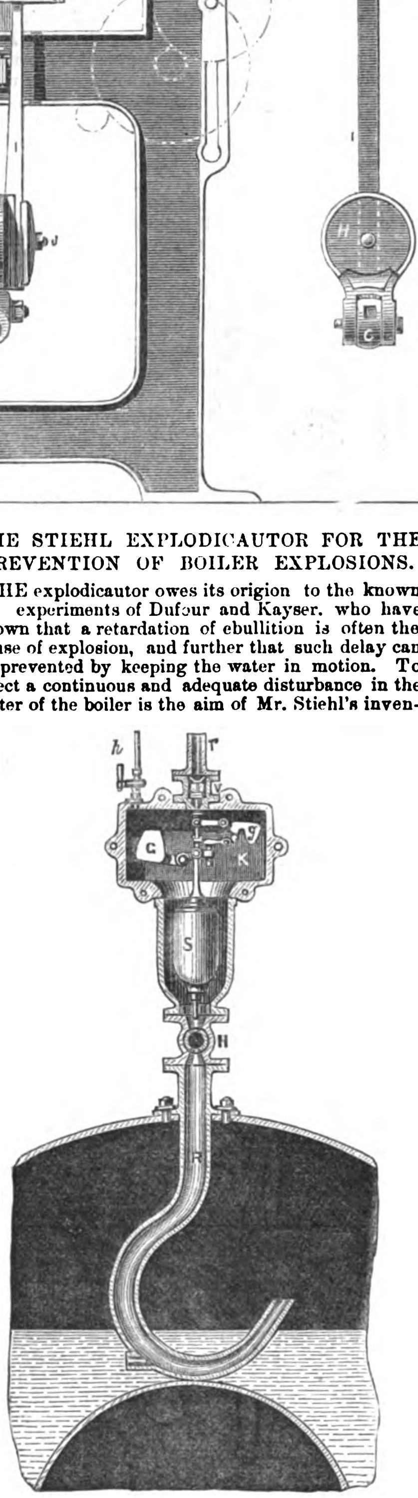
WORKING UNDER-PICK LOOMS.

MESSRS. J. GREGSON AND W. MONK, of Preston, machinists, have patented some improvements in looms, which refer to the method of working under-pick looms. They work them by a metallic pick motion on each end of the tappet shaft, and which is obtained by a cam on each end of the tappet shaft. The cams act on a bowl working on a stud connected with an horizontal picking shaft, to the ends of which is attached a swivel or universal joint, with catch box for holding the picking stick. In our engraving, fig. 1 is a side elevation of the loom showing the end of the tappet shaft on which is screwed the cam A; it likewise shows the side elevation of the picking shaft B, in which is a slot C. This slot is for regulating the stud D and bowl E for picking. F F are brackets for carrying the same. G is a universal joint, attached to which is a catch-box H, into which is fixed the picking stick I by the bolt J. Fig. 2 is a front view of the same. Fig. 3 is a back view of the universal joint, catch-box, and picking stick. Fig. 4 is a side elevation of a universal joint and catch box reversed to give a longer throw to the picking stick when required. K, in fig. 1, is a buffer strap for the picking stick to buff against, which projects from side of frame and is tightly suspended and stretched from L to L; M is likewise a strap attached to a spiral spring to prevent the rebound of the shuttle. N is a spiral spring to bring back the picking stick to its original place after picking; this spring is attached to a boss *o* on shaft B. The action will be through the cam on the tappet shaft B to the bowl on the picking shaft, and thence through universal joint, catch box, and picking stick to shuttle box. By these means a firm steady motion is obtained, and a great number of mechanical appliances, leather strapping, and checks are dispensed with. There will be but little wear and few breakages, the cloth will come off free from dirt or black oil, and, from the steadiness of the loom, the cloth will be better woven.

We understand that looms on this principle have been working in many places for some time past and are giving every satisfaction. They are found to be more durable, and to have less wear and tear than those upon the ordinary system. With these improvements there are said to be fewer breakages; they are easily applied, and effect a great saving in leather and other material. The cloth is clean and free from all black spots and dirt, and less power is required to drive the loom than is generally required.

THE STIEHL EXPLODICAUTOR FOR THE PREVENTION OF BOILER EXPLOSIONS.

THE explodicautor owes its origion to the known experiments of Dufour and Kayser, who have shown that a retardation of ebullition is often the cause of explosion, and further that such delay can be prevented by keeping the water in motion. To effect a continuous and adequate disturbance in the water of the boiler is the aim of Mr. Stiehl's invention.



The principle is that a quantity of water is sucked up and then again dropped down from the obtained height. The construction of the instrument will be more clearly understood from the annexed engraving. On the upper end of the tube R, which is outside of the boiler, a kind of box is constructed containing the swimmer S, which is partly balanced by the weight G. In the upper part, K, of the box there is also another weight *g*, attached to the lever *b*, which is arrested by the catch *k*. A safety valve V, and a cock *h*, are on the box. The space above the valve communicates by means of a little tube *r* with the vapour-room in the boiler. As soon as the cock *h* is opened, the water from the boiler ascends in the tube R, and lifts the swimmer S, whereby the lever *a* frees the catch *k*. The liberated lever *b* pushes against the valve V, and opens the same. The steam enters the box K, and the accumulated water falls back into the boiler. The swimmer then draws the lever *b* into its original position, the valve closes, the catch sets again, and the process begins afresh. By means of the cock *h*, the number of lifts can be regulated. Below the swimmer box as well as in the steam passage to the valve is a cock. The two cocks make a separation of the apparatus from the boiler possible, thereby allowing eventual repairs without any inconvenience. The following advantages are pointed out—First, the apparatus works even at overpressure of 1½lb. per square inch (0·11 kilo. per square centimetre). Secondly, the disturbance caused in the water is equally intense be the tension high or low. Thirdly, the adjusting of the apparatus is exceedingly simple and safe whether there be few or many lifts. Fourthly, as to the consumption of steam, it may be said that the same is small. Three to five lifts per minute will be sufficient to properly stimulate the stagnant water. Experiments have shown that 80 cubic inches (1·32 litres) per lift is the average of steam used. Thus the apparatus would only use 7lb. of coal in 24 hours. It is hence to be recommended that the explodicautor be kept at work at all times, thus preventing accident by neglect. The cock *h* may, according to more recent observations in ordinary cases, be kept closed, since the condensation of the steam in the upper part of the box is sufficient to set the apparatus going with fifteen lifts per minute. Fifthly, there is little or no wear and tear. Sixthly, there being no stuffing-box, the cost of maintenance are equal to zero. Lastly, access is gained to all loose parts by removing the lid of the box. The apparatus has a height of 40in. (1·046 metres) above the boiler, 12in. (315mm.) to 16in. (420mm.) width. A 4-inch (105mm.) hole in the plate of the boiler is sufficient to pass the tube R. Four conic steel screws, which are furnished with the apparatus, serve to fit it on. The explodicautor has been tried by Herren Forstmann and Hoffman, and G. Baedeeker, at Essen. According to their experience, it works at all tensions down to 1lb. per square inch (0·07 kilo. per square centimetre) with the same amount of certainty. The apparatus is patented in Prussia, England, France Belgium, Austria, Saxony, and Russia.—"Zeitschrift."

A SHOCK of an earthquake was felt at Bologna, on Saturday afternoon, which set the bells ringing and stopped the clocks, but fortunately did no further damage.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

AT an ordinary meeting of the above Society, held on the 9th inst., Mr. W. Forsyth Black, C.E., in the chair, an interesting paper on steam and other power hammers was read by Mr. Frederick H. Roberts, C.E. (member of Council).

The author referred in detail to some of the earlier machines, such as the helve or tilt hammers used for shingling, forging blooms, and shafting, tilting steel, &c., but, as this class of machine depended, to a great extent, for raising the hammer and its connections either through the direct medium of cams, eccentric or similar arrangements, it followed that the power required to work them was extremely large, and the parts of the machine itself very heavy and cumbersome to withstand the consequent strains. It was also found that the larger the mass of metal to be worked, the lighter the blow given, and, conversely, the smaller the mass, the heavier the blow; it was, therefore, ill adapted for heavy forgings. The invention of the steam hammer solved the difficulty which was found to exist, and to it, to a considerable extent, is due the perfection obtained in all classes of machines where ponderous forgings are found to be absolutely necessary.

The first idea with reference to the steam hammer the author traced as belonging to that great engineer, James Watt, who obtained a patent in 1784 for heavy hammers or stampers for forging iron, copper, or other metals without the intervention of rotative motion, by fixing the hammer head either directly to the piston or piston rod of the engine. Another patent followed this in 1806, by a Mr. Deverell. He proposed to admit steam underneath the piston of an engine by means of a valve, and during its up-stroke the air at the top of the piston was compressed by the pressure of steam beneath, which was released at the proper moment. The compressed air on the top of the piston, in addition to the gravity of the hammer head, was to give the blow. But neither of these ideas were put into practice at that period, and it was not until 1837 that any practical design was put forward for a steam hammer, and then by Mr. Nasmyth, of Patricroft, who urged its superiority for working metal over all other machines, but was unable to procure its adoption until about 1840, when he found that M. Schneider, of Creusot, profiting by his design, had constructed a machine on his plan. In 1842 he obtained a patent for his steam hammer, and from that time it became a recognized power, and a necessity in all works of importance. The facility which it afforded for executing all kinds of forging had the effect of greatly increasing the quantity of work to be done, and effecting a material saving both in time and labour.

The steam hammer, as originally constructed, required the valves being worked by hand, which left the machine in the power of the workman to give proper efficiency. The valves were also very difficult to work. This plan answered for the time for small machines, but where rapid motion was necessary, and for larger hammers, it was unsuitable. Several designs for self-acting motion, therefore, followed in quick succession. The author then referred to the different designs that had been introduced for this purpose. In the ordinary self-acting hammer, the man has to watch the metal under operation, and, as its form and position change, he must set his valve gear to suit as near as possible. The author considered that the motion, to be properly self-acting, should be independent of the workman as regards the adjusting of the gear to suit the varied thicknesses of the metal on the anvil; and, in order to obtain the full force of the blow, it should reverse simultaneously with or immediately after the blow is given, and at whatever point in the stroke the blow takes place. He considered that was accomplished in Sturgeon's double-action hammer, where the blow itself was made use of as the agent to work the valve, and described the mechanism employed; also the various types of double-action steam hammer; likewise the numerous modifications and improvements effected. The author then spoke as to the specialities of the heaviest classes of steam hammers of modern date, including those of Mr. Ramsbottom's design; likewise those erected for M. Krupp, at Essen.

With reference to machines of a lighter class, the author described the various designs for power hammers, and referred to the patent pneumatic hammer, several of which he had erected, and which are specially adapted for general smithy work, or light forgings, planishing and beating out metal, &c. It is extremely simple in action, working by means of the alternate exhaustion and compression of air within two cylinders, in one of which is a piston, to which the hammer head is connected by means of the piston rod. By opening a small valve, the vacuum formed within the cylinder is destroyed, and the blow weakened or stopped instantly, according to the amount of the valve opened. These machines are capable of working up to 500 blows per minute when required. At some future opportunity, we purpose to refer further in detail to this machine, and to illustrate the general arrangement, as adopted by several engineers and coppersmiths. The meeting was well attended, and a good discussion ensued.

THE BERMUDA DOCK.

THE following notification from Captain May, respecting the progress of the Bermuda Dock, has been issued by the Admiralty:—"'Northumberland' at Sea, Start Point, N.W., fifteen miles, June 25.—I beg to forward, for the information of the Lords Commissioners of the Admiralty, the following particulars relative to the Bermuda Dock:—Everything thus far has turned out most satisfactorily. The dock steers remarkably well; the towing cables led through the stern ports of the towing ships seem but little to affect their steering power, their rudders not being paralyzed, or even partially so, as was by some people anticipated. The consumption of coal on board the 'Northumberland' and 'Agincourt' is at present about 45 per cent. per hour, the dock being towed about five knots, the weather being calm, water smooth, and circumstances most favourable. The 'Terrible,' though towing astern of the dock, is not a dead drag, as her paddles are kept revolving slowly at an hourly expenditure of about 10cwt. of coal. If all goes well, as there is reason to anticipate, I shall not communicate with Lisbon. I might remark that I took the Bermuda in tow without the assistance of any lighters floats. The dock was brought under the 'Northumberland' stern, whilst she was lying at anchor, and the 26-inch cables readily hauled on board. Before leaving Sheerness, these cables were securely lashed on board the Bermuda to the riding bits amidships at 50 fathoms length, this being done to prevent the dock yawing in the narrow channels. Finding the dock was steering so satisfactorily, I left well alone, and do not intend to tow to the full scope, unless compelled to do so by bad weather or a heavy swell. The weather has continued very hazy since the flotilla left Sheerness; no observations have been obtained, or land seen since leaving Dover. I have, therefore, dispatched he 'Medusa' to the rendezvous off the Eddystone, to warn the 'Helicon' and 'Lapwing' of our approach and supposed position. Should I not find those vessels, I have directed them to follow down the track laid down by the hydrographer. Everything goes most satisfactorily, and the following are the quantities of coal remaining on board the larger ships at 8 a.m. this day:—'Agincourt,' 966 tons; 'Northumberland,' 1,026 tons.—I have, &c., (Signed).

"C. H. MAY, Captain and Senior Officer."

THE ROYAL CORNWALL POLYTECHNIC SOCIETY.

FEW, if any, local scientific associations confer the amount of benefit upon the surrounding population that the above Society does upon the industrial classes in Cornwall. It is, therefore, with much satisfaction that we announce its thirty-seventh annual exhibition, which will be opened at a very convenient date for the visitors to the meeting of the Bristish Association, at Exeter, viz., on the 27th of August. As usual, medals and prizes will be awarded by the Society in the mechanical departments for exhibits connected with natural philosophy, chemical analysis, mechanical and other scientific inventions and improvements, models of machinery not displaying invention, and naval architecture. The Society offers every inducement to exhibitors, by making them no charge for space. To the Society's long lists of special premiums another has this year been added of considerable importance. The efforts which have recently been made in Cornwall to introduce machinery for boring and tunnelling purposes as a substitute for hand labour is well known, and for several years past, the exhibitions of the Royal Cornwall Polytechnic Society have afforded ample evidence of the progress made in that direction. To stimulate further exertions in the matter, premiums of £10 are offered by Capt. Wm. Teague and the shareholders in Tincroft Mine, and £5 by the Society for the best practical suggestions (with models or drawings) as to the motive power to be employed in driving boring machines in Cornish mines, including the method of conveying the power of the machines. The council have fixed August 7 as the the last day for receiving applications for space, and intending exhibitors should put themselves in communication with the honorary secretaries, Messrs. W. P. Dymond and A. Lloyd Fox, at Falmouth, as soon as possible.

WAR EXPENDITURE.

THE annexed table is extracted from a paper on war taxation, by Mr. William Stokes, which was recently read before the National Reform Union at Manchester. Mr. Stokes' object was to set forth the permanent consequences of what he terms profligate war expenditure and periodical invasion panics. The conclusion he draws from the figures is that the industry, trade, and manufactures of Great Britain are more shackled and burdened by needless taxation than those of any other nation:—

	National Debt.	Amount per head.		
	£	£	s.	d.
1. Ducal Hesse	228,916	0	5	4
2. Sweden	4,114,880	1	0	0
3. Norway	1,854,157	1	1	10
4. Chili, S. America	2,933,405	1	15	0
5. Prussia (1866)	42,123,064	1	15	8
6. Turkey	69,142,270	1	19	1
7. Oldenburgh	621,585	2	1	2
8. Electoral Hesse	1,485,892	2	9	6
9. Brazil	30,762,289	3	1	3
10. Hanover	6,423,955	3	3	6
11. Russia	274,544,770	3	14	1
12. Wurtemburg	7,033,911	3	19	6
13. Saxony	9,912,049	4	4	10
14. Belgium	25,070,021	5	0	7
15. Brunswick	1,707,707	5	16	5
16. Bavaria	29,669,267	6	3	5
17. Baden	9,256,728	6	9	6
18. Austria	268,965,064	7	5	3
19. Denmark	14,862,465	8	18	9
20. Italy	211,503,298	9	8	3
21. Portugal	42,930,472	9	17	4
22. Spain	163,927,471	10	4	6
23. Greece	14,000,000	12	15	3
24. France	566,680,057	14	18	9
25. Hamburgh	4,222,897	16	16	5
26. United States	579,880,391	18	18	9
27. Holland	81,790,799	21	17	10
28. Great Britain	797,031,650	26	10	0

THE ROYAL HORTICULTURAL SOCIETY.

THE President and Fellows of the Royal Horticultural Society gave a very interesting entertainment yesterday week in their conservatory, which was lighted up with taste and effect. During the evening, the members of the St. Cecilia Choral Society, under the direction of Mr. C. J. Hargett, performed a selection of glees and part songs, the distinctive feature of the programme being that all the pieces, except one, were the compositions of English masters. The great tent, with its groups of rhododendrons, was illuminated during the evening with coloured lamps and the lime light. The combination of the two descriptions of lights, however, was not quite a success; the effect would have been much better with the pure light. The great rose show took place last Tuesday, and the exhibits on that occasion fully equalled the display of any former period. The cut specimens were most numerous, but there was also a fine show of pot roses. The principal prizes were carried off by Messrs. Paul and Son, Mr. C. Turner, Mr. J. Keynes, and Mr. B. R. Cant.

FORBES'S LAST NEW RIG FOR SHIPS.

IN the course of this work ("Nautical Magazine") we have seen a change in the sails of our merchant shipping, which, from its extended adoption, has evidently answered its intended purpose. The same inventor (Mr. R. B. Forbes, of Boston), has now sent us another child of his brain, and one which, great as the former was in the arrangement of a ship's sails, seems likely to produce a still greater revolution in the method of bending and furling these light appendages to a ship's furniture. The arrangement by which this is effected is so thoroughly novel, and one which so effectually reverses all former proceedings of duties, that although some advantages are evident (such as a flatter sail and an easier furl), it would be premature to express at present an opinion of his system. And we shall, therefore, content ourselves, as in duty we are bound to do, by allowing Mr. Forbes the opportunity of explaining it himself:—"London, May 22. Dear sir,—In the first place I must introduce myself anew to you, as the originator of the double-top-sail rig, for which you kindly allowed a place in the "Nau-

tical Magazine," in 1851. I desire to call the attention of seamen, shipowners, and others to a new mode of arranging the same proportions of sail, rig, &c., as illustrated by the auxiliary packet ship the 'Massachusetts,' built under my orders, and after my plans in 1845. By this method, all my square sails, except courses and sky-sails, or royals, are bent by the foot and not by the head, as at present; my lower yards are slung or parelled just above instead of below the eyes of rigging and stays; top-sail yards are slung or parelled to a prolongation of the lower mast through the cap, also just above the eyes of backstays and stays and not under or below them, as at present. I bend to the head of the sail a spar about a quarter or one-fifth of the length of the yard above it, in the middle, and leave a space (when sail is set) between the said spar and the yard, so as to clear the stay, and not to cramp the yard in bracing sharp. Sky-sails clew up and lower as usual; all other yards are fixed by slings, and move only on parells. Courses come down to the deck; other sails come down to the foot. All the square sails of a ship, by the new method, are bent by the foot to the yards and not by the head, as usual; the yards (except the upper one, say sky-sail or royal) are permanently slung or parelled to their respective masts, just over or above the stays, and the eyes of the rigging and backstays, and not under or below them, as at present. This mode of bending sails and slinging their yards involves a wholly new arrangement of the standing rigging and the position of the yards. It is proposed at no distant day to give a full description of this new rig, with diagrams. The sails below the upper ones of all consequently furl on the yard at their foot and not at their heads, and trice up instead of 'clewing' up, as usual. The courses come down to the deck, and are there reefed or furled, except in light winds, when they may be hauled up, as usual. The principal advantages derived from this rig are, dispensing with tyes and sheets, better setting of the sails, facility for furling or reefing by few men, especially the courses; yards brace almost fore and aft, which is a great advantage in steamers. So great a deviation from old established customs will, no doubt, meet with much criticism, and, as usual, opposition, especially among those who contract for building and equipping ships. Having had much experience in fitting ships, it enables me to propose this new system of rigging ships with confidence, for no seaman who has seen the preliminary sketches has made any grave objections to it.—I am, your obedient servant,

"R. B. Forbes, of Boston, U.S.A.

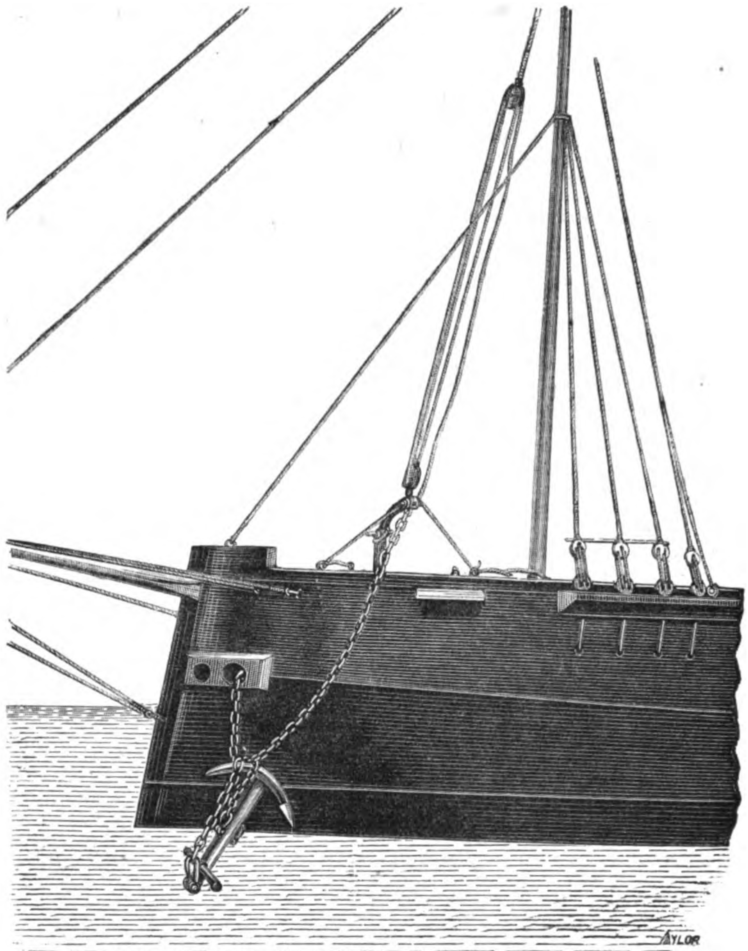
"To the Editor of the 'Nautical Magazine.'"

RAILWAYS IN THE UNITED STATES.

THERE were in operation in all the States on January 1, 1869, 42,255 miles of line, the cost of which, at 44,000dols. per mile, equalled 1,800,000,000dols. The total amount of net tonnage passed over them in 1867 is stated at 75,000,000 tons, having a value of 10,472,250,000—a sum equalling six times their cost and more than four times greater than the whole amount of the National Debt. It is said that the tonnage is understated, and cannot be less than 100,000,000 tons, which would be rather more than the quantity of minerals carried on the lines of the United Kingdom. It is believed that at least 5,000 miles of new railroad will have been opened in the United States in the course of the year 1869. Already the returns show a mile to every 876 of the population. The earnings of the American railroads, says the "New York Times," are very much greater than those of the English. The railroad mileage of that country in 1867 was 14,247; in the United States, 39,276. The cost of the former equalled very nearly 2,500,000,000dols., that of the railroads of the United States, for the same year, 1,700,000,000dols. The gross earnings of the English roads, upon their cost, equalled 7·86 per cent.; those of the United States very nearly 25 per cent. The English roads, however, have a great advantage over our own in operating expenses, their net earnings, as a rule, fully equalling one half of the gross receipts. In this country the net cannot be estimated at over 30 per cent. of the receipts. The average gross earnings per mile (per mile travelled by trains) of the railroads of the State of New York in 1867 was 2dols. 30cents per mile; those of Great Britain, 1dol. 25cents. But the cost per train-mile of running trains (the "working expenditure") was 166cents on the New York lines, and only 61dols. 37cents on the British. The most startling difference in the items of cost is in the the matter of fuel; the cost of the same in this country being 21·60 per mile, in England 3·42 per mile. Coke is almost exclusively used upon English roads, upon our own wood or raw coal; the former is a very expensive fuel, while the latter is very destructive to the engine. We excel all nations in the art of construction, and in securing the largest revenue for a given service, but not in the economy of working. Our inferiority in this respect is, however, largely due to cost of material, which, for the more important articles, is twice greater in this country than in Europe.

METHOD OF FISHING AND CATTING ANCHORS WITH ONE HOIST.

Fig. 5.



RED LEAD.

RED lead, an important ingredient in the manufacture of flint glass, has long been a "staple" of Birmingham industry. Formerly, glass makers' red lead was obtained from Derbyshire, but the quality was inferior, and imparted to the glass an objectionable shade of colour known in the trade as the "Derby blue." For many years, Blair and Stephenson, of Tipton, secured a monopoly in the supply of this commodity. In the year 1817, a manager of this firm, Mr. Boyle, entered into partnership with Adkins and Nock, of Smethwick, as manufacturers of red lead, and when Messrs. Blair and Stephenson retired from the trade, this firm became the largest producers. We ("The Engineer") are indebted to Mr. Henry Adkins for a description, which follows, of the process of manufacture. A quantity of lead is placed on the bed of a reverberatory furnace of a peculiar construction, and exposed to a high temperature, while the metal is constantly agitated by striking it upon the surface with a rake. A combination takes place between the lead and the oxygen of the atmosphere, and the oxide of the lead thus formed is removed by the rake to the back of the furnace. These operations are continued during a period of twelve hours, at the expiration of which time any metallic lead which may have failed to become oxidized is removed, and the remaining oxide is exposed by constant turning to the action of the air, and at the termination of a further period of twelve hours is withdrawn from the furnace. The substance thus produced, which is called litharge, is now ground into an impalpable powder with water, and flows into a series of tubs, where it is kept in a state of agitation by a revolving stirrer, furnished with arms. The particles of metal which have escaped oxidation, having a greater specific gravity than the oxide, remain in the stirring tubs, while the oxide of lead passes on into another series of tubs, where it subsides from the water. The supernatant water is afterwards removed by a syphon, and the moist litharge transferred to a reverberatory furnace, where it is exposed to the combined action of a low temperature and a current of air for a period of twenty-four hours. During this process, the litharge enters into combination with a further quantity of oxygen, and minium or red lead is produced. The manufacture is completed by passing the substance through a revolving cylinder of wire gauze, to remove any lumps that may have been formed, or any large particles of foreign matter with which it may have become intermixed during the previous operations. The principal manufacturers in this district are Messrs. T. Adkins and Co., Smethwick; Messrs. Lloyd and Co., Smethwick; and Messrs. Burr, Brothers, and Co., Shrewsbury.

LARGE BLAST AT LIME POINT, CALIFORNIA.

THE operation of blasting off the rocky headland of Lime Point, opposite Fort Point, and forming the northern entrance to San Francisco Bay, for a heavy water battery, has been conducted under the direction of Colonel G. H. Mendell, U.S. Engineer Corps. Two blasts have already been made; one with about 10,001b. of powder, and a second with 24,0001b. This second blast is supposed to have been the largest ever used in military engineering, and moved about 80,000 tons of rock. This manner of moving large masses of rock was first introduced by Field-Marshal Sir John F. Burgoyne, in the operations for constructing the immense breakwater works at Holyhead, England. It was subsequently used for blasting a roadway around the cliffs of Dover for a railway. The philosophy of the blasting is, that of tunneling into the base of the rocky headland and making several chambers to hold the powder, and then blocking the tunnel up again and firing the powder by electricity. One charge in the operations at Dover contained 18,0001b. of powder, the largest known outside of the Lime Point operations.

The headland at the northern side of the Golden Gate is called Lime Point, not because of any lime rock forming the cliff, as almost every kind of rock is represented, except lime rock. The white appearance of some of the low rocks is due entirely to bird lime. The Government purchased 1,900 acres from S. R. Throgmorton, for 125,000 dollars, in currency, which included Horseshoe Cove.

The last blast was at the extreme point of the cliff, nearly facing Fort Point. The company which assembled to witness it went on board the steam tug "Katie," belonging to the Engineer Department, consisted of General Alexander, United States Engineers, Prof. Le Conte, of the University of Cali-

fornia, Prof. Davidson, United States Coast Survey, numerous Army officers and their ladies and invited guests; in all, about fifty. On arriving at the snug landing constructed by Colonel Mendell, on the easterly shore of the Point, by filling in a causeway of 100ft. or 200ft., to the Needles, to break the southerly swell, the company walked to the Point, a distance of about 2,000ft., in a southerly direction, to examine the locality. About 60 workmen were busy in removing the rock and earth moved by the previous large blasts. At the Point, a tunnel had been run in a north-westerly direction, into the base of the hill, a distance of about 30ft., where a chamber was formed on the right, to contain 3,000lb. of powder; thence the tunnel ran in a direction south of west 31ft., where a chamber was formed on the left for 6,000lb. of powder; thence on the same line 45ft., where the third chamber was formed to contain 7,500lb. These chambers were about 5ft. by 7ft., to contain from 125 to 130 cubic feet.

When all were chambered out, a board partition was put up in front of each chamber to hold the powder. The greatest care was used in placing the powder in the chambers. The men wore the wooden French sabots, or bandaged their feet in bagging. The barrel of powder was opened at the mouth of the tunnel, and carried into the chambers in sacks, the men groping their way into the dark tunnel and delivering their dangerous burden to the foreman, who emptied it in one immense bin in the chamber. At a certain stage of the filling up, eight cartridges were distributed at different points in the mass; each cartridge having an electric wire leading to the central wire connected with the magnetic machine outside. As fast as these chambers were filled, they were sealed up with clay and the tunnel tamped with the same material, the wires for firing the mass leading through a small wooden box at the bottom of the tunnel. These wires, two in number, were of copper, on an insulated wire to convey the electricity to the mass of powder, and a plain wire for the return current; one connected with the positive and the other with the negative pole of a powerful Beardslee magneto-electric machine, located in a secure place outside and several hundred feet distant. The company went on board the steam tug, a few hundred feet distant, to witness the effect of the explosion. On waving a white handkerchief by Colonel Mendell on shore, the machine was put in rapid motion by a crank, the positive and negative poles of the battery were connected at half-past 3, when the explosion took place with a heavy dull sound, and an immense mass of rock and earth was thrown into the air about 50ft., and the whole face of the cliff came crashing down to the base and tumbled into the sea. Heavy masses came down at intervals, as they were loosened. The company went on shore and examined the result of the blast, which proved far more extensive than it appeared from the steamer. The cliff had been blasted off for about 200ft. along its face and for about 175ft. in height, with an average depth of about 60ft. The mass of rock and earth thrown down is estimated at 60,000 tons. The 60 workmen are able to move about 10,000 to 12,000 cubic yards monthly, and fill in on outside of the plateau, which is about 20ft. above low tide.

The kind of batteries which will be placed here is undecided, but they will not be of masonry. Experiments are now being made with a view to putting in iron batteries. These will be erected on the solid rock, some little distance back from the front, and will probably consist of the 15-inch and 20-inch Columbians already in use in the Government arsenals, which will throw shot of several hundred pounds weight, according to shape, for a distance of four to five miles. The range of the battery will be very extensive, embracing nearly three-quarters of a circle, and will occupy about 500ft. east and west, and about the same distance north and south, on the eastern face, which commands Raccoon Straits, Angel Island, Alcatraz Island and the southern shore of the entrance to the Bay. The work is prosecuted slowly, as the present appropriation for this purpose is too small to allow of rapid work.—San Francisco paper.

THE PUTNAM MACHINE WORKS.

THESE works, which are located at Fitchburg, Mass., on the line of the Vermont and Massachusetts Railway, were instituted in 1854. Some three years since, the business having outgrown the capacity of their shops on Water-street, some twenty-six acres of land alongside of the railway track were purchased, and new buildings were put up at a cost of some 200,000 dollars. The new works, with their accessories, look to an almost indefinite extension of business, and are admirably arranged in every department, as may be gathered from the "American Railway Times." The main machine shop building is of brick, one storey high, 625 × 48ft., supported by 35 iron columns, 20ft. high in the centre. To these central columns are fastened the main shafting for driving the machinery. This building has 284 windows, 500 gas burners, and is warmed by over six miles of steam pipe, and is devoted to seven different departments of work, although the whole is free from any partition or other obstructions to the sight. Each separate department has a large L built out at the right hand for the erection and delivery of machinery, the manufacturing being all carried on within the main building. Six of these L's are 36 × 52ft. and one is 44 × 52ft., and in these are powerful cranes for handling the heavier articles. On the left hand side of the main building, and immediately opposite the large L's, are small L's, 12ft. square, appropriately fitted up as offices for the heads of the different departments of work, thus leaving the main building, with its forest of machinery and mechanical devices, free from all obstruction. Each of the seven different departments has its appropriate work; thus in one we find the blacksmiths' shop, with its forges and heavy hammers. The next is devoted to the manufacture of steam engines, from 150-horse power down to any required size; in the next are made drills and planers of all capacities. The next is devoted to lathes; in one is made the Burleigh rock drill, and so on, the establishment turning out all kinds of machinists' tools, shafting, and mill and wood-working machinery.

At the front end of the long building is to be a handsome four-storey brick building, with a Mansard roof, for the general offices, halls, &c. This is as yet unfinished, but in one part of it we found a small, well appointed machine shop, fitted up for the exclusive manufacture of the smaller steel tools, taps, dies, reamers, cutters, &c. The gauges used here are the same as adopted by the United States Government. Parallel with the machine shop, and divided by a wide yard running to the railway track, are to be seen storehouses for iron, coal, and sand, all these being delivered directly from the cars; the foundry; the moulding room 54 × 130ft.; several furnaces capable of melting four tons per hour each; a large two-storey building 40 × 160ft., the basement of which is used for the manufacture of flasks and the storage of heavy materials, while the second storey is used for a pattern shop and for storing patterns. Then comes a brass foundry, 30 × 40ft.; a building for cleaning castings, 32 × 40ft., and several other buildings for various purposes, all arranged systematically for labour saving and easy supervision. This well-conducted establishment has grown up from small beginnings to its present magnitude, under the eye and personal supervision of the active manager of the works, Mr. S. W. Putnam, from whom the works take their name. They now employ some 250 men in the different departments of skilled labour, and the character of machines turned out are second to none in the country.

FIXED AND FLOATING DEFENCES IN AMERICA.

ONE of the chief technical military problems now before the nation, is, whether the majority of its heavier guns, designed for coastwise defence, shall be mounted on fixed or on floating platforms. We, U.S. "Army and Navy Journal," put this as a "problem," because on this subject there would seem to be a difference of opinion; since, at all events, the energies of some of our most famous and experienced officers are concentrated on the various means of patching up, thickening, and otherwise strengthening, our old forts, which were constructed, and very admirably constructed, too, with a view to less formidable attack than that which they now have to expect. If guns are planted on fixed platforms, it requires very little study to see that not only must they be mounted within very easy range of the channel they are designed to protect, and mounted also in such a way as to give great facility of manipulation and accuracy of aim, but still further and of far greater importance, this channel itself must be blocked up by obstructions, in order to keep the enemy for a sufficient time under the range of the guns. Unless such obstructions are effectually placed, very obviously the attacking fleet will move by the forts, out of the range of the guns, and, aided by the inevitable confusion of battle, and the pall of smoke which settles on the landscape, this feat is never difficult of accomplishment. Guns in a fixed fort are, after all, as has been aptly said, very often a sort of "chained monsters," only to be feared within their reach; and hence it may be taken as an axiom that it is absolutely necessary to keep the enemy within their range, by some device, in order to accomplish the result desired. On the other hand, obstructing a commercial harbour is, in itself, not only so humiliating, but so injurious a device, that, very naturally, it should be one of the last resorted to. Take, for example, New York Harbour. Surely, the very last method to be taken for defending this harbour ought to be that of obstructing its channels. It would hardly be tolerated by the merchants of the city, and hence the natural anxiety to seek other means of defence. It may be stated, without fear of denial, that in every case where a fleet of steamers has endeavoured to run by forts, of whatever strength, and supplied with ordnance of whatever quantity and calibre, through an obstructed channel, they have always succeeded. So, for example, it was at Vicksburg, on the Mississippi; and again at New Orleans, when Farragut ran by Forts Jackson and St. Phillip; and again at Mobile, when the same officer ran past Forts Morgan and Gaines; and again in the Paraguayan war, when the allied fleet ran by Humaita. Indeed, the running of batteries on our Western rivers was almost an every-day occurrence. Who ever heard of Porter stopping for a fort, however powerful, if he could run by? The truth is that it became a mere question of expediency, in an unobstructed channel, whether to attempt to reduce a powerful fort by bombardment, or to run by it and capture the city or strategic points it was meant to cover. In this dilemma, our school of engineers have long maintained the necessity of mounting heavy guns for coast defence on movable platforms. The advantages of this scheme are apparent, both on the ground of efficiency and of economy. We do not, therefore, share the apprehensions sometimes indulged regarding the inadequacy of one or another improvement prepared for our fixed defences, since it is very clear that, when actual need arises, we can always call upon mechanical ingenuity to supply in the direction of movable defences, perfect protection for our harbours and coasts.

Correspondence.

BRIDGE v. TUNNEL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—My attention having been called to a statement which has appeared in the newspapers of the 25th inst., that a deputation of the promoters of the proposed tunnel under the English Channel have waited upon the President of the Board of Trade to ask for a Government guarantee on a sum of two millions sterling, for the purpose of making experiments as to the practicability of such a means of communication with the Continent, and have represented to Mr. Bright that a commission of scientific men have reported in favour of the scheme, and that the French Government are waiting to see what action the English Government would take in the matter, I think it my duty, on behalf of the Anglo-French Railway Bridge Company, to state that I have never heard that such is the case; on the contrary, I am led to believe that the sympathies of his Imperial Majesty the Emperor of the French are with the company which I represent.

It is possible the commission may have recommended that the proposed experiments should be made, but it is quite certain that the Emperor has, personally, and uninvited, been to inspect the progress of the experiments now making (without Government aid) by the Anglo-French Railway Bridge Company, and that he expressed himself, after a lengthy examination of the details, much pleased with what he saw. It is obvious that his Majesty must feel great interest in the success of this grand undertaking.

The system of bridge building proposed by M. Boutet has been so far proved that two bridges have been built in France on his principle, and a bridge, with two spans of half a mile each in length, is in contemplation near St. Malo, the viaduct being a mile in length. These experiments have been made with money subscribed by English and French believers in the practicability of M. Boutet's system; and until it has been shown that their belief is unfounded, I submit that the promoters of a rival scheme ought not to receive Government assistance to enable them to do that which the Anglo-French Railway Bridge Company have done, and are doing, at their own expense.—I am, Sir, yours, &c.,

HENRY STEAD, Secretary.

Anglo-French Railway Bridge Company,
18, Old Broad-street, E.C., June 28.

[The report of the interview above referred to appears in another column, having reached us too late for insertion in our last.—ED. M.M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—G. F. T.—R. B.—E. R.—G. W. H.—S. U.—J. T.—R. S.—T. E. K.—J. B.—R. W. and Co.—S. A.—G. W. R.—H. S.—R. T.—H. B.—P. and Co.—G. S.—H. T.—F. M.—J. D. and Co.—T. W.—K. and E.—F. J. and F. J.—S. E. K. C.—T. N.—E. F. B.—R. I.—G. E. P.—W. C.—R. H. D.—J. F. S.—E. T. H.—W. W.—H. R.—W. S.

Meetings for the Week.

MON.—Royal Institution.—General Monthly Meeting, at 2 p.m.

Naval, Military, and Gunnery Items.

THE first military district in Canada, the headquarters of which have been at Toronto, has been broken up. Major-Gen. Stisted and staff moved to the camp at Point Levis, and took the command of the troops on the fortifications from June 10.

THE inhabitants of Wimbledon having complained of the great crowd resorting to the camp on Sundays, there will be no admission to the enclosure on Sundays, July 4, 11, and 18, except by tickets, viz., 1. The usual members' pass; 2. The Wimbledon residential special pass; 3. Special Sunday passes issued through the officers in command of volunteer corps in camp. No carriages will be admitted.

THE monthly statement of the Bureau Veritas, of Paris, shows that in the month of May last, 190 vessels have been reported as totally lost. The list comprises 87 English, 25 American, 16 French, 14 North German, 10 Norwegian, 9 Dutch, and 5 Italian vessels, and 24 vessels sailing under various other flags. The total losses in the corresponding month of 1866 was 230; of 1867, 182; and of 1868, 171.

MESSRS. HENDERSON, COULBORN, and Co., of Renfrew, have launched a screw of 1,200 tons, on board which they are now fitting a pair of their high and low pressure engines of the collective force of 120-horse power nominal. The vessel, which has been named the "Blanche," has been built for MM. Mallet, of Havre. The "Mary Hamilton," screw, built by Messrs. W. Hamilton and Co., for the Turkish Government, has made a favourable trial trip.

LAST Friday some field telegraph waggons were started from Chatham for Aldershot Camp. It is understood that these waggons will in future accompany the troops in their field movements, and that they will be under the superintendence of Serjeant Ross, Royal Engineers, for some years connected with the telegraph office at Aldershot, and who has recently undergone a course of instruction in field signalling and telegraphy at Chatham.

THE Lords of the Admiralty have caused a circular to be issued authorizing officers, seamen, and marines on board her Majesty's ships to discontinue the use of the razor under certain restrictions. The hair of beard, moustachios, and whiskers is to be kept well cut and trimmed, and not too long for cleanliness. Care is to be taken that those officers and men who avail themselves of the privilege are not to be whimsical. The beard is not to be worn without moustachios, nor the latter without the former.

EVERY facility is afforded to the troops at Aldershot for learning to swim, and efficient measures for the safety of the bathers are put in practice. Bathing parades, in accordance with instructions contained in the "Queen's Regulations," and the divisional standing orders, will be held. Bathing pickets, consisting of two corporals and six privates, expert swimmers, will mount daily at the bathing places from 10 a.m. to 8.30 p.m., half to be on duty at a time.

THE annual distribution of prizes to the pupils on board the school frigate "Conway," stationed in the Mersey, was held last Friday afternoon. Mr. Childers, First Lord of the Admiralty, distributed the prizes. He was accompanied by Admiral Dacres and Captain Seymour. Her Majesty's gold medal for general excellence, awarded by the votes of the other pupils, was won by Frederick Fawcett; the Admiralty nomination to the naval cadetship by John F. Stuart; and her Majesty's second prize also by John F. Stuart.

MESSRS. W. C. MILLER and SONS, of Garston, floated the "Brazilian" screw steamer from their graving dock on the 24th inst., after having lengthened her 125ft. Her dimensions now are as follows:—Length between perpendiculars, 403ft.; breadth, 37ft. 9in.; depth, 35ft. 4in. She will be propelled by engines of 500-horse power, and steered with Skinners' vertical steering apparatus. With the exception of the "Great Eastern," this vessel is, we believe, of greater length than any other in the merchant service. She is said to be intended for the Suez Canal navigation.

EACH of the Royal dockyards at Keil and Dantzic has been supplied by Messrs. Merryweather and Sons, London, with one of their powerful double cylinder fire-engines, built at their works in Lambeth. The steam fire-engine sent to Keil dockyard is similar to that which gained the gold medal at the Paris Exhibition, in 1867, and discharges 1,000 gallons of water per minute to a distance of 250ft. As many as twelve jets may be thrown simultaneously. Each of the Royal Dockyards at Portsmouth, Plymouth, Woolwich, Deptford, and Chatham is also furnished with a steam fire-engine of similar power manufactured by the same firm.

IN the year 1868, the registerred shipping of the United Kingdom (exclusive of river steamers) employed in our home and foreign trade, comprised the unprecedented number of 22,250 vessels of 5,516,434 tons, employing 197,502 men, exclusive of masters, viz., 20,525 sailing vessels of 4,691,820 tons, employing 153,840 men, and 1,725 steam vessels of 824,614 tons, employing 43,662 men. At the end of the year there stood registered as belonging to the United Kingdom 28,444 vessels of 5,780,530 tons; viz., 25,500 sailing vessels of 4,878,236 tons, and 2,944 steam vessels of 902,297 tons. This is the highest tonnage ever recorded. There was built and registered in the United Kingdom in 1868, 879 sailing vessels of 300,477 tons, and 232 steam vessels of 79,096 tons.

WE have to record the death of Serjeant William Vile, one of the few veterans left who were present at the ever memorable battle of Waterloo. He was born May 4, 1787, and at an early age he joined the 49th Regiment of Foot, or the Somersetshire Regiment, of which he was made serjeant. He served through the whole of the Peninsular campaign, and was in every battle, including the battle of Waterloo. He was at the taking of Monte Video, in South America, and was one of the detachment of the 40th who, under Colonel Henry Thornton, in 1828, were the pioneers of the western district of New South Wales from Sydney to the Blue Mountains. He had the Peninsular and Waterloo medals. He was only once wounded in the whole of his engagements, that being in one of his wrists. As a curious coincidence it may be mentioned that he died on June 18, being the 54th anniversary of the battle of Waterloo.

M. TRONSENS has made a communication to the Paris Academy of Sciences, in which he suggests a new arrangement of ships' lights to prevent collisions at sea. He proposes the use of three lights, arranged in the form of a right-angled triangle, one side of which is to be vertical and another parallel with the medial line of the vessel, and towards the head, and placed in the highest possible position. The light at the summit to be of a different colour from the other two, and the distance between the lights to be about 18ft. Observation of the two lights in a vertical line will, says the author, furnish an approximate notion of the distance from the ship, and by comparing the apparent distance of the two lights on the horizontal side with that of the two on the vertical side, an idea of the ship's route may be obtained; at any rate, the relative distances will show whether that course is to the right or left of the line of observation, which is the main fact to be ascertained, and that without the aid of any instrument being required.

THE following reports from her Majesty's ships "Camel," "Serapis," and "Hercules," on the Wigan Coal Company's Yard coal, have been published:—"Camel": These coals are the most economical coals used for nearly three years; the duties of the engines have been accomplished easier, or otherwise more steam generated than with common Welsh, or a mixture of Newcastle. These coals make very few ashes, and also very few clinkers. There is more smoke, but not as much as from Newcastle; with the exception of Risca Rock coal, they are the best used for fourteen years. "Serapis": This coal is of a good quality for generating steam, but burns more quickly and makes more clinker, soot, and smoke than the several descriptions of Welsh coal generally supplied. It is not suited for the voyages of the Indian troop ships, as it is liable to choke the tubes. "Hercules": This coal is of good quality, little smoke, average amount of clinker and unconsumable ashes, burning fast. Estimated economical value as compared with best Welsh coal—Welsh coal, 100; Wigan coal, 92.

THE annual returns relating to shipping have been presented to the House of Commons, on the motion this session of Mr. Stevenson. They show that at the end of the year 1868, there stood registered at ports of the United Kingdom and Channel Islands, 25,500 sailing vessels of 4,878,233 tons, and 2,944 steam vessels of 902,297 tons; and in the British possessions 11,370 sailing vessels of 1,380,991 tons, and 523 steam vessels of 74,604 tons; making in the whole, 36,870 sailing vessels of 6,259,224 tons, and 3,467 steam vessels of 976,901 tons. If we go back to 1859, as a date sufficiently distant to show the progress of shipping, we find at the end of that year registered at ports of the United Kingdom and Channel Islands, 25,784 sailing vessels of 4,226,355 tons, and 1,918 steam vessels of 436,836 tons; and in the British possessions 10,177 sailing vessels of 961,283 tons, and 321 steam vessels of 35,928 tons; making in the whole 35,961 sailing vessels of 5,187,638 tons, and 2,239 steam vessels of 472,764 tons. The grand totals are these:—In 1859, 38,200 vessels of 5,660,402 tons; and in 1868, 40,337 vessels of 7,236,125 tons.

Miscellanea.

MR. A. JOHNSTON has laid before the House of Commons a Bill to extend to sea crab and lobster fisheries the provisions of the third part of the Sea Fisheries Act of 1868, empowering the Board of Trade to make local orders regulating the fisheries, the inspector of oyster fisheries to be also inspector of sea crab and lobster fisheries.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending June 26, was 3,573. Total number since the opening of the Museum, free daily (May 12, 1858), 1,592,834.

THE borings for rock salt near Wylen, Switzerland, have given very favourable results. Near the Rhine, a bed of 80ft. in thickness has been found at a depth of 420ft. below the surface, and another 50ft. thick not far off. The salt is hard, pure, and of excellent quality.

ON Saturday afternoon, a whale, measuring about 15ft. long, went ashore, alive, at Tynemouth, near the base of the Lighthouse Cliffs. Being observed dodging about the rocks, it was captured by some fishermen, and killed by a soldier sticking his bayonet through it.

The Great Metropolitan Choral Festival of 5,000 voices, to be held at the Royal Horticultural Gardens, under the direction of Mr. G. W. Martin, to-morrow (Saturday), will be the largest gathering of choristers ever brought together for an open air festival. The choir will consist of 3,000 first and second sopranos, 1,000 tenors, and 1,000 basses. The Viceroy of Egypt and several members of the Royal Family are expected to attend the festival.

A SEVERE trial of field implements has recently taken place at Wuren, in connection with the Mecklenburg Agricultural Society. After a series of experiments, lasting two days, our English implements fully sustained their reputation. The first prize bronze medal for wheel ploughs, the first prize silver medal for grubbers, and the first prize bronze medal for jointed harrows, were won by Messrs. Ransomes, Sims, and Head, of Ipswich.

THE number of visitors to the South Kensington Museum during the week ending June 26, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 13,008; Meyrick and other galleries, 2,993; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,493; Meyrick and other galleries, 310; total, 18,804. Average of corresponding week in former years, 10,911. Total from opening of Museum, 8,553,830.

THE preliminary meeting of the ironmasters of South Staffordshire and East Worcestershire was held at the Exchange in Birmingham, on the 24th ult. A resolution was unanimously passed to adhere to the current scale of prices for all descriptions of manufactured iron the make of this district. At very few of the works are all the mills and forges in full operation, but the trade is unquestionably in a better state than it was three months ago. The quarterly meetings will commence at Wolverhampton on July 7.

WHILE the temperature has lately been almost that of winter, an excessive heat prevails in many parts of Europe. At Kiew, Russia, the thermometer has been as high as 110¾deg. Fah. The rye and wheat are already in ear, and will be ready for harvesting by the end of the month. A drought prevails in Hungary, and the Lake of Neusiedel is quite dry, and the bottom of its bed is covered with thick grass, on which the inhabitants are pasturing their flocks. The heat is so great that fears are entertained of some epidemic disease.

THE forthcoming meeting of the British Association at Exeter promises to be highly attractive to those connected with the mining interests. Advantage has been taken of the proximity of the place of meeting to the mining districts of the Western Counties for arranging a special exhibition of mining products in the Devon and Exeter Albert Memorial Museum. It has been decided that no charge shall be made for exhibition space, and Mr. W. S. M. D'Urban, the curator, has undertaken to furnish all necessary information to intending exhibitors.

THE Japanese dignitaries, says the Boston "Journal of Chemistry," who recently visited this country under the direction of Mr. Burlingame, were observed to use pocket paper instead of pocket handkerchiefs whenever they had occasion to remove perspiration from the forehead, or "blow the nose." The same piece is never used twice, but is thrown away after it is first taken in hand. We should suppose, in time of general catarrh, the whole empire of Japan would be covered with bits of paper blowing about. The paper is quite peculiar, being soft, thin, and very tough.

GENERAL MORIN, in giving an account at the Academie des Sciences of the successful application of his ventilating apparatus in a large weaving factory employing 400 workpeople, and in which were lighted 400 jets of gas, observed that its advantage might be judged of from the fact that during October, November, and December, 1867, when the ventilation was defective, only 15,000 kilogrammes of bread were consumed, while, during the same months of 1868, after it had been improved, 20,000 kilogrammes were required, being a gain of 25 per cent. for the health and vigour of the operatives.

A STATEMENT prepared in the Public Debt Office at Calcutta shows that in the last half of the year 1868 notes of the registered debt of India were presented for interest at the Treasuries of India as follows:—By Europeans, 25,77,74,500rs., and by natives, 11,74,23,300rs. The proportions are 69 per cent. held by Europeans, and 31 per cent. held by natives. These proportions may be assumed to obtain in regard to the whole 57,07,52,600rs., the amount of notes presented and not presented. The enfaced notes held in London, 15,75,19,400rs., are assumed to be held by Europeans.

THE annual Parliamentary return shows that in year 1868, 10,837,804 tons of coal, cinders, and culm, of the declared value of £5,352,525, were exported from the United Kingdom, an increase of 422,026 tons over 1867, but a decrease in declared value. Above 1,900,000 tons were exported to France. 10,575,275 tons were shipped coastways from port to port of the United Kingdom, a less quantity than in 1867 by 724,115 tons. 5,976,452 tons of coal were brought into the port of London in 1868, being 353,098 tons less than in 1867; 2,981,230 tons came coastwise, and 2,995,222 tons by inland navigation and by railway.

THE extension of time granted for the construction of the new dock, with the additional works authorized by the supplemental Hull Dock Act of 1866, expiring on the 28th ult., it was determined by the directors of the Hull Dock Company to virtually open the dock in compliance with the terms of the Act, although the public opening does not take place until the 22nd inst. Accordingly, the Goole steamer "Her Majesty" was placed in the large lock in readiness for the opening of the gates on the arrival of the chairman and directors. The vessel made the circuit of the dock, and returned into the lock pit, from whence, owing to the state of the tide, she was penned into the river Humber.

TOWARDS the close of last week some of the digging claims in the Sutherland goldfields turned out very well, and a few of the lucky diggers made from 10s. to 12s. a day for a few days. This raised the ebbing spirits of most of the men, and all hands are now working with a little more courage. Most of the old claims are running out, and a general desire is expressed that a new allotment of ground should be marked off. A few new hands are still arriving, and the number of licenses issued for the month now amounts to 170. One of the Inverness jewellers visited Kildonan last week, and purchased a considerable quantity of gold at £3 10s. an ounce.

IN carrying out one of the many improvements which the lord of the manor (Mr. Hugh Jones, Bryn Hall), has undertaken in the ancient town of Caerwys, Flintshire, the workmen engaged in pulling down some old masonry a few days ago found imbedded therein some antique and very interesting articles of china and other ware, which must have remained concealed for many generations. Caerwys was a town of great importance during the sovereignty of the native princes, and the present adjoining hall of Maesmynan stands on the site of the palace of that noble chieftain, Llywelyn ein Llyw Olaf, the last independent Prince of Wales. It is expected that curious relics belonging to that period will be discovered in the course of approaching excavations.

A CURIOUS discovery was made at Cracow the other day, during the renovation of the monument of King Casimir the Great, the last member of the Piast dynasty, known in Polish history as "the King of the Peasants and the Jews." One of the workmen having struck the pedestal with his hammer, in order to test its strength, several bricks fell out, leaving an opening through which the interior of the pedestal, which is hollow, was clearly visible. On enlarging the opening it was found that Casimir's coffin, which rested on four iron bars, had rotted away, and that the remains had fallen to the ground. On the skull was a crown of gilt copper, in the shape of a plain circlet surmounted by five lilies. Near this was a silver-gilt sceptre, and close to his feet a pair of large copper spurs. The body was covered with a shroud of thick silk, which is still in tolerably good condition.

RATHER a remarkable circumstance—as showing the strong desire in Turkey to possess railways—is the plan now formed to lay down a railway at the expense of the "vilayet," or Viceroyalty of Broussa. The "Engineer" states that the line is proposed to be between the port of Moudania, on the Sea of Marmora, and the large and busy city of Broussa. This would be executed by money contributions supplied by provincial and municipal taxes, but the earthworks by a contribution of labour, as a labour rate or prestation. The existing roads to Broussa from Ismid and Moudania have proved so useful, notwithstanding all their defects, and the imperfections of the labour rate system, that the inhabitants are encouraged to apply the latter on a larger scale. As a commutation in money is allowed for those who do not work, abuses arise in that department, but, nevertheless, a large fund accrues for construction. When completed, the line will pay well. It is likewise taken up by the Viceroyalty with the view to a possible extension to Konieh in the interior.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3740, 3749, 3762, 3784
BUILDINGS AND BUILDING MATERIALS—3746, 3763, 3772, 3777, 3785, 3788, 3796
CHEMISTRY AND PHOTOGRAPHY—3771, 3785
CULTIVATION OF THE SOIL, including agricultural implements and machines.—3735, 3736, 3755, 3770, 3789, 3790
ELECTRICAL APPARATUS—3780
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3742, 3756, 3758, 3765, 3787, 3794
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3753, 3774, 3775
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—3741, 3757, 3765, 3776, 3782, 3798
GENERAL MACHINERY—3732, 3743, 3779, 3781, 3792
LIGHTING, HEATING, AND VENTILATING—3737, 3750, 3771
METALS, including apparatus for their manufacture—3760, 3785
MISCELLANEOUS—3731, 3748, 3751, 3753, 3759, 3761, 3764, 3767, 3773, 3778, 3780, 3791, 3795, 3799
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3733, 3738, 3744, 3745, 3752, 3754, 3768, 3793, 3800
SHIPS AND BOATS, including their fittings—3747
STEAM ENGINES—3783
WARFARE—3734, 3769, 3797

3731 F. A. FARWIG, Selurst, and C. HAYNES, Bermondsey New-road. *Sheet metal casks.* Dated December 8, 1868.

The inventors make metal casks with four equal sides, the heads and bottoms having flanges, which heads and bottoms are placed in their positions inside the body of the casks, then dipped or soldered and riveted in the ordinary way. The body is made in four equal parts, bent at right angles and joined together with the usual lap-jointed double seams in centres. The top of the cask is made concave and convex, for the purpose of strengthening the top of the cask, and the concave forms an air chamber. The body and bottom are made with convex or hollow flutes, and when extra strength is required that is produced by soldering or fastening to the inside of the cask tinned wire or other metallic ribs.—Patent completed.

3732 J. FITTER, Birmingham. *Nuts.* Dated December 8, 1868.

This consists, first, in making the nuts or screw boxes of table expanders of a white metal or alloy, in place of the bars or gun metal ordinarily employed for that purpose. The nuts or screw boxes are made of this white metal or alloy by the process of casting. Second, in casting the nuts or screw boxes of table expanders on the screws of the table expanders by the use of metal moulds instead of casting the nuts or screw boxes in sand, as is usually practised.—Patent completed.

3733 O. REYNOLDS, Manchester. *Signalling.* Dated December 8, 1868.

This consists, principally, in attaching some suitable explosive material or compound to any convenient part or parts of the train, such explosive material or compound being so attached and connected with a trigger button, ring, or other suitable contrivance, that it may be exploded by any of the passengers or by the guard when necessary, and by its report convey the required signal to the guard or engine driver.—Patent abandoned.

3734 R. B. RODEN, Usk. *Firearms.* Dated December 8, 1868.

The ordinary lock which usually is placed upon the side of the stock, or in some instances in the centre of the stock, is by this invention entirely dispensed with, and the piston or striker by which the ignition of the cartridge is effected is operated or functioned by a lock in connection with, attached to, or formed partly in, the breech lock or closer, and in some instances moving with and on the same axis as the breech lock, and, if required, securing or locking the breech block firmly in position during the discharge of the cartridge. The breech block or closer and shoe or barrel, where no shoe is employed, together with the trigger arrangements and mode of latching down the breech block or the piston of the latching stud, and the manner of attaching the shoe or barrel to the stock, as also the form of the stock itself, may be varied and modified to suit the altered requirements.—Patent completed.

3735 T. SPEIR, Blackstone. *Cultivating land.* Dated December 8, 1868.

This consists in fixing one or more pairs of plough shares, mould boards, and bodies to brackets fitted on opposite sides of a shaft. This shaft is carried in a rectangular frame, and when the machinery or apparatus is in operation, the shaft lies in a diagonal direction. When the ploughing mechanism or apparatus has travelled across the field which is being ploughed or cultivated in one direction, the position of the diagonal shaft is reversed, and at the same time turned upon its axis so as to turn the plough bodies (which are fixed on the opposite side of the shaft and point in an opposite direction) into position to enable the apparatus to be employed in cultivating or ploughing the land in a reverse direction.—Patent completed.

3736 T. SPEIR, Blackstone. *Cultivating land.* Dated December 8, 1868.

This consists in placing one or more pairs of plough shares, mould boards, and bodies upon a series of transverse shafts carried upon an oblong frame. The plough shares, mould boards, and bodies are fixed on opposite sides of the shafts, an equal number being placed on each side so as to cut an equal number of furrows in advancing or returning across a field. On each of the transverse shafts a pitch or chain wheel is fitted, actuated by a pitch chain or an ordinary chain from the central transverse shaft, which may be fitted with a double pitch or chain wheel, so as to actuate the transverse shafts, which are situated on each side of it by separate chains, or an endless chain may be used for that purpose. By means of a hand wheel the shafts are turned on arriving at each side of the field being cultivated, so as to bring the proper set of ploughs into position, according to the direction in which the apparatus is to travel.—Patent completed.

3737 F. LANCASTER, Bootle. *Consumption of fuel.* Dated December 8, 1868.

This consists in placing or building within, and at a short distance from the back end of the furnace, a firebox or other fire grate. A metal plate, or a metal plate and firebrick, firetile, or fireclay combined, in some cases perforated with holes for the admission of air from the chamber formed by the space left between the plate or wall, or both of them, and the tube plate or back of the furnace. This chamber has an inlet for the admission of atmospheric air proportioned to the quantity of air, which in each particular case may require to be admitted. The inlet opens under the firegrate, and is furnished with a regulator in the form of a damper, door louvres, or other suitable mechanical arrangement, and is worked from the front of the furnace in any convenient manner inside the firebox, furnace, or other firegrate.—Patent completed.

3738 F. W. MOSS and G. MOSS, Leicester. *Railways.* Dated December 8, 1868.

In carrying out this invention, the inventors dispose between the rails of a line of railway, projections, in the shape of double inclined planes, placed at suitable distances apart. Each of these double inclined planes is made to slide transversely in a guide placed between the line of rails by means of a chain or wire attached to each side of the inclined planes. Each of these chains is connected to a bell crank placed at opposite sides of the line. One of these bell crank levers communicate by means of a chain or wire with a bent lever or other device pivoted at one side of the line, a short distance in advance of the inclined projection, in such manner that it will be on a level with or above the rail, near which it is placed, so as to be depressed by one of the wheels of the engine when passing.—Patent abandoned.

3740 C. P. COTTON and J. L. LYSTER, Dublin. *Kilns.* Dated December 8, 1868.

In a kiln constructed according to this invention, the upper part of the chamber of the kiln may be of any usual shape—elliptical, cylindrical, conical, or otherwise. At a certain point, say, about one-third the entire height of the kiln from the bottom, the chamber suddenly expands below this point, and from this expanded portion it becomes gradually narrower down to the draw hole or bars.—Patent abandoned.

3741 W. H. POTTLE, Gray's Inn-road. *Umbrellas, &c.* Dated December 8, 1868.

This relates to the runners of umbrellas, parasols, and sunshades, and arrangements in connection therewith. The improved runner is formed with a longitudinal slot or opening, and is fitted or provided with a ring or collar, which is capable of being rotated or turned on the runner wholly or partially, that is to say, to the required extent in both directions. Suitable stop arrangements are provided to hold the ring in the required position. A portion of this ring is raised or arched, so as to form a sort of bridge-piece. Two pins, studs, or stops are fixed in the stick, one at the upper and the other at the lower part thereof, in convenient positions for the operation of the runner.—Patent completed.

3742 J. KIRK and J. KIRK, Nottingham. *Weaving.* Dated December 8, 1868.

The inventors place between every carriage thread used (emanating, of course, from the bobbin encircled within the carriage) in that part of the fabric to be woven any given number of longitudinal warp threads, ranging in number according to the closeness of the weaving desired to be produced. The warp threads are caused to move in such manner that each bobbin thread produces a portion of the weaving. These warp threads are all weighted, so as to draw off any required quantity of the bobbin or wefting threads, according to the distance or number of longitudinal warp threads over which they should be drawn.—Patent completed.

3743 J. BALL, Nottingham. *Cutting threads.* Dated December 8, 1868.

There are two standards, one at each end of the machine. Each standard has three vertical arms; the standards are connected by tie bars near the lower part. The front vertical arms of the standards are also connected at their upper ends by a tie bar; the tops of the back arms are also connected by a tie bar. The upper ends of the central vertical arms are connected by a tie bar, which is formed with a knife edge on the top side and in front of the last-mentioned tie bar, but is placed somewhat lower in another bar, which has a rounded smooth edge on the top side. This bar is also secured to the front of the central vertical arms, and below the last-mentioned bar.—Patent abandoned.

3744 G. P. WHITE, Furnival's-inn. *Roadways, &c.* Dated December 8, 1868.

The inventor employs corrugated wrought iron or steel plates, riveted together to the required width, laid with the corrugations extending across the roadway or platform from side to side. The corrugated plates are curved or arched upwards to the contour of the roadway, which is laid directly upon them, and at either side of the roadway or platform their edges are supported by angle irons, which are tied together by the tie bars of T iron, or iron of other form, or transverse girders passing from one angle iron to the other underneath the corrugated arch. Longitudinal bearers or supports, which may advantageously be of timber, so as to avoid a too great rigidity, are introduced between the arched plates and the ties.—Patent completed.

3745 W. BAINES, Smethwick. *Signalling.* Dated December 8, 1868.

For signalling and working the switches, in order that it may be impossible to place the signals in a manner inconsistent with the position of the switches, and therefore dangerous, the inventor fixes to the lever of the trailing points a long socket or boss, on which the other levers of the switches and signals are mounted and turn. The socket or boss carries a bar running from end to end of

it. This bar, which acts as a stop, passes through slots in the signal levers, and also in the lever of the facing points, in order that the facing point lever may control the positions of the down signal levers. These are mounted on each side of it, and between them and the facing point lever there are mounted frames or plates, capable of sliding a short distance in guides in a direction at right angles to the plane in which the point lever moves. There are notches in the frames or plates, which fit projections on the levers, so as to hold the levers.—Patent completed.

3746 S. S. ANDERSON, Bishops Auckland. *Bricks, tiles, &c.* Dated December 9, 1868.

This consists, first, in the application of a steam cylinder for the purpose of imparting a reciprocating motion to the cutter frame of that class of brick and tile-making machines where the clay or other plastic substance is moved forward through a suitable die on to the cutter table by means of screw blades turning upon a central axis in a mixing chamber. The slide valve of this steam cylinder is worked by means of studs or a cam fixed upon the axis of the roller, which conveys the clay or other plastic substance from the die box on to the table upon which it is to be cut into bricks, tiles, or other similarly shaped articles. Second, in an improved die box with a chamber for containing the lubricating fluid, attached thereto and fitted with suitable plugs, taps, or valves for regulating the supply of lubricating material to the inner surface of the die.—Patent completed.

3747 J. T. PARLOUR, Brooklyn, New York. *Blocks.* Dated December 9, 1868.

This relates to keel and bilge blocks, which are more especially designed for supporting a ship or other vessel laid up in dock for repairs. These blocks are made in several parts or sections, and the invention consists chiefly in the peculiar construction and arrangement of the parts or sections, and in the novel means for adjusting and securing the same in any desired position under the vessel to adapt the blocks to vessels of various dimensions without removing the water from the dock.—Patent completed.

3748 F. MEADOWS, Red Lion-court. *Brass ruling.* Dated December 9, 1868.

In machines constructed according to this invention, the knife or cutter is fitted in a carrier, free to be moved up and down in vertical guides. A link, operated by a lever handle, bears upon an incline on the carrier. The carrier carries a platten or presser fitted in a vertical guide therein, and a strong spring on the carrier presses on the platten.—Patent completed.

3749 R. NEEDHAM, Dukinfield. *Fuel economizers.* Dated December 9, 1868.

This relates, first, to the means of driving the gearing which gives motion to the scrapers of fuel economizers, and consists in obtaining the necessary motion for this purpose from the force of the feed water as it is fed into the economizer. This may be accomplished in various ways; for instance, the water might be made to raise a clack valve, the motion of which is communicated to a ratchet wheel by means of a catch and lever and clack valve, which rises and falls as the feed water is forced through the pipe, and thus acts on the lever, which is connected by means of the connecting rod to the ratchet lever.—Patent completed.

3750 J. BOLTON, Bristol. *Charcoal.* Dated December 9, 1868.

The inventor makes the retorts conical, and mounts them with their axes horizontal. By this the charcoal is carried forward continuously by the simple revolution of the retort without internal mechanism. He also, in some cases, makes the retorts with corrugations lengthways, by which means a much larger amount of metallic heating surface is obtained, and the charcoal, which is itself a bad conductor of heat, is consequently more uniformly heated. In some cases, in order to increase the heating surface, he places inside an otherwise plain retort a number of ribs or shelves running lengthways of the retort and radiating from the centre; such ribs also give increased strength to the retort.—Patent abandoned.

3751 J. PARKINS, Brewer-street, Golden-square. *Embossing, &c.* Dated December 9, 1868.

The machine consists of an oblong metal frame fixed at one end to an ordinary stamping machine bevelled off on its inner edges so as to form V guides on which the die bed slides. This die bed consists of a steel or other metal block having a hole in it for the reception of the die. A small trough is attached to the inner side of the die bed, to catch the superfluous ink that will be caused to flow round and down the die by the sharp edge of the die coming in contact with the brush of the inking apparatus. Sliding on this oblong frame is another and smaller metal frame which receives a reciprocating or forward and backward motion from the die bed, which is actuated by means of cords acted upon by a treadle and weight, or by any other suitable mechanical arrangement. On the sides of this second frame are formed vertical wedge-shaped cams, which, as the frame and die bed are moved to the right, in order to bring the die under the inking brush, will support the cushion or impression frame out of the way so that the die may pass forward without touching it.—Patent completed.

3752 T. STURGEON, Manchester. *Signalling.* Dated December 9, 1868.

This consists in an improvement upon the ordinary vibrating electric bell. Besides making the usual connections between the belt and the battery, the inventor makes another connection by means of a wire passing through these points, from which it is desired to have a means of communication.—Patent abandoned.

3753 A. G. GOODES, Newgate-street. *Cigars.* Dated December 9, 1868.

The inventor employs the husk of the Indian corn or maize plant (Zea mays) to form the "bunch" wrapper instead of using either paper or tobacco for this purpose. The flavour of the cigar or cheroot will in this manner be greatly improved. The husk is applied in its natural sun-dried condition for wrapping round the "bunch," in the same way as when using tobacco leaf or paper for the purpose.—Patent completed.

3754 W. GRIFFITHS, Mount-street, Grosvenor-square. *Bits and bridles.* Dated December 10, 1868.

The inventor provides each end of the bit bar, in addition to the ordinary rings to which the reins are attached, with another smaller ring through which the safety reins are to be passed, the bit bar being made either in one piece or jointed in the centre.—Patent completed.

3755 J. NORMAN, Glasgow. *Grinding grain.* Dated December 10, 1868.

This comprises two serrated plates, between which the grain passes, whilst one plate has imparted to it, by means of a revolving crank or its equivalent, a short rapid reciprocating stroke, or both plates may be made to reciprocate in different directions.—Patent completed.

3756 W. H. PLATT, Ashton-under-Lyne. *Shuttles.* Dated December 20, 1868.

The object is to dispense with the square mortise hole which is usually made in the lower side of the shuttle. Instead of cutting the square mortise hole beneath the shuttle for the reception of the spring, the inventor only mortises away sufficient from the upper part of the shuttle to receive the square end of the shuttle peg, and from the base of this short mortise he bores out a hole in the direction of the shuttle point, and he inserts therein a straight or flat spring, slightly curved or bent at one end, supporting and holding the said spring by means of two pins or cotters driven in from the side of the shuttle.—Patent abandoned.

3757 W. G. MANWARING, Banbury. *Sewing machines.* Dated December 10, 1868.

This relates to lock-stitch sewing machines, wherein the needle is actuated from a rotary driving shaft or spindle carried in the fixed arm of the machine, and consists essentially in transmitting motion from the overhead shaft to an oscillating or vibrating shuttle carrier, by means of an eccentric crank pin, cam or other mechanical equivalent mounted on the driving shaft, and connected by a connecting rod and short lever arm with a rocking shaft situate below the cloth plate, which rocking shaft carries the vibrating shuttle drum.—Patent abandoned.

3758 A. MATTHIESEN, St. Bartholomew's Hospital. *Paper.* Dated December 10, 1868.

The inventor submits wood when in a state of division, such as shavings, sawdust, or disintegrated wood, to what is known as a retting process, that is to say, the wood in a state of division is steeped either in running or stagnant water, and is allowed to undergo a retting or fermenting process, by which process certain constituents of the wood will be decomposed and removed, and the subsequent treatment of the residual ligneous fibre for the production of pulp or paper will be thereby rendered more economical, and the process of boiling and bleaching be more easily effected.—Patent completed.

3759 H. A. BONNEVILLE, Paris. *Measuring.* (A communication). Dated December 10, 1868.

This consists in a graduated circle, giving, by means of a vernier, the ten seconds of horizontal angles. There is a glass moving in the plane perpendicular to the circle, and another glass fixed by a support in the vertical plane of the glass upon the circle. A powerful microscope is closely connected with the glass, and there is a very sensitive level resting on a ruler of a determinate length. A scale is fixed vertically at the extremity of the ruler, in the plane of the optic axis of the microscope, and divided into half millimetres (the millimetres are alone marked with a figure comprised between 1 and 100). A micrometrical screw is joined to the lower part of the scale, giving the 2-10,000th of a millimetre of the scale read on the graduated circle of the screw. Another very sensitive level may be applied on the glass, and serves to determine its horizontal position.—Patent completed.

3760 W. GRAY and T. BIGGIN, Sheffield. *Spanners and wrenches.* Dated December 10, 1868.

This consists, first, in the placing of the cavity in the moulds to receive the steel in a fluid state in a slanting direction, so that the stream of molten steel, when poured into the moulds, falls straight to the bottom of the mould, as shown, so as to keep clear, and not come into contact with the movable or fast steel pegs or cores, which would be liable to be damaged by the molten steel falling upon them, and also prove injurious to the articles produced. The moulds are proposed to be made in parts or portions, to open with or without a hinge at the bottom, as may be found most convenient.—Patent completed.

3761 W. S. JACKSON, Carter-street, Walworth. *Decomposing bones.* Dated December 10, 1868.

This consists, first, in a more effective and economical method of applying solutions of hydrochloric acid and similar known solvents to bones, for the purpose of dissolving the earthy matter, and separating it from the animal matter thereof, by arranging the bones in suitable vessels, as described herein, and then subjecting them to the solvent action of the solutions, these solutions being applied to the bones under an increased pressure or at the ordinary atmospheric pressure only as required, until they are saturated, or nearly so, with the earthy matter of the bones. Second, in the decomposition of the phosphates of calcium, obtained by the action of solutions of hydrochloric acid or bones, by means of silicic acid, for the economical extraction of their phosphoric acid and phosphorus. Third, in submitting the animal matter obtained by the action of solutions of hydrochloric acid or bones to the direct action of high pressure steam for the productions of gelatin and glue.—Patent completed.

3762 J. SMITH, Kingsland, and J. F. N. B. SIMONS, Great St. Helens. *Steam boilers.* Dated December 10, 1868.

The boiler is completely encased in brickwork or setting, with the exception of the top of the steam dome and the manhole cover. This brickwork or setting is not in contact with the boiler, but an air space an inch or so wide is left. This space is in communication with the flues, so that the air in the space becomes heated, and there is no outlet from the casing, so that the draught is prevented passing through it; otherwise, the boiler would become unduly heated over the water line.—Patent abandoned.

3763 C. E. BROOMAN, Fleet-street. *Roofing.* (A communication). Dated December 10, 1868.

This consists in roofing or covering houses or other buildings with oblique slates or tiles secured by bent metallic wires or fastenings and staples or eyes on wooden or metallic lathwork. To carry out this mode of roofing, square slates or tiles are employed without a shoulder, and with a notch at the base to receive the metallic wires or fastenings fixed to oblique lathwork. The wires or fastenings are preferably of zinc or of galvanized iron. The bottom or lower part of each engages into the notch of a slate or tile, whereby a strong roof or covering is obtained.—Patent completed.

3764 J. F. BENTLEY, Peterborough. *Wells.* Dated December 10, 1868.

This relates primarily to sinking or forming wells by the employment of cylinders with conical ends which are caused to enter into finely divided silica or other kinds of earthy matter commonly called "silt," "quick silt, &c."—Patent completed.

3765 W. DAWES and E. A. RAMSDEN, Leeds. *Harmoniums, &c.* Dated December 10, 1868.

Upon or in connection with the pallets or valves of the "Bourbon" or other bass notes of the instrument, or in some cases upon additional reeds for this purpose, the inventors use reverse-action levers or other suitable or convenient mechanical movement or attachment, so constructed that the pressing down of any key within the range or limits of the attachment shall silence or prevent the speaking of all the notes above itself in the stop or stops thus fitted, and shall restore or allow the speaking of any note above itself when it is lifted or ceases to be the sub-bass note required, so that when in action the stop or stops to which this automatous movemen its applied can only speak or sound "one note at a time," and that the lowest note that is pressed down or used by the player upon the keys instead of the highest or upper note.—Patent completed.

3766 J. PICKLES, E. RAMSBOTTOM, S. HAGGAS, S. FOULDS, J. SHACKLETON, all of Bingley, York, and W. BERRY Bradford *Spinning frames.* Dated December 11, 1868.

Upon a small portion of the spindle top the inventors form a double threaded (or it may be a treble or quadruple threaded) screw, with a plain part above and below it. The flyer has a corresponding female screw tapped into the upper part of the head or boss thereof, the lower part being plain to correspond with the plain part below the screw on the spindle top before mentioned. This screw, which is made left handed, as usual for the spindles of spinning frames, and right handed for twisting frames, greatly accelerates the disconnection of the flyer from the spindle. They make the pitch of the screw from ¼in. to ½in., and so that by giving a slight touch to the shoulder of the flyer in the direction the spindle runs, it will release itself from the spindle in one turn of the screw, or thereabouts.—Patent completed.

3767 R. WAYGOOD, Newington. *Ventilation of mines.* Dated December 11, 1868.

This consists in fitting or constructing self-acting valves in the ventilating shaft, and in the approaches from the workings thereto. These valves open to allow of the ordinary upward current, but immediately close against any tendency to a return current. The valves may consist of strong sashes divided into squares, each of which is provided with a hinged balanced flap opening outwards only.—Patent abandoned.

3768 T. HOLDER, Westbourne-road, and G. DOVER, Holloway. *Horse shoes.* Dated December 11, 1868.

This consists in adapting a clip-shaped piece of metal or appliance to the front part of a horse shoe when fixed to a horse's foot by nails in the usual way; also in placing roughing pieces or points of steel loosely in such said clip piece, so that they can only be removed or withdrawn when the clip is taken off or removed from the shoe when the roughing points are worn down or otherwise rendered useless.—Patent completed.

3769 H. CARTER and G. H. EDWARDS, Bow. *Firearms.* Dated December 11, 1868.

The breechblock or plug is arranged to open and close by a vertical motion by means of a hinge or joint in connection with the barrel, the plug fitting the space cut away in a converted gun, or falling into the space formed in a gun manufactured in the first instance for a breech-loader. The under surface of the plug is flat at the sides to fit the upper surfaces of the sides of the open breech, and is provided at each end with a slotted guide, the guide nearest the barrel serving to contain the striking pin, the stop of the same, and a tube to which it is connected, the other guide containing the sliding locking catch, whereby the plug is shut down and secured in the body of the gun. This locking catch protrudes or extends beyond the closing end of the plug, and retreats when in the act of closing, by reason of the angular or curvilinear face against the surface of the rear of the body. It is also in line with a stem which enters the tube on which the stop of the striking pin is fixed, and a spring being inserted within the tube it follows that the action of the closing catch and tube, stop, and striker, will always be antagonistic, the spring tending to drive the respective parts from each other.—Patent abandoned.

3770 P. KOTZO, Pesth, Hungary. *Reaping.* Dated December 11, 1868.

The object is to ensure the efficient working of the rakes and gathering arms of reaping machines by the use of a simple construction of driving gear. This the inventor proposes to obtain by the employment of an inclined rake shaft, which when rotated will give the desired rising and falling movements to the rakes and gathering arms, and cause the latter to come into contact with the corn and gather it up to the knives, and when the corn is cut enable the rakes to sweep the corn off the platform on to the ground.—Patent completed.

3771 W. H. BAILEY, Salford. *Regulating heat.* Dated December 11, 1868.

In pyrometers where the indication of the temperature depends upon the expansion of rods or tubes of different substances it is sometimes necessary to adjust the indicating apparatus so as to compensate for the permanent expansion which may have taken place in either of the substances used. This invention consists, in the first place, in arranging pyrometers so that this adjustment may be made without taking any part to pieces. This is accomplished as follows:—The indications are made in the usual way by means of a hand or pointer working over a graduated dial, but instead of attaching the case which carries the dial permanently in one fixed position upon the tube or rod, it is screwed on up to the proper position, and secured by means of a small stud which passes through a slot and holds it just sufficiently tight to prevent it being moved by accident. This slot is long enough to allow of the dial being screwed up after the substance has been permanently expanded sufficiently far to maintain the relative lengths of the bars and compensate for the permanent expansion.—Patent completed.

3772 F. WALTON, Staines. *Building.* Dated December 11, 1868.

The inventor constructs a light building requiring only comparatively unskilled labour in its erection and but little foundation, and which is very dry and warm, in the following manner:—He takes a number of narrow planks and places them horizontally one over the other, separating them one from the other by placing at intervals blocks or short uprights between them. These blocks may be of

wood or a moulded brick or drainpipe. In this way, a frame of the desired dimensions is produced, the blocks being arranged in vertical lines, and the frame being firmly bound together by long bolts passing from top to bottom of it. Each bolt is passed close alongside of, or it may be through, a vertical line of blocks. The frame may be lathed and plastered on both sides, or wicker-work hurdles may be fixed upon it to receive the plaster, or it may be planked or otherwise closed. In place of wood planks and blocks, other materials may, in some localities, be advantageously substituted; thus, for the planks, sheet iron bent to a trough-like form or otherwise may be used, and for the blocks lengths of iron tube may be substituted. The inventor takes a number of iron bars or sheets, about ½in. to ¼in. thick, the edges of which are turned up by a pair of rollers, and the patentee places them horizontally one over the other, separating them from each other by placing short cast-iron pipes or tubes between. The pipes are arranged vertically one over the other, and either through or alongside of each vertical line of tubes a long bolt is passed through all the sheets of iron, and screwed up tight. A rib or bar of wood is then bolted on to the flanged edge of the iron sheets, and then the frame so constructed can be lathed and plastered, or it can be covered with iron, wood, or felt. When plaster is used, wickerwork hurdles or wire gauze may be used instead of laths to receive the plaster. Blocks of concrete, with holes through them, or earthenware tiles or blocks of wood may be substituted for the cast-iron tubes aforementioned.—Patent completed.

3773 E. H. BAYLEY, Newington-causeway. *Filters.* Dated December 12, 1868.

Instead of one sediment well, three wells of a cylindrical form are placed transversely across the bottom of the tank. The water in the tank flows first into the central well, to the bottom of which the sediment falls through a trap, and is drawn off by a cock. The water thus partially purified then flows through two separate pipes into the lower part of the two outer wells.—Patent completed.

3774 B. HUNT, Searle-street. *Cooking.* (A communication). Dated December 12, 1868.

The apparatus in question is composed principally of five tubular boilers, constructed as to their details in accordance with the French patent of Mr. Cail, dated May 23, 1860 (No. 45,242). Besides the five boilers, it is provided above and below with an injection or a surface condenser, or with condensers of another kind.—Patent completed.

3775 J. MILLWARD, Birmingham. *Preserving meat.* (A communication). Dated December 12, 1868.

This consists in subjecting the meat or animal matter to be preserved to the following process or method of treatment:—The meat, either in whole carcases or in parts, is suspended within a vat or receiver, from which the air is then exhausted as completely as practicable by an air pump or other means. The vat is then rapidly filled with gaseous bisulphide of carbon, protosulphide of carbon, carbonylic sulphide, or some equivalent gas, either alone or with phenic acid, methyl, or other product of the destructive distillation of wood or coal. The sulphides of carbon may be produced by any of the well-known methods. When such phenic acid or methyl is used, it is employed in the proportion of about one ounce thereof to every 100 cubic feet of sulphide of carbon gas, but the inventor does not limit himself to these proportions, and the phenic acid or methyl may be dispensed with entirely. —Patent completed.

3776 A. WOODS, Holloway. *Spring mattresses.* Dated December 12, 1868.

The inventor takes, by preference, three frames, and places one above the other. The top and bottom frames are made of the same size, and are adapted to the shape and size of the bedstead to which they are to be applied. The third frame, and which is placed between the top and bottom frame, is somewhat smaller than the others, and the patentee makes the frames of wood, and, by preference, of spruce, deal, or pine, for the sake of lightness. —Patent completed.

3777 H. LAW, Essex-street, Strand. *Waterclosets.* Dated December 12, 1868.

The inventor connects the service pipe, by means of which water is to be supplied to the closet, whether from a main under pressure or from an elevated cistern, with a valve cock so constructed that upon raising the piston of the same, communication is opened between the service pipe, and a vessel of vulcanized india-rubber or other suitable elastic material, capable of expanding under pressure and of contracting upon the removal of the same, and he encloses this vessel with a mould of the size and form which it is desired that the vessel should assume when filled with water under pressure, and of sufficient strength to resist the greatest pressure to which the vessel can be exposed.—Patent abandoned.

3778 C. ELLISON and E. PARKINSON, Crosshills. *Measuring.* Dated December 12, 1868.

This consists of a stand in form of a cross, the stem or upright being in two or more parts, so as to be adjustable in the height of the crosspiece to the armpit or under the arm of the person to be measured, the bottom of the stand resting on the ground or floor. The crosspiece is flexible, and with a strap having eyelet holes attached to one and with a stud or pin in the other, so that it may be bent around and secured to the body. An upright piece is attached to the cross so as to be adjustable to the centre of the back, and also to the height of the back of the neck or collar. On this upright are two other parts at right angles thereto, one capable of being set to the back of the shoulder and the other to the waist of the person being measured. On the other arm of the crosspiece is an upright, capable of being set or adjusted thereon, and to the front of the neck of the person, and also on the said cross are two adjustable bosses or collars, to which are attached tape measures, to measure the shoulder and waist. On the lower part of the stem is also an adjustable crosspiece to lay across the thighs, on which is a boss carrying a plummet line and an upright piece to adjust to the front centre of the body on which is a crosspiece to adjust the fork or between the thighs of the person.—Patent completed.

3779 T. SMITH, Birmingham. *Bellows.* Dated December 12, 1868.

This consists in securing a pair of guide rods in a horizontal position in the body of the bellows from front to back, the forward ends of which are attached to an annular collar forming part of the body. The other ends of the guide rods are secured to the bottom of the bellows. The larger end of the pipe is formed with a suitable flange or collar, and slides upon the pair of guide rods through the annular collar into the body of the bellows. When the pipe is required to be fixed in position, it is drawn out upon the guide rods, and secured by screws or bolts passing through the annular collar and the flange or collar of the pipe.—Patent abandoned.

3780 Z. POIRIER, Lambeth. *Stoppers.* Dated December 12, 1868.

This safety stopper is composed of a short vulcanized india-rubber or cork tube, in the upper part of which is inserted a metallic ring, on which this tube is kept fast by any suitable means, either by binding, spurs, expansion, &c. A screw-tapped peg with a conical head is inserted upwards in the india-rubber tube, through which it runs, and is provided with a round screw nut at its upper part. This tube so fitted is inserted in the neck of the bottle to be stopped, and the screw nut being turned to the right with the fingers causes the screw-tapped peg to move upwards; the conical head of the latter entering gradually in the india-rubber tube presses it against the internal side of the neck at the very place where this neck is conical, and the bottle is hermetically closed, because the conical head of the peg presses the india-rubber or cork tube in its whole periphery against the conical neck of the bottle. To open the bottle, the screw nut must be turned to the left; then, by pushing down the peg, its conical head comes out of the rubber tube, and the stopper is easily removed.—Patent completed.

3781 S. COPPERTHWAITE, Chapel Allerton, York. *Turning.* Dated December 12, 1868.

This consists of apparatus to be applied to an ordinary lathe, in which apparatus a series of cutters is so arranged in a drum that, as it revolves, each cutter is successively caused to act on the material or blank to be turned, so that the shape of the said blank is perfected during one revolution of the drum.—Patent abandoned.

3782 C. E. BROOMAN, Fleet-street. *Indicators.* (A communication). Dated December 12, 1868.

The apparatus, when applied to letter boxes, comprises two turning prisms, one of which, for carrying the figures to show the hours or times of collection, has a vertical axis, and the other, for showing the days of the week, has a horizontal axis.—Patent completed.

3783 G. PRESTON and J. PRESTIGE, Deptford. *Lubricators.* Dated December 12, 1868.

This relates to lubricators for the use of tallow and other hard fatty substances. The process of lubrication with the lubricators is continuous, and by means of an internal spiral tube or worm becomes operative immediately the steam is admitted to the engines.—Patent completed.

3784 J. ERSKINE, Manchester. *Economising fuel.* Dated December 12, 1868.

This consists in forming the fire-bridge on a beam or otherwise, to commence about on a level with the fire-bars, and ascend to within a few inches of the under side of the boiler or top of the flue or furnace.—Patent abandoned.

3785 J. HAMILTON and J. B. CRAWFORD, Glasgow. *Cutting stone, &c.* Dated December 12, 1868.

This consists in using a thin blade of steel which is held in a suitable tool holder, attached to or forming part of a planing or slotting machine slide rest or revolving disc. The thin blade of steel is placed in a groove or recess made to receive it in the front part of the holder, and at the lower or cutting end it is supported by a piece of metal projecting downwards from the holder, so that as the cutting action is going on, the projection affords a rigid bearing to the tool. The tool holder is provided with a screw rack and pinion rollers, or other means for lowering the tool as its lower end wears away, or it may be lowered by the attendant workman.—Patent abandoned.

3786 A. PRINCE, Trafalgar-square. *Reducing ores.* (A communication). Dated December 12, 1868.

The ore of gold or silver is to be powdered and mixed with a proportionate quantity of fluoride of calcium, natural or such as is artificially prepared, or of any other fluorine salt or acid, and the mixture is to be exposed to the combined action of steam and carbonic acid. A decomposition of the mineral results, and a milky solution is obtained, from which the mechanically suspended gold is abstracted, by passing the liquid through a bath of mercury or other suitable menstrum. The refuse of the mineral solution is used as a cementing liquid or base for paint.—Patent abandoned.

3787 G. A. C. BREMME, Liverpool, *Flax.* Dated December 12, 1868.

This relates to new and improved apparatus for causing the continuous rotary movement in one direction of a shaft or prime mover to communicate to other parts of the mechanism a reciprocating rotary movement greater in the one direction than in the other, and such improved apparatus is especially applicable to the machinery referred to above. The construction which is adopted for this purpose is the following:—A toothed wheel is fixed on the reciprocating shaft of the roller, and a pinion is held in gear with this wheel, by means of radii or arms, connecting the axis of the wheel with the axis of the pinion, allowing both to rotate freely, but keeping their axes always at the proper distance for gearing. The axis of the pinion or any convenient point of the arms or rocking frame is connected by a connecting rod to a crank or eccentric, fixed on a continuously rotating shaft or prime mover, so that as this prime mover rotates, the pinion is caused to vibrate in an arc described from the centre of the reciprocating shaft. On the reciprocating shaft he mounts loosely a pulley or wheel which is driven with continuous rotary motion by a band, strap or by suitable gearing from any convenient prime mover. This pulley or wheel has affixed to it a toothed wheel or pinion, which gears into the vibrating pinion or into a wheel affixed to it.—Patent completed.

3788 H. L. D. MARSDEN, Louth. *Framings and joints.* Dated December 12, 1868.

The transverse section of the parts to be jointed together may be either three or four sides, or polygonal or circular, but the inventor prefers the square form. The construction of the joint or a portion of the frame is as follows:—Taking timbers of square transverse section as an example, namely, two pieces are placed across each other and in contact, and are then bolted, screwed, pinned, nailed, or otherwise rigidly fastened together; a third piece is then placed in one of the angles formed by the intersection of the first two pieces, having parts of two of its sides in close contact with a portion of a side of each of the two first pieces. The direction of the length of the third piece must be inclined to the direction of the length of each of the other two, and not be parallel with it. Parts of the other forms are united in a similar manner.—Patent abandoned.

3789 J. HINE, Cockermouth. *Millstones.* Dated December 12, 1868.

The apparatus consists of a rectangular frame having a longitudinal opening or slot, in which works the block containing the diamond or other cutter. This frame is firmly attached, by means of a nut working in a slot at one end of the frame, to a radial arm pivoted at the centre of the millstones, so as to turn freely, the pivot being fixed to an adjustable plate fitting in the eye of the stone. The attachment between the arm and frame is adjusted by means of the nut and slot, so that lines may be cut tangentially to any circle described from the centre of the stone. When a line has been cut by traversing the cutting tool or block by hand from one end to the other of the opening in the frame, the frame is advanced a suitable distance for making a second cut by turning a thumb screw connected to and placed in the rear and near the outer end of the frame. The thumb screw works in a screw socket pivoted to a bed plate, resting on the stone on which the operator sits. In this manner, by turning the thumb screw each time the cutting block traverses the frame, a number of similar and successive cuts will be produced, extending from the circumference of the stone tangentially to any circle described from the centre of the stone, according to the angle at which the radial arm is fixed to the frame. When the thumb screw has reached the end of its course, the motion is reversed, and the bed plate advanced, to proceed as before, until the cutting or dressing of the stone is completed.—Patent completed.

3790 R. NORFOLK, Beverley. *Reaping.* Dated December 14, 1868.

This consists in performing these operations by self-acting machinery, actuated from the driving wheel or other convenient part of the machine, whereby not only is the labour reduced, but the work is performed with more regularity than heretofore. A convenient mode of carrying out this invention is as follows:—To the driving wheel or its axle is fixed a toothed wheel gearing into another wheel, to which is attached a cam which acts on a lever projecting from the platform. The cam is made with a long dwell to hold the platform up, while the corn is accumulating upon it, and with a recess to allow the platform to drop suddenly when a sufficient quantity of corn for making a sheaf has been cut. The toothed wheels above referred to can be changed, so as to vary the rotary speed of the cam, according to the state of the crop or to the size of the sheaf.—Patent completed.

3791 W. MEAKIN, Great Woodstock-street. *Lock spindles.* Dated December 14, 1868.

One handle or knob of china or other material is firmly secured to one end of a square spindle, in any customary manner, with the ordinary attachment revolving in a rose plate firmly secured to the door. The other handle or knob (of china or such like material) has a metal bush or ferrule affixed to it, in the centre of which is a hole accurately tapped to suit a screw thread cut on the angles of the spindle; this metal bush or ferrule has a projecting collar, forming a circular recess to receive a disc of brass, iron, or other material.—Patent completed.

3792 H. E. NEWTON, Chancery-lane. *Producing power and motion.* (A communication). Dated December 14, 1868.

Motion is imparted by a pendulum to a shaft by gear wheels. The cogs of these wheels engage with each other and give the shaft a rocking motion. A working beam is keyed on this shaft, by which motion is conveyed to a crank by a connecting rod. This crank imparts a rotary motion to a fly wheel, the shaft of which is provided with another crank to convey the power and motion to a duplicate arrangement of parts, by a connecting rod attached to another pendulum by an adjustable connection. This pendulum is keyed on to a shaft, and as it oscillates, it imparts motion to a similar arrangement of parts to that just described. Speed wheels, which may be varied in size and multiplied in number, are employed to obtain any required speed for driving machinery.—Patent abandoned.

3793 J. J. STEVENS, Southwark. *Railway switches.* Dated December 14, 1868.

This relates, first, to a reversible switch lever, and consists in the mode of fixing to the lever the weight which holds the switches in their places.—Patent abandoned.

3794 S. W. SMITH, Leeds. *Spinning.* Dated December 14, 1868.

The object is to dispense with the "mule" in spinning, twisting, or doubling, and to operate directly and continuously, by means of a spinning frame, and this is accomplished by the use of a pair of hollowed rollers constructed as afterwards described.—Patent abandoned.

3795 J. ALLMARK, Oldham, and W. BLAKEY, Liverpool. *Tobacco.* Dated December 14, 1868.

This consists in enabling the operator to cut various lengths or thicknesses of tobacco at will, to accomplish which, there is attached to a false bottom, a half nut, working on a sceaw, such half nut being acted upon by a spring or other flexible material to keep the same in gear while working; by compressing the spring or other flexible material, the half nut is thrown out of gear from the screw. The false bottom can then be moved to any part of the box, for the purpose of cutting off any length or thickness of tobacco, or instantly removed to the true bottom of the box to receive a fresh supply.—Patent abandoned.

3796 C. E. BROOMAN, Fleet-street. *Locks.* (A communication). Dated December 14, 1868.

This consists in constructing locks or fastenings with a flush or non-projecting catch bolt, the object being to avoid the inconveniences of a catch bolt with an inclined plane, and which always springs out of its hole when the door is open.—Patent abandoned.

3797 W. J. MURPHY, Cork. *Ordnance.* Dated December 14, 1868.

This relates to improvements in the details of an invention for which letters patent were granted to the same invention dated December 11, 1865, No. 3127.—Patent completed.

3798 J. THOMAS, Gilbert-road. *Tea kettles.* Dated December 14, 1868.

This consists, chiefly, in providing a tea kettle with a

tube or tubes, or with one or more tubes and cups, so formed and arranged as to serve as passages for the heat and draught, so that the heating surface is greatly increased and rendered more effective while the fire is kept bright under the kettle by the free passages of air through the tube or tubes.—Patent completed.

3799 HON. LORD J. HAY, Piccadilly. *Engine counters.* Dated December 14, 1868.

The inventor proposes to employ a peculiar combination of levers in connection with a ratchet wheel or wheels. This combination consists of two groups or series of any number of levers, links, and pawls, the one group or series acting so as to rotate the ratchet wheel or wheels, whilst the other is making the back or return stroke, and *vice versa*, whereby a nearly continuous rotatory motion in the ratchet wheel is obtained. This motion is produced, moreover, at only one half the speed of the ratchet wheel, which is requisite with the ordinary intermittent ratchet motion, as the wheel, in such case, remains at rest during the back stroke, and, consequently, a loss of time is incurred, which has to be compensated for by extra speed in the wheel when in actual motion.—Patent completed.

3800 T. LYNCH, Enishowen. *Railways.* Dated December 14, 1868.

This consists, first, of friction strap lever brakes applied to the locomotive engine and carriages through the medium of drum wheels keyed to the driving and running axles of the engine and carriages respectively, by the arrangement of which the friction straps are caused to impinge tightly upon the peripheries of the drums by weighted levers acting in connection with the traction chains direct from the engine propelling the carriages, thereby supplying the requisite brake power to the train by the slacking of the speed of the engine aforesaid. And, second, in constructing locomotive engines for the above purpose with a firebox and smoke flue at each end, provided with ash pans, with or without regulators for admitting air to the furnaces or fireboxes, in which case the front firebox is used in connection with the after flues, and thus obviate the necessity in each instance of the engine requiring to be turned, and at the same time facilitate the entrance of the draught direct to the fire in the front firebox of the engine.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated June 22, 1869.

1902 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in apparatus or machinery for opening and closing gates, doors, or barriers, and for actuating semaphore signals by means of electricity.

1903 J. Martin, Chapletown-road, Leeds. An improved process for rendering cloth and other fabrics and materials repellent of water, and in the apparatus connected therewith.

1904 G. Musgrove, Pelton Colliery, near Chester-le-street, Durham. A new or improved apparatus for indicating signals in mines or shafts, or in other places.

1905 W. Clark, Gateshead-on-Tyne, Durham, and E. Walker, London-street, City. Improvements in the construction of windlasses.

1906 T. and R. Nuttall, Walmsley, near Bury, Lancashire. Certain improvements in weaving counterpanes, quilts, and other similar fabrics.

1907 J. C. Norman, Great College-street, Camden Town, Middlesex. An improved plough for ploughing land.

1908 G. M. Harris, Quay-street, Iron Works, Gloucester. An improved vice specially adapted for holding pieces of metal intended to be planed on planing machines.

1909 J. L Evans, Merthyr Tydvil, Glamorganshire. Improvements in the construction of apparatus for cold rolling iron for tin plates.

1910 R. R. Kelly, Manchester. Improvements in supplying furnaces with coal and other fuel, and in machinery or apparatus connected therewith.

1911 W. R. Lake, Southampton-buildings, Chancery-lane. An improved combustible compound.

1912 M. Henry, Fleet-street, City. Improvements in the mode of, and apparatus for, typographical composing and printing.

1913 H. T. Munns, Birmingham. Improvements in portable sketching camera obscuras.

Dated June 23, 1869.

1914 R. Moreland, jun., and D. Thomson, Old-street, St. Luke's, Middlesex. Improvements in steam rollers, also partly applicable to traction engines.

1915 W. Spence, Quality-court, Chancery-lane. Improvements in the manufacture of sugar and alcohol, and in apparatus for the purpose.

1916 J. H. Johnson, Lincoln's Inn-fields. Improvements in injectors for feeding steam generators.

1917 D. B. Park, Gracechurch-street, City. Improved means and apparatus for removing animal and vegetable deposits from the bottoms of vessels.

1918 A. J. Deblon, Fives-les-Lille, Department of Le Nord, France. Improvements in machines for calendering stuffs.

1919 O. Zabel, Quedlinbourg, Prussia. A grease box for all sorts of pistons, slides, &c.

1920 A. M. Clark, Chancery-lane. Improvements in electric telegraph apparatus.

1921 A. M. Clark, Chancery-lane. An improved anti-explosive or safety lamp applicable for mining and general purposes.

1922 H. A. F. Duckham, Camden Town, Middlesex. Improvements in gas regulators.

Dated June 24, 1869.

1923 R. Caunce, Mansfield, Nottinghamshire, and M. G. and B. Bradley, Nottingham. Improvements in machinery or apparatus for twisting yarns and other threads of cotton, wool, silk, or other fibrous substances.

1924 W. W. Neame, Birchington, Kent. Improvements in fencing, and in tools or apparatus for the manufacture thereof.

1925 R. N. Williams, Hackney-road, Middlesex. Improvements in the manufacture of reflectors for artificial light.

1926 S. Joy, Manchester. Improvements in apparatus for removing the dust from rag machines and other machines of a similar description.

1927 J. Macintosh, North Bank, Regent's Park. Improvements in waterproof varnishes and paints.

1928 J. Brooke and J. Hirst, Huddersfield. Improvements in certain fabrics technically known as paddings.

1929 J. Taylor, R. and J. Ingham, and J. Charples, Cranshaw Booth, Lancashire. Improvements in carding engines, by which the doffer is divided into spaces, such that the slivers are at will made of the same weight, and their width adjusted to produce rovings or slubbings, suitable for spinning cotton waste and similar substances.

1930 R. Olpherts, Ardee House, Ardee, Louthshire, Ireland. Improvements in shears and knives for reaping and pruning.

1931 A. H. Still and D. Lane, Cork. Improvements in the manufacture of gas.

1932 W. Bracelin, Robert-street, King's-road, Chelsea, Middlesex. Improvements in velocipedes.

Dated June 25, 1869.

1933 W. Palliser, Army and Navy Club, Pall Mall. Improvements in key fastenings for railway chairs.

1934 W. F. Williams, Broad-street, Golden-square, Middlesex. Improvements in boxes for holding jewellery and for other similar purposes.

1935 J. Heys, J. Duckworth, and G. Barnes, Haslingden, Lancashire. Certain improvements applicable to carding engines.

1936 H. Caro, Mannheim, Grand Duchy of Baden, C. Graebe, and C. Liebermann, Berlin, Prussia. Improvements in preparing colouring matters.

1937 J. Lamb, Kidderminster. Improvements in bobbin frames for carpet looms.

1938 A. B. Childs, Mark-lane, City. Improvements in catamenial sacks or uterine supports.

1939 C. Cochrane, Ellowes, Upper Gornall, Staffordshire. Improvements in the preparation of iron ores for smelting.

Dated June 26, 1869.

1940 W. Madders, Manchester. Improvements in, or applicable to, embroidering machines.

1941 F. C. Lecoultre, Geneva, Switzerland. An improved method of changing the barrels of musical boxes.

1942 J. Donald, Johnstone, Renfrewshire. Improvements in apparatus for finishing woven fabrics.

1943 J. Lomax, Hulme, Lancashire. An improved means or apparatus for arresting and depositing the stive or flour contained in the air discharged from millstones during the process of grinding.

1944 J. Lomax, Hulme, Lancashire. Improvements in apparatus for preventing the deleterious effects of back lash in driving millstones.

1945 F. Wohlgemuth, New York, U.S.A. Changing a breech-loading shot gun into a breech-loading rifle.

1946 A. Clark, Chancery-lane. Improvements applicable to the permanent way and rolling stock of railways.

1947 T. Gray, Union-road, New Wandsworth, Surrey. Improvements in the manufacture of varnishes.

1948 W. H. Perkin, Sudbury, Middlesex. Improvements in the manufacture of colouring matter suitable for dyeing and printing.

1949 G. Fielding, Leeds-road, Huddersfield. An improved smoke burner to be adapted to the flues of steam boilers.

1950 A. Bewring, Old Bond-street, Middlesex. Improvements in the manufacture of shirt collars.

Dated June 28, 1869.

1951 W. P. Wilding, Preston, Lancashire. An improvement in the construction of self-acting mules employed for spinning cotton.

1952 C. D. Abel, Southampton-buildings, Chancery-lane. An improved ventilating hat or covering for the head.

1953 M. Kennedy, New York, U.SA. Improvements in short levers weighing scales.

1954 J. W. Burton, Leeds, and R. W. Morrell, Bradford, Yorkshire. Improvements in the manufacture of combined woven and felted fabrics.

1955 G. T. Smith, Ordsall House, East Retford, Nottinghamshire, and C. Challenger, Retford, Nottinghamshire. A new or improved material or composition applicable to the manufacture of floor cloths, tarpaulins, railway sheets, and other waterproof fabrics.

1956 J. Howard, Bedford. Improvements in horse rakes.

1957 W. R. Lake, Southampton-buildings, Chancery-lane. An improved method of, and apparatus for, rendering and refining lard, tallow, and other fatty and oleaginous matters.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1682 W. Poupard
1690 J., S. A., G. E., and F. F. Reading
1700 W. Buckley and L. Smith
1701 J. Milroy
1719 W. Wyatt
1724 J. H. Johnson
1727 S. C. Lister
1739 J. H. Johnson
1758 T. C. Craven
1774 J. Clegg and J. Smith
1784 J. D. Brunton
1903 R. Mitchell

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1844 H. Ponsonby
1857 E. C. Nicholson
1890 I. Holden
1901 J. Tatham

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1631	1803	1811	1819	1828	1838	1845	1855
1697	1804	1812	1820	1830	1839	1846	1856
1789	1805	1813	1821	1832	1840	1847	1857
1791	1806	1814	1822	1833	1841	1848	1858
1793	1807	1815	1823	1834	1842	1851	1859
1799	1808	1816	1826	1836	1843	1852	1860
1801	1809	1817	1827	1837	1844	1853	1862
1802	1800	1818					

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," June 29, 1869.

471 G. W. R. Pigott
474 H. Tylor
482 E. T. Hughes
483 W. R. Lake
489 H. D Bowyer and J. L. Norton
497 C. Brook, L. Barker, and M. Thompson
499 J. A. Wade and J. Cherry
501 D. G. FitzGerald
511 A. Henry
515 T. Smith
526 J. T. Wibberley
527 J. Mabson
532 J. H. Mori
538 J. E. Lucas
543 J. W. Reid
544 W. R. Lake
562 W. F. C. Moutrie
567 W. E. Gedge
573 B. Hunt
583 W. Turner and J. W. Gibson
586 W. E. Newton
590 W. R. Harris
616 G. J. Snelus
643 J. Sloper
685 A. M. Clark
719 A. M. Clark
730 W. R. Lake
772 A. M. Clark
779 J. Thomas
858 W. H. Phillips
963 B. Dobson and J. Eastham
1002 W. Y. Craig and S. P. Bidder
1011 J. Howden
1015 D. J. Hoare
1057 W. H. Douglas
1096 H. A. Bonneville
1153 J. G. Jennings
1212 G. Green
1285 J. K. Broadbent and S. and J. Prestwich
1289 R. Sterne
1295 B. Dobson
1345 E. and T. Waltham
1371 A. and E. Fau
1487 C. E. Spooner and C. A. Huddart
1581 W. Morris
1675 G. Preston and J. Prestige
1759 W. Sellers
1785 W. L. Wise
1811 G. W. Howe
1847 B. Wartski
1849 W. R. Lake
1850 G. W. Fox
1856 A. Destouy
1868 W. R. Lake
1869 W. R. Lake
1884 H. A. Bonneville

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 25, 1869.

3953 J. A. A. Landa
3956 F. A. V. Michel
3967 T. F. Henley
3971 G. Davies
3972 P. and R. Gornall
3982 A. Barclay
3989 T. Gibson
8 B. G. George
15 A. Carter and C. R. E. Grubb
18 H. A. Bonneville
21 J. M'Kenny
41 E. Robbins
54 H. G. Fairburn
59 J. Daglish
62 W. T. Waite
98 C. J. Gunther
110 J. R. Hodgson
112 E. P. North
162 G. Brown
177 G. A. Crow
193 D. Rivenc
280 A. V. Newton
502 J. Newton
693 C. Fairbairn
1210 J. C. Ridley
1278 T. Forster and P. B. Cow
1444 J. A. Marden

Sealed June 29, 1869.

3964 S. and W. Fox, J. Beffitt, and G. Grange
3969 W. Winter
3990 J. Soelig
2 T. Singleton
3 S. Lyons
4 W. M. Williams
13 A. Batchelar
19 W. A. Biddell and J. Redgrave
35 W. Dawes
106 C. P. Coles
137 S. Russell
141 J. H. Johnson
148 F. Braby
176 C. E. Brooman
228 W. E. Newton
244 A. V. Newton
260 G. Tangye
295 K. C. Watson
351 W. E. Newton
355 F. Braby
361 J. H. Johnson
363 A. Clark
376 E. Meldrum
431 C. Thomas
564 A. V. Newton
753 J. H. Johnson
847 J. Hamilton and R. Paterson
968 R. Johnson
1291 G. Hawkshurst and J. Pollock
1315 R. B. Forbes
1321 W. R. Lake
1462 W. F. de la Rue

LIST OF SPECIFICATIONS PUBLISHED

For the week ending June 19, 1869.

No.	Pr.	No.	Pr.	No.	Pr	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d		s. d.		s. d		s. d.		s. d.
3188	0 4	3418	0 6	3470	2 0	3503	0 4	3529	0 4	3556	0 4
3234	5 8	3420	0 6	3473	0 6	3505	0 4	3531	0 4	3557	0 4
3305	0 8	3422	0 8	3479	0 10	3506	0 4	3537	0 4	3558	0 4
3325	0 6	3426	0 10	3485	0 8	3509	0 4	3538	0 4	3559	0 4
3343	0 10	3435	1 0	3490	0 4	3511	0 4	3540	0 4	3561	0 4
3350	0 8	3441	1 4	3492	0 4	3512	0 4	3542	0 4	3564	0 4
3359	0 8	3443	0 10	3493	0 4	3516	0 4	3543	0 4	3565	0 4
3365	1 0	3445	0 10	3494	0 4	3518	0 4	3544	0 4	3602	0 4
3371	1 4	3446	0 10	3496	0 4	3520	0 4	3547	0 4	3979	0 8
3389	2 6	3451	0 10	3498	0 4	3522	0 4	3548	0 4	187	0 8
3397	0 6	3453	0 10	3500	0 4	3527	0 4	3550	0 4	275	0 4
3401	0 8	3457	0 10	3502	0 4	3528	0 4				

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JULY 9, 1869.

THE NITRO-GLYCERINE EXPLOSION.

WHEN our brief remarks upon the nitro-glycerine catastrophe at Cwm-y-glo were penned last week, no detail particulars had come to hand. Since that time, however, the facts have been fully made known by the daily press, so that it is only necessary here to refer to them very briefly before commenting upon the sad affair. It appears that about four tons of nitro-glycerine formed part of a cargo from Messrs. Nobel and Co., of Hamburg, to Carnarvon, consigned to their agents in Carnarvonshire. The ship was moored in the river Menai, and a portion of the explosive oil having been placed in the Llanddwyn magazine, the rest was brought in lighters and placed on the quay in Carnarvon. After waiting for some hours without the carts which were to have carried the nitro-glycerine to the mines having arrived, other men—who are stated to have been used to removing the material—with two carts, were engaged. These left about 4 p.m., on the Wednesday, with a portion of the nitro-glycerine, for Glyn-rhonwy quarry, in the vale of Llanberis. The two carts appear to have been of the most ordinary kind, and without springs, or any other means of absorbing the sharp jolts a rough road would inevitably cause. The carters proceeded through the village of Cwm-y-glo, where they had stopped to refresh themselves, and while still within sight of the loungers, the terrific explosion took place, which scattered death and destruction around. The details of scattered atoms of flesh, and fragments of the carts, are sickening, and may well be passed by; but to show the violence of the shock, we may mention that two holes of over 7ft. in diameter and depth, and about a horse's length apart, clearly indicated the fatal spot. The catastrophe occurred exactly where the diversion of a new road lately made by the Llanberis and Carnarvon Railway joins the old road, about 400 yards beyond the centre of Cwm-y-glo village, five miles and a-half from Carnarvon, and 300 yards from Pont Rhyddallt, the bridge that spans the narrow water uniting the upper and lower lakes of Llanberis.

Such, in brief, are the particulars of the explosion; the results were death to nearly a dozen persons, and serious injury to a great number more, besides a large destruction of property. A coroner's inquest was of course held, and a verdict of "accidental death" was returned. From this verdict we entirely dissent, as it is clear that the explosion was the result of sheer carelessness. The tins of nitro-glycerine were packed with straw in wooden cases, and placed for transport, over a rough mountain road, in a common tumbril. Thus, no precautions whatever were taken by the carriers to counteract the concussive effects of jolting upon this dangerous material. If no decent carts were to be had, or if there was no such thing as sand at hand wherein to bed the cases, they ought never to have been allowed to leave the quay. There is another and well known alternative with which, we should think, those in charge of the deadly material ought to be familiar, and that is to mix the nitro-glycerine with methylated spirit, which renders it perfectly harmless. Some one or other of these preventive measures certainly ought to have been taken. As, however, we cannot find that any precautions whatever were adopted, we attribute the explosion not to "accident," but to gross and culpable negligence.

But we go still farther, and say that an explosion—even an accidental one—of nitro-glycerine, ought never to occur at all, for the simple reason that it ought never to be used. We know its value to our miners, and should therefore hesitate to cry it down utterly, did we not also know that there is an equally efficient, but infinitely safer, material which ought to supersede it. We allude to dynamite, which is simply nitro-glycerine incorporated with sand, and by this means rendered harmless under every condition except that of being fired with a percussion fuze. Ordinary fire simply burns it quietly up, concussion will not affect it at all; but ignite it with a percussion fuze, and all its resistless energy is instantly developed. We speak from experience in this matter, having been present at a series of crucial experiments which took place about a year since, and which were fully reported by us at the time.* This substance is also the invention of Mr. Nobel, and we wonder that he can sell an ounce of nitro-glycerine, when a practically safe substance, giving equal effect, is to be had. But a few shillings a ton in favour of the dangerous commodity may be at the bottom of the matter, and this often makes all the difference in the world with some people, who are willing to accept any risk provided they can pocket a few pence by it. But unless some stir is now made to remedy the present hazardous condition of matters, the subject will most likely drop, and we shall not hear of it again until another, and perhaps far worse, explosion occurs. We are aware that there are rules and regulations with respect to the storage and transport of nitro-glycerine. All we can say is, that if they were observed on the present occasion, they are wretchedly inadequate for the purpose, and should be revised at once. If they were not carried out—and we cannot believe they were—then there must be a culpable party still in the background who ought to have seen to the enforcement of regulations affecting such important results. If—and there is still another hypothesis upon which the explosion may be explainable—if there was no one whose duty it was to see to the enforcement of these rules in a place where was a depôt of this deadly substance, then the sooner such a farce is ended by the appointment of a proper officer the better for public security. But we hope to see the matter well looked into, and nitro-glycerine superseded by the safe and valuable blasting agent—dynamite.

* See MECHANICS' MAGAZINE for July 17, 1868, p. 41.

STREET CLEANSING.

SO long as a drain or sewer is constructed of the proper dimensions, has a sufficient amount of fall bestowed upon it, and is kept well supplied with water, it will generally flush itself, or, in other words, be self-cleansing. The cause of sewers becoming choked up and stagnant, and, as a consequence, sources of infectious contamination, can in nearly every instance be traced to the violation of certain conditions, the fulfilment of which, every sanitary engineer is well aware, is indispensable to the efficient discharge of their contents. It will be acknowledged that a sewer performs its duty with the maximum effect when it conveys away from the neighbourhood of human beings and human dwellings, with the greatest possible rapidity, the excreta and refuse committed to its channel. This desirable result is, therefore, dependent upon the velocity imparted to the particles carried along in the current, which is, in its turn, dependent upon two conditions, namely, the fall, and the head of water, or other fluid conveyed away by its means. To a certain extent, these two requirements for effecting a rapid discharge of the contents are interconvertible, so that if it is impossible to employ one of them to the degree that would be considered advisable, the other may be availed of to a greater extent as a compensation. It is a mistake, however, to suppose that any amount of flushing will compensate for the defects inherent in a badly constructed and unscientifically designed sewer. Where the drainage of a town is dependent upon the action of sewers which have little or no fall, and are, besides, of a form and size which render them unfit for their work, there is no other remedy but to do away with them altogether, and establish the future drainage and sewerage of the place upon a better basis. In addition to the adoption of the best form of sewer, the most suitable and economical gradient and other particulars of a constructive nature, there is one precaution, the non-insurance of which will render that, of all others we have mentioned, completely abortive. This precaution consists in the adoption of means calculated to prevent "foreign substances" passing into the drains and sewers. Many persons indulge in the serious error that anything and everything that is in the nature of refuse may be discharged into the sewers; that, in fact, unless they carry away everything that is not wanted elsewhere, they are not fulfiling the purpose for which they were intended. Those who hold these opinions make no distinction between a sewer and a dustbin, and probably consider the latter a superfluous arrangement where the former exists.

The object of street cleansing is to prevent improper substances from passing into sewers, and thereby forming deposits and accumulations which the most powerful flushing would fail to dislodge. To effect this object, all street gulleys should, in the first place, be solidly and properly constructed, and well trapped. It is too much the practice for local boards, and other corporate authorities, to pay but little regard to this important desideratum. With a misplaced and false economy, they refuse to pay a price for gulleys, and what may be appropriately termed "sewer fittings," which would ensure their being of a good quality and proper construction, and prefer purchasing low-priced inferior articles, which are perpetually getting out of order, and ultimately becoming perfectly useless. Under these circumstances, it is no wonder that the *detritus* from the roads and streets finds a ready means of access to the sewers, and that the latter are frequently condemned for not adequately conveying away contents which should never have been permitted to enter them. The removal of all animal and vegetable refuse from the surface of the streets and roads of a town should be accomplished by scavenging and not by draining into the sewers. In the majority of our towns, this is effected with more or less completeness, according to the vigilance of the authorities, and the supervision they exercise over the more unscrupulous portion of the community. As a rule, there is a great deal more scavenging of the streets to be done than what is at all necessary. If a large number of the inhabitants of London were to make their ashpits and dustbins the receptacles of their domestic refuse instead of the streets, the cost of our metropolitan scavenging would be very much reduced. The scavenging of streets, in the simplest sense, signifies merely the removal of all surface refuse which is not of a nature suitable for being carried off by the sewers. In its extended sense, it may be taken to mean not only the removal but the ultimate sifting or sorting of its various components. Town refuse is of considerable value as a manure, but, unfortunately, the means for transporting it to the land are generally so very inadequate for the purpose that it is scarcely possible to dispose of it at a price that will at all pay for its collection. Any small profit that might be made out of it is altogether absorbed in the large outlay required for cartage or other mode of transport.

It is a subject for candid discussion, upon what principle the scavenging of towns should be conducted. Should it be carried

out by the local authorities themselves? or should it be placed in the hands of a contractor? In considering this point, there are two chief conditions to be borne in mind. The one is that of cost, and the other that of efficiency. So far as the former is concerned, the balance will undoubtedly lie upon the side of the contractor. A contractor who has abundance of plant and material at his command will be unquestionably able to undertake the scavenging of a town at a cheaper rate than the authorities could hope to execute it. This rule applies pretty generally to every description of work, although now and then notable exceptions arise. For instance, a very large amount of railway work has been done in India by the companies themselves, and, it is alleged, at a less cost than a contractor would have undertaken it for. At first sight, it appears as if a railway company could always do work cheaper than a contractor, but in making this comparison it is frequently forgotten that it requires a large outlay for plant and materials before the company is equally well fitted to undertake the work as the contractor. Passing from the question of the cost of cleansing streets to that of accomplishing it in the most efficient manner, the balance in this case is on the side of the local authorities. On the one hand, we have the interest of the individual, and, on the other, that of the community at large. However faithfully a contractor may adhere to his engagement, yet still he has to make his profit out of the job, and, in one sense, cares nothing about the sanitary welfare or health of the public. If the local authorities or their officers are lax in enforcing the conditions of the contract, it is not to be expected that the contractor would be the man to remind them of their duty. Moreover, in the event of any dispute or disagreement between them and him, the convenience of the public might be seriously interfered with pending the necessary arbitration and arrangements. Again, the local authorities have individually or collectively no interest in the execution of the work beyond a desire to perform it economically and in the manner that may be most conducive to the public welfare, and the conditions prescribed by all sanitary regulations. There are many large towns where the system of cleansing and scavenging the streets by contract has been tried and found wanting, and ultimately abandoned. Leeds, Manchester, Birmingham, and other towns, are examples in question. The item of watering must not be omitted in estimating the probable cost of maintaining the surface of streets and roads in proper order, and a liberal allowance must be made, as a long drought will cause a most material increase in the expenditure for this purpose. Hand labour is probably the best where the work to be done is on a comparatively small scale. Where, however, the town is sufficiently large, and the traffic sufficiently important and heavy, a great saving will be effected by the employment of sweeping machines and horse scrapers.

THE SOCIETY OF ENGINEERS AT CHATHAM.

JUST twelve months ago, we recorded the visit of the Society of Engineers to the Chatham Dockyard Extension Works, which are being built upon a large tract of marshy ground, formerly known as St. Mary's Island. Since that time, considerable progress has been made, and the works are now at a stage full of interest to engineers. Accordingly, last Friday, the members and associates of the Society made their second excursion of the present season, when they visited the works, by permission of the Lords Commissioners of the Admiralty. The "Oread" steamer was chartered for the occasion, in which the members and their friends, to the number of about one hundred, made a pleasant run down the Thames and up the Medway, luncheon being served on board on the way down. The band of the Grenadier Guards was on board, and added to the pleasure of the day by performing an excellent selection of music. Amongst the members present were Messrs. F. W. Bryant (president of the Society), W. Adams (vice-president), Baldwin Latham, W. H. Le Feuvre (past-presidents), G. J. Leonard, Robert Harris, George Waller (members of council), Alfred Williams (honorary secretary), Perry F. Nursey (auditor), G. W. Harris (secretary), A. E. Stephenson, W. Hendry, J. Westwood, R. Baillie, A. E. Walton, A. Latham, F. E. Houghton, J. Methven, E. Matheson, H. W. Hunt, G. W. Usill, &c., &c. Among the visitors were Messrs. J. Blackstone, W. F. Martin, A. Browning, E. Lane, W. Shephard, W. Le Senadey, J. Pullan, O. Byrne, J. Carey, E. Spon, F. N. Spon, J. Redl, L. Hislop, &c., &c.

On their arrival upon the works, the visitors were received by Mr. A. Gabrielli, the contractor, and Mr. Sidney Merton, his confidential agent, by whom, and Mr. Golla, Mr. Gabrielli's engineer, they were conducted over the docks. Although we described these works upon the occasion of the previous visit of the Society, it will be as well again to refer to them, as they are of considerable magnitude and importance. The extension docks cover an area of about 320 acres, and lie to the north-east of the present yard. The works, when completed, will consist of four graving docks, each of which will be 510ft. long, 80ft. wide at the coping, and 41ft. 6in. from floor to coping level. They will have 28ft. 6in. depth of water at the highest level of the neap tides. There are also three large basins, the combined area of which will be 74 acres, and the depth of water in each 30ft. at high-water neap tides. The first of this series of basins—the one nearest the town of Chatham—will be a repairing basin. The second, which is situated in the centre of the reclaimed marsh, will be occupied by ships having their engines fitted, and is called the factory basin. Alongside of this basin the factory will be built. In the third basin, vessels will be fitted out before proceeding down the river.

Many difficulties were encountered in the earlier stages of the work from water, &c., but these have been successfully overcome. The works are progressing very satisfactorily, and Mr. Gabrielli expects to complete them by Christmas, 1870, the time stipulated in the contract. In the first dock, the granite flooring is laid, and the sides are built up to the broad altar, or about half their intended height. The main culvert, with its branches and cesspits, in connection with a pumping engine, by which the docks will be emptied when the tide does not serve, is finished. In the second dock, the floor has been laid, and the entrance commenced; the third and fourth docks have not yet been commenced. In the first basin, which is called the repairing basin, the walls are in an advanced state, and the river entrance is being made. The entrance from this basin to the second, or factory basin, is also being made, and the walls of the latter basin are being built. The excavation of this basin will be effected by convict labour at the instance of the Government, Mr. Gabrielli having built a great part of the wall and prepared the trenches for completing the remainder. The works of the third or fitting-out basin have not yet been commenced. Not only is the progress of the work satisfactory, but also the character of the same, the construction being highly creditable to the contractor. The best materials are used, and the work is carried out in a thoroughly substantial manner. There is no doubt these docks, when completed, will compare well, in a constructive point of view, with any modern works of the kind. Mr Gabrielli is no new hand at this special branch of engineering construction, he having carried out the harbour extension at Malta, moles and breakwaters at Palermo, Naples, and Ancona. Before leaving the works, the visitors partook of refreshment which had been provided by Mr. Gabrielli, and which were especially welcome after a two hours' hot and dusty inspection.

While at Chatham, the visitors were conducted by Mr. Bernays, the clerk of the works in the dockyard, over the "Cerberus," double-turret ship, now lying at Chatham, and which is being fitted up for service in Australia. They also went through the shops in the dockyard, and inspected the "Sultan," 5,226 5-94ths tons, which is now in course of construction. The chief object of interest in the yard was the plate-bending furnace, which is heated by liquid fuel on the Dorsett principle. A generator, in which creosote is distilled, is placed near the furnace, and the gaseous product is conveyed by pipes to the furnace, where it is burned in jets. The advantages are, that the plates are heated in about a quarter the time required in a coal furnace, little or no scale is produced, and it is more economical than the ordinary process. This furnace and its performances will be found fully described in our issue for May 14 last. The armour plates for the "Sultan" are being heated for bending in this furnace, whilst a second and smaller furnace is used for heating thinner plates. The party re-embarked about half-past five o'clock, dining on board their vessel on the way up, reaching town about ten o'clock, after what will no doubt prove to be the most successful trip of the season.

MODERN PRACTICE OF THE ELECTRIC TELEGRAPH.*

AS telegraphy progressed in the Old World, so books and technical productions made their frequent appearance, and an English telegraph engineer's library now shows an extensive collection of both theoretical and practical works—the latter, we are glad to observe, being largely on the increase. In the New World, however, although telegraphy has increased with gigantic strides, the increase in telegraphic literature has been small and unimportant; and it is, therefore, with satisfaction that we notice the advent of a practical telegraph work. The author is Mr. Frank Pope, a gentleman of considerable experience in the American telegraph world, and the following extract from his preface will bear out the foregoing remarks:—"The works heretofore accessible to the American telegraphist have been of a popular rather than a scientific character, or else of so elementary a nature as to be of little service except to the most inexperienced student." To remedy this defect, the author has prepared this interesting work for the practical electrician and operator, supplying a want long felt, and more especially with reference to the American system of working, where details and other points differ materially from the different systems treated in "foreign works, the difficulty and expense of obtaining which has prevented their general circulation among the class for whom this treatise is more especially designed."

To ourselves, the most interesting portion of this work will be the descriptions of the different apparatus used for signalling in America, and the various methods of insulation adopted; but to those for whom the work is written, the most valuable part is undoubtedly the descriptions relating to the use of batteries, Ohm's laws, and "testing telegraph lines." The author remarks on this latter point, "the apparatus and methods

* "Modern Practice of the Electric Telegraph; a Handbook for Electricians and Operators." By FRANK L. POPE. New York: RUSSELL BROTHERS, 28, 30, 32, Centre-street. 1869.

now in general use in this country are of a somewhat primitive nature, but the improved modes of testing which have long been employed in Europe are gradually becoming appreciated here, and as these are based on sound scientific principles, it is to be hoped that they will soon supersede the imperfect ones heretofore employed." A long chapter is given to this subject, and the method of calculating the distance of various faults by resistance measurements is given. A description is given in the appendix of Thomson's reflecting galvanometer, and a number of well-known useful formulæ are given. The technical phraseology frequently differs somewhat from ours: "ground" for earth, "cross" for contact, "to ground a wire" for to put to earth. The following description of our ordinary "weather contact" will show the peculiarity :—"Weather cross.—The escape of the current from one wire to another upon the same poles, owing to defective insulation, is sometimes wrongly called 'induction' in 'sympathetic currents.'" Weather cross is a much more appropriate term. Our climate being moist, we are, consequently, liable to this sort of fault, and to obviate it have for years used an earth wire from the arms or supports down the pole to the earth. Any escape or leakage that may take place, due to the weather lowering the insulation, will then go to earth instead of from wire to wire. "This practice," the author thinks, "might be adopted in America with great advantage to the working of the lines."

A chapter containing "notes on telegraphic construction" is very useful, and contains much valuable advice. Amongst the notes is given the plan adopted by the Bishop Gutta-Percha Company for making joints in gutta-percha covered wires. One special instruction in italics we cannot help noticing, "Use no spirit lamp, nor anything with a flame." The gutta-percha is heated by being placed near a hot iron. It is strange that with us no joint whatever is made without the assistance of a spirit lamp, and that frequently applied; and yet of the countless joints annually made in this country, how rare it is to hear of an experienced jointer making otherwise than a good joint.

From a careful perusal of the present work we are assured that it supplies a long-felt want, and it is more than probable that it will tend much to improve the knowledge of electricity and practical telegraphy amongst the operators, enabling them to obtain some technical knowledge of the apparatus they are constantly using. But we cannot dismiss the work without noticing the wholesale manner in which extracts have been taken from some of our English works. We allude more especially to the works by Mr. Culley on "Practical Telegraphy," and Mr. Clark's "Electrical Measurement." The author seems to imagine that his slight acknowledgment of obligations for the excellent works are amply sufficient.

THE FRENCH ATLANTIC CABLE.

VARIOUS conjectures were made as to the causes that compelled Sir S. Canning to cut and buoy the cable. But few imagined that at this period of the year a violent gale should have brought about that result. The gale must have been severe, for the "Chiltern" lost her lifeboat. At the time the gale came on, a sudden fault made its appearance. This was known at Brest; but it is satisfactory to find that on the weather sufficiently moderating to allow the resumption of work, the cable was picked up, the fault removed, and paying out proceeded with as if nothing had happened. However much we may regret the appearance of these faults, and the sudden advent of a gale of wind, yet it will be found that the occasion is one that brings with it the knowledge how operations in water two miles deep can with such facility be carried on. A fault arises, the vessel is stopped, the cable picked up until the faulty part comes within reach, when, after its removal, paying out goes on again. A gale of wind suddenly arises, the cable is safely buoyed, and the paying-out ship lays to within sight of the buoy, and resumes operations when the weather has sufficiently improved. One of the greatest risks in paying out a long submarine cable has been generally considered to be the uncertainty of the weather; but the present successful operations would seem to have reduced that risk so much as to eliminate it altogether.

The statement showing the progress of the work we continue from our last week's number :—

STATEMENT OF PAYING OUT.

Date. Noon.	Lat.	Long.	Distance run. Nautical miles	Nautical miles payed out.	Rate per hour.	Slack. per cent.
June 22	48·30	8·55	174	—	5·5	—
” 23	—	—	294	310	5·5	5·5
” 24	48·30	13·58	377	405·7	4·0	7·6
” 25	48·34	17·06	497	542	5·7	9·0
” 26	48·37	18·57	574	635·9	3·9	10·8
” 27	48·32	22·01	697	775	5·8	11·2
” 28	48·22	25·11	823	915	6·0	11·8
” 29	48·06	27·50	920	1,038	[illegible]	13·0
” 30	Cut and buoyed.					
July 2	Cable recovered.					
” 3	—	—	1,020	1,148	—	—
”	47·36	33·10	1,145	1,281	5·75	12·6
” 4	46·54	36·04	1,269	1,420	5·8	11·9
” 5	46·03	38·47	1,397	1,562	6·0	11·8
” 6	45·30	41·42	1,524	1,700	5·75	11·55
” 7	44·36	44·05	1,639	1,840	5·8	12·8

From the preceding table it will be seen that the progress of paying out is satisfactory, and that by the decrease in the slack the depth of water has decreased. The electrical condition is reported perfect. The "William Cory" has laid the shore end and intermediate portion off St. Pierre, and the end is buoyed ready for the arrival of the "Great Eastern." If all goes well, and the same satisfactory progress continues, we shall shortly be able to announce the successful submersion of this the largest and most important section of this great enterprise.

THE METEOROLOGICAL SOCIETY.

THE annual meeting of the Meteorological Society was held on June 16, at the Institute of Civil Engineers. The chair was taken by the president, J. Glaisher, F.R.S., and among the fellows present were Drs. Tripe and Mann, Messrs. Silver, Symons, Eaton, Dines, Perigal, &c. Seven gentlemen were elected fellows. The first paper read was upon snowfall in Canada, descriptive of its average amount, seasonal variations, and the nature of the snow drifts of the country. Being mainly statistical, it afforded little matter for discussion, but it was remarked by the president and Mr. Doggett that when the fall of snow was excessive in Canada the weather was warm here, and this seems an inference worthy of investigating. The next paper was a sequel to two previous communications, by Mr. C. Meldrum, on the relative position and direction of air currents in the South Indian Ocean. These papers confirm, for the southern hemisphere, the law of wind in relation to atmospheric pressure, already abundantly proved for the northern hemisphere. The author contends that cyclones originate between the north-westerly or tropical current and the south-easterly or polar wind of the southern ocean, only when the former is situated on the northern edge of the latter. When these conditions are reversed, calms or moderate winds alone ensue. This is exactly what was to have been inferred by analogy from what has long been well known for the northern hemisphere. The author asserts that this knowledge affords a basis for weather forecasts, as did Admiral Fitzroy, of whom he is evidently a very able disciple. He should, however, have taken less credit to himself, and given more to others whose labours have cleared the jungle and made the path so easy for him.

Mr. J. Martin described a self-registering aneroid manufactured by the Stereoscopic Company, which was exhibited and attracted a great deal of attention. It was certainly an excellent piece of work, though of its scientific accuracy of course we cannot speak.

Mr. Doggett read a paper on the signs of weather afforded by average temperature and monthly rainfall. Compensation is the law of nature, and indefinite cold or heat, rain or drought, can no more be expected at any place, than darkness without the due proportion of light. But the laws of this compensation as regards meteorological periods have yet to be determined, and such researches as Mr. Doggett's will render important service in opening up this much neglected branch of the science. A short portion was read of a paper on the height of the barometer in relation to the direction and force of wind, by Mr. R. Strachan. As the proceedings had not yet occupied an hour, and the paper was a short one, its curtailment by the president seemed very uncourteous, more especially as he immediately allowed Mr. Casella to describe a form of Sixe's thermometer which he has effected for deep-sea soundings, which can be made to resist a hydraulic pressure of about 3 tons on the square inch without error of indication. We do not ourselves know of an investigation, taking account of the force of wind as well as its direction in connection with the height of the barometer, although such investigations are calculated to throw considerable light on the value of the barometer as an indicator of weather to an isolated observer.

The report for the past year was next brought forward. Strange to say, it seemed concerned less about the business and progress of the society than about extraneous affairs, and appeared to be excessively voluminous, for only scraps here and there were read. It announced that the fellows numbered about 320, that the society has above £1,000 invested in the funds, and that hopes are entertained by the council of receiving recognition and aid from the Government in the shape of apartments for offices and meetings. The society has rendered much valuable service to the public, while its utility is capable of great extension; therefore, the boon sought is one well deserved and likely to be of public advantage. The members of the society are at present ridiculously few considering the vast interest taken in meteorology by the public generally. With fitting accommodation and, especially ready access to its library, which is now quite inaccessible, the society ought to expand greatly both in numbers and importance. The usual votes of thanks were given to the officers, and a very pleasing part of the proceedings was the warm and laudatory terms in which the meeting recognized and recorded a vote of thanks for the generosity of the Institute of Engineers, in gratuitously accommodating the society with a meeting room, as it has done for many years.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

THE DENSITY OF HYDROGENIUM—THE EFFECTS OF CORALLINE—THE OXYHYDROGEN LIGHT SCHEME—PEROXIDE OF HYDROGEN IN THE AIR.

MR. GRAHAM, whose demonstration of the metallic nature of hydrogen we noticed some time ago, has corrected, with the candour that characterizes the true philosopher, an error into which he fell in determining the density of solid hydrogen, or hydrogenium as he calls it. In making this determination, he at first proceeded on the assumption that the density of the palladium, with which the hydrogenium was associated, remained constant. This, however, he has found is not correct. He has satisfied himself that there is

a change in the molecular condition of the palladium. Taking this into consideration, he finds that his former estimate of the density of hydrogenium was much too high, and now gives us the figures 0·73 as the true density.

We mentioned some time ago the irritation of the skin produced by red socks and stockings, and said that the effects had been traced to a dye known as coralline, and prepared from carbolic acid. There are very wonderful stories told of the effects of this dye, both in this country and in France, but it seems that they must be received with some doubt. M. Landrin states that he has made numerous experiments with the substance on animals and on himself, applying it externally and internally, and has found it to produce no effects whatever. M. Chevreul also told of a dyer who dyed his arm with coralline, and suffered no unpleasant consequences from it. It is very difficult to arrive at the truth in matters of this kind. The skins of different people differ greatly in sensibility, and what produces no effect on one person will excite the greatest irritation in another.

The oxyhydrogen light scheme has now taken a definite shape in Paris. A company has been formed, the capital necessary has been raised, and application has been made for permission to lay down pipes to carry oxygen and hydrogen over about a fourth of the city. It is not very likely that the permission will be granted, and the promoters will have to confine themselves to supplying individuals with compressed gases, as was originally proposed. We have published the patented processes by which M. Tessié du Motay obtains the oxygen and hydrogen which he proposes to distribute over Paris, at a cost so low that the oxyhydrogen light is promised much cheaper than common gaslight; but ingenious and relatively cheap as they undoubtedly are, it is impossible to believe that the service can be made so inexpensive as to supersede coal gas. The prospectus of the company enlarges upon the cheapness and purity of the light, the complete combustion, and the absence of all deleterious matters in the products of the combustion; but is quite silent as to the danger of introducing into a house two gases not possessing any smell, and which, consequently, may escape without observation, and the mixture of which forms an explosive compound of far greater power than any mixture of coal gas and air. To any danger of this kind, continental engineers appear to shut their eyes. We saw, a short time ago, a patent taken out in Belgium for making a mixture of coal gas and air, storing it in gasholders, and distributing it over the city of Brussels for heating purposes. The engineering details given showed a complete knowledge of the subject of the manufacture and distribution of gas, but there seemed to be no recognition of the risk, imminent enough, of blowing up the whole concern. A consideration of this kind, some years ago, stood in the way of a scheme of the kind projected for Birmingham, and will, no doubt, now prevent the Oxyhydrogen Light Company from getting permission to lay down their pipes over Paris.

The information comes all the way from Tiflis, in Persia, that peroxide of hydrogen has been discovered in the air. Schönbein, who had no doubt of its existence in the atmosphere, never succeeded in demonstrating its presence. This success, however, is claimed by M. Struve. Along with the peroxide of hydrogen, the discoverer always finds ozone and nitrite of ammonia. These were also found in hail and in sea water. In these days, when the origin of nitrates of water is so warmly debated in connection with the question of the possible previous sewage contamination of water, we are fortunately reminded by M. Deville of the fact that he collected snow on the Andes, at the height of about 14,000ft., which yielded a large amount of nitric acid, doubtless derived from nitrite of ammonia, which Struve has now discovered in the air.

PARLIAMENTARY NOTES.

In the House of Commons, on the evening of yesterday week, Mr. Knight asked the Secretary of State for War, whether reports had been received from the military authorities of the Presidencies of Bombay and Madras highly commendatory of Major M'Gwire's camping system with field hammocks as calculated to add greatly to the health and efficiency of troops in the field and on the line of march; and, if so, whether it was the intention of the Government to extend the full benefits of such system to British soldiers in India and the colonies.

Mr. Cardwell said that the reports from Madras and Bombay were favourable to the system, but they were not approved of by the Commander-in-Chief in India, and their adoption was not recommended by the Government of India. Until they were approved of in India, it was not probable they would be generally adopted.

Mr. Hoskyns asked the Secretary of State for War when it was the intention of the Ordnance officers to proceed with the cadastral survey of the midland and southern counties of England on the same (6-inch) scale already adopted in Ireland and in some of the northern counties; and whether it was in contemplation to enlarge the scale to 25in.—*i.e.*, about a square inch to the acre.

Mr. Cardwell replied that the midland survey had not been proceeded with, but the survey of the southern counties was in progress, and he believed that the whole would be completed in about fifteen years.

At the same sitting, Mr. Charley asked the Secretary of State for the Home Department, whether the Government intended to take any steps this session to carry out the recommendation of the report recently presented to Parliament, on the Print Works Act and Bleaching and Dyeing Works Act; and that print works and also bleaching and dyeing works should, subject to modifications, be placed under the general provisions of the Factory Act.

Mr. Bruce said that a bill was in preparation, but he did not think it possible that it could be passed this year.

Mr. Peek asked the Postmaster-General whether the proposed monopoly of telegraphic messages would in any way interfere with wires already in operation, or which in the future might be desired, between the offices and works of manufacturing and other firms, which were frequently separated by a considerable distance.

The Marquis of Hartington replied that it was not intended in any way to interfere with telegraphic communications used in private business.

On Monday evening, the question of a Parliamentary grant for the Faraday memorial was opened by Dr. L. Playfair, who asked the Chancellor of the Exchequer whether the following extract of a letter, purporting to be written by him, dated May 5, 1869, and read at a public meeting on June 21, was correctly reported:—"I do not in the least doubt the signal merits of Faraday, and I hope that a monument may be erected worthy of so great a man; but I cannot consent to appropriate public money towards the monument of a private citizen, however illustrious. I do not make this rule: I find it." And, if it was a correct extract, whether he would state to the House the exact terms of the rule to which he referred, and the date at which it was made.

The Chancellor of the Exchequer said that the extract was perfectly correct, but he was sorry to say that he was unable to state the exact terms of the rule, which was derived from practice. He had a list of the statues in London, putting aside kings; they were fifteen in number. Of these, one, the statue of Nelson, was erected partly by Parliamentary grant and partly by public subscription. The statue of Richard Cœur de Lion was erected by Parliamentary grant, aided by private subscription. The statue of Sir John Franklin was erected entirely by Parliamentary grant. All the other statues in London had been erected by private subscription. From that practice he deduced the rule that it was not the practice to appropriate public money towards the monument of a private citizen, however illustrious. The history of England also showed that the practice on this point had always been uniform. Such illustrious men as Shakespeare, Milton, Locke, and Newton, were without statues erected at the public expense, and therefore Faraday must feel content to be passed over in such company. The incentive to action had been regard for duty more than a love of glory. And certainly the nation which was prodigal of public monuments was not in the ascendant scale.

At the same sitting, Lord G. Hamilton asked the Secretary of State for the Home Department if it was the intention of the Government to adopt the suggestion contained in the verdict of the jury at the recent inquest at Hounslow, viz., that the Government should appoint permanent inspectors to carry out more strictly the purposes of the Gunpowder Act.

Mr. Secretary Bruce replied that the subject was under consideration. The accident could not be traced to any fault on the part of the Government, for a very short time before the occurrence the establishment was carefully examined by Colonel Younghusband and Captain Smith, who reported that everything was as it ought to be.

THE PAYING AND NON-PAYING WEIGHTS PULLED BY THE LOCOMOTIVE ENGINE IN 1867.*

By Mr. B. Haughton, C.E.

The railway statistics published by the Board of Trade annually, as far as they go, are of vast importance in determining the quantity and cost of the useful work done by the locomotive. In a country such as the United Kingdom, possessing 14,247 miles of railway (or 22,091 miles of single line), which has been made at a cost of £502,263,000, equal to £35,253 per mile (or £22,736 per mile of single line). In which the receipts from railway traffic are £39,480,000 per annum, or £119,636 per day (in all such calculations I assume that the year contains 330 working days). In which 287,688,000 railway trips (not including those of season ticket holders) are made in the year, equal to 871,781 trips each day, each trip 12¾ miles in length. In which 148,253,800 tons of goods, minerals, &c., are carried per annum, equal to 449,250 tons each day, each ton pulled over say 25 miles. In which 6,328,490 trains are started per annum, equal to 19,177 trains each day. In which the locomotive travels 148,542,827 miles per annum, or 450,129 miles each day. Which has been the cradle of the railway, and in which it and its complement, the locomotive, were first invented, constructed, and brought into operation. In such a country the question of the administration and conduct of the railways must be a paramount one; and we cannot as its people be said to have done justice to this magnificent piece of mechanism until we shall have so investigated its economy, and the science of its action and effort, as to place beyond dispute the laws of its existence.

It is particularly desirable that such should be studied at the present day; there is just now a lull in the railway atmosphere; railway construction, incessant for the last forty years, has at length ceased; the engineer is idle, the capitalist without whose co-operation he dare not lift his hand, stands aloof; the public look on and suffer from the estrangement, and their occupation in this department of their manifold labours being gone (for the construction of 552 miles of single line per annum since 1827, with its attendant expenditure of £12,500,000 yearly, must have been to them a source of much and very profitable business); they began during their enforced leisure to examine and criticize the natural history of the giant that they have created, with the view to bending him to a more tractable and economic servitude; and in truth most wildly and inconsiderately have they approached the investigation. We cannot altogether blame them for having placed themselves so far under the guidance of *doctrinaires*. He who, by virtue of his office, ought to have been their guide in their attempt to solve the various questions at issue has not come forward to assist them with his counsel, and out of his practical and special knowledge of the situation. The engineer which an immense material development in the current century has produced, has been so entirely absorbed in and devoted to the physical side of the railway question, that he really has not had time to consider its moral aspect. As soon as he shall have done so, and explained the condition of affairs, we may reasonably expect that the aforesaid public will become contented with "things as they are," as the intelligent British public always is, when light is given to it, and when it is made aware by the logic of facts that "things cannot be otherwise."

I hardly ever remember to have seen the truth so persistently distorted as of late by certain pamphleteers, magazine writers, and ambulatory orators, in regard to this question. In one case, a most elaborate literary picture has been drawn in an article styled "The Great Railway Monopoly," the object of which appears to be to induce the Government to undertake the management of the

* Read before the Civil and Mechanical Engineers' Society.

railways of the United Kingdom; to confer upon the travelling public the benefit of low fares; and to prove indirectly the total incapacity of those who have the control and direction of the railway *menage* of the country. The article is remarkable for the display of much research, and in short conveys the idea that it comes from the hand of an accomplished and fluent compiler. It, however, reminds the engineer of a grand and boldly designed arch of masonry under construction; it is perfect as to the material selected, its foundations are on a rock, its abutments, its counterforts, and haunches are undeniable, but it fails to support itself on the withdrawal of the centreing, because of the omission of one simple though indispensable feature—the key—which in the case of this slap-dash article must be supplied by the engineer, and the absence of which stamps the writer as being a literary conjuror rather than a practical man. With such instructors as these alluded to, and the magicians of the Belgian State lines, it is not to be wondered that the English public are disturbed as to the condition of their railways. It is not surprising that, at the first blush, they should believe themselves to be the victims of a selfish association of monopolists, and that this immense property is tended and controlled by an executive of quacks, who are guided by the leading idea that high fares alone will generate income; never was a more unfounded belief fostered.

The railways of the United Kingdom at the present day are conducted by an accomplished, scientific, and highly skilled body of experts, who know their business, do it, and don't talk about it, and who, moreover, take out of the locomotive all they can, and present it freely and exuberantly to those whom it is their interest, as well as their pleasure to accommodate—the travelling community; as shall presently be shown, this is, as the "Times" has lately stated, "the best served travelling community in the world," though I cannot endorse the final phrase in the sentence, that it is "the most ungrateful," because ingratitude is a vice of the weak and the unintelligent, and I cannot admit that my countrymen belong either to the one or the other class, but the rather that, having been made aware of the actual condition of affairs, they will accept it as being, on the whole, the best possible, considering all the circumstances of the case, and will unite with those who are only too well pleased to be assisted by them in concerting means for the elimination of such minor defects of the railway system as exist, and which are only those that belong to every human institution, but which, nevertheless, we must combat unceasingly, so as to attain as much perfection as our knowledge of the sciences involved will admit.

To begin, accordingly, the work done by the locomotive in 1867, the last year for which the Board of Trade Returns have been published, was, viz:—

3,924,624 passenger trains pulled 19·08 miles each.

	Tons.	Per cent.
Paying weight . . .	27,472,368 ...	4·89
Non-paying weight .	533,748,864 ...	95·11
	561,221,232	100·00

2,403,866 goods trains pulled 30·64 miles each.

	Tons.	Per cent.
Paying weight . . .	146,635,826 ...	30·34
Non-paying weight .	336,541,240 ...	69·66
	483,177,066	100·00

6,328,490 total number of trains pulled 23·47 miles each.

	Tons.	Per cent.
Paying weight . . .	174,108,194 ...	16·67
Non-paying weight .	870,290,104 ...	83·33
	1,044,398,298	100·00

Horizontal mile tons.

Passenger trains	10,708,101,106
Goods trains	14,804,545,302
	25,512,646,408

This work was done by 8,619 locomotives, showing work done by each, per annum, 2,960,047 horizontal mile tons; work done by each per day, 8,969 horizontal mile tons, equivalent to 382 tons pulled 23·47 miles per day, and further 17,234 miles run by each engine per annum.

Taking the 23·47 miles, the actual average distance run by each train per day, as consisting of an ascending gradient of 1 in 300 for half the distance or 11·735 miles, and a descending gradient for the remaining half; and assuming 26 miles per hour to be the average speed of each train, equivalent to an exercise of horse power as under:—

Train Mileage of Board of Trade Returns.

$$\frac{148{,}542{,}827}{3{,}924{,}624+2{,}403{,}866} = 23{\cdot}47 \text{ miles run by each train per day.}$$

Total Train Tons.

$$\frac{1{,}044{,}398{,}298}{3{,}924{,}624+2{,}403{,}866} = 165{\cdot}03 \text{ tons' weight of each train.}$$

Average inclination, 1 in 300 up for 11·735 miles; and 1 in 300 down from the same distance.

Average speed, 26 miles per hour.

From these data are obtained the results:—

$$\frac{26 \times 5280}{60} = 2288 \text{ feet run by train in 1 minute.}$$

$$\frac{2288}{300} = 7{\cdot}626 \text{ feet lift of train in 1 minute.}$$

$$\frac{165 \times 2240 \times 7{\cdot}626}{33{,}000} = 85{\cdot}41 \text{ horse power due to lifting the trains.}$$

$$\frac{165 \times 9 \times 2288}{33{,}000} = 102{\cdot}96 \text{ horse power due to friction, \&c., at 9lb. per ton.}$$

$$+85{\cdot}41+102{\cdot}96 = +188{\cdot}37 \text{ horse power required in ascending the incline.}$$

$$-85{\cdot}41+102{\cdot}96 = +17{\cdot}55 \text{ horse power required in descending the incline.}$$

$$+188{\cdot}37+17{\cdot}55 = 205{\cdot}92 \text{ horse power exercised throughout the average run of 23·47 miles.}$$

Trains. Trains per Day.

$$\frac{6{\cdot}328{\cdot}490}{330} = \frac{19{\cdot}177}{8619{\cdot}} = 2{\cdot}22 \text{ trains pulled per day by each engine.}$$

Each train pulled 23·47 miles, at 26 miles per hour, gives 54·16 minutes occupied in the average journey.

$$\frac{54{\cdot}16 \times 2{\cdot}22 = 120 \text{ minutes.}}{60} = 2 \text{ hours.}$$

205·92-horse power × 8619 engines = 1,774,824 total horse power exercised for 2 hours each day of 339 days per annum, in behalf of the travelling public.

Considering that these engines may be held on the average to be capable of exercising 400-horse power each without forcing; the 206-horse power actually made available will perhaps be considered too small a per centage to take out of each engine, but it will be understood that it is not possible to render useful the maximum power of the total number of engines in the country, for these reasons; that a certain portion must be held in reserve in case of ordinary accident to running engines; that another portion will be engaged as bank engines, and in shunting trains about the stations; that a large proportion of the whole will stand in the sheds for cleaning, and in the shops to undergo the repairs due to the daily wear and tear of an exceedingly complicated and perishable machine; and that over and above all these requirements an ultimate reserve will be necessary in order to make sure that a provision shall exist against all eventualities, and that in no possible case shall the company fail to perform their duties to the public punctually as advertised in the time bills. These results cannot be taken as illustrating the work to be gotten from individual engines, but only as being useful in comparing the total work of one year with that of another in the same country; in comparing the work done in one country with that done in another; and above all and eminently, in showing a people how much they take from their machinery in gross, with the object of exhibiting the weaknesses of the system, so as to effect such reforms as shall lead to improvements in organisation and administration thereafter.

In reviewing the foregoing figures, I shall ask your attention to two salient matters therein exhibited, the first of which is that I have reduced the work done to horizontal mile tons, and that I believe this to be the only true mode by which a railway company can accurately test the nature of its operations; and, secondly, to the extraordinary preponderance of the figures indicating the non-paying weight pulled as compared with the paying weight, viz.:—Firstly, the usual mode of estimating the work done, as practised by boards of directors, is that by train mileage. The train mileage of one half-year exceeds that of the corresponding half in the previous year, and this is hailed as a matter of congratulation from the chairman to his proprietors; or the increased income per train mile of the half-year has exceeded that of the corresponding six months of the former year by a certain per centage, which is equally a cause of satisfaction to his audience; whereas it is quite within the range of possibility, and has no doubt happened before now, that each of these apparently pleasing results of the half-year's work has been nothing less than a captivating illusion; for, in the first case given, that of an increase of train mileage, the latter may have increased without bringing an increase of revenue, and may have brought with it a positive loss; and, in the second case, that of an increased income per train mile, the same may have arisen in consequence of a reduction of mileage, and may have existed coincident with a falling off of revenue. The train mile is not a measure of the useful work done, because the weight of the train is not told; given the weight of the train, however, subdivided into its paying and non-paying weights, and a basis of calculation is afforded which places the work done beyond cavil.

In order to attain this object, it will be necessary that the paying and non-paying weights of each train started shall be registered, as well as the distance travelled by each vehicle. This, though causing some extra office work, will amply pay for itself in the long run. I have endeavoured to reduce the work done, as given in the Board of Trade statistical tables to the horizontal mile ton by rating the weights of the average trains of the year as follows. It will be observed that some of the items in the tables are assumed. I have determined their value as best I could from the most reliable sources I have been able to consult; the remaining items are taken from the Board of Trade returns, viz.:—

Weight of the average passenger train in 1867—

Non-paying load.		
Engine and tender . .	50 tons.	
7 carriages	56 „	
2 breaks	10 „	
		116 tons.
Empty carriages, &c., to be pulled back, say, $\frac{1}{6}$th of above . .		20 „
Paying load.		
73 passengers, with luggage, &c., at 2 cwt. each . . .		7 „
Total		143 tons.

I have chosen 7 as a fair average figure for the carriages to each train. This number of composite carriages should contain, if full, 196 persons, narrow gauge; and in corroboration of this rating, I may quote Mr. Robert Stephenson, who in his address to the Institute of Civil Engineers in 1856, rated the then trains as capable of holding on the average 200, while not actually carrying over 100 passengers. It appears from the Board of Trade returns that the number of passengers has decreased since then, doubtless owing to competition, and the wish to render travelling more attractive by the running of an increased number of trains, since only 73¼ passengers were carried per train in 1867; or it may have been more directly due to the practice of sending through carriages to all the principal stations with the more important trains, thus saving their occupants the necessity of changing from one carriage to another *en route*. The empty carriages to be pulled back with their attendant portion of the weight of the engine, consequent on the irregularity of flow of the streams of traffic in opposite directions, is a fact that cannot be evaded, I have rated it at one-sixth the non-paying weight.

(To be continued).

A NEW REFRIGERATOR.

A VERY useful application of scientific principles, and one which will be appreciated during the present hot weather, has been made by Messrs. Wright and Co., of Broad-street, Birmingham. This consists of a portable refrigerator, in which water is used instead of ice. It consists of a close-topped metal cover, surrounded by a rim containing water, and covered with a porous textile fabric. By capillary attraction, the water rises over the whole surface, evaporation immediately ensues, and a cooling effect is produced. A great advantage this invention possesses over all others is, that the warmth of the atmosphere is the means of producing the cooling effect, so that, while in very hot weather the difference between the inside of the refrigerator and the external air is very great, in cold weather, when not wanted, there is no perceptible difference. It will be seen that this refrigerator cannot fail to keep provisions cool during the hottest weather, as the principles by which the effect is produced are the operation of natural laws.

THE Russian Government has issued a ukase for a universal exhibition, to be held at St. Petersburg next year, to open on May 15.

SELF RECORDING ANEMOMETER.

BY MR. BECKLEY.

Fig. 1.

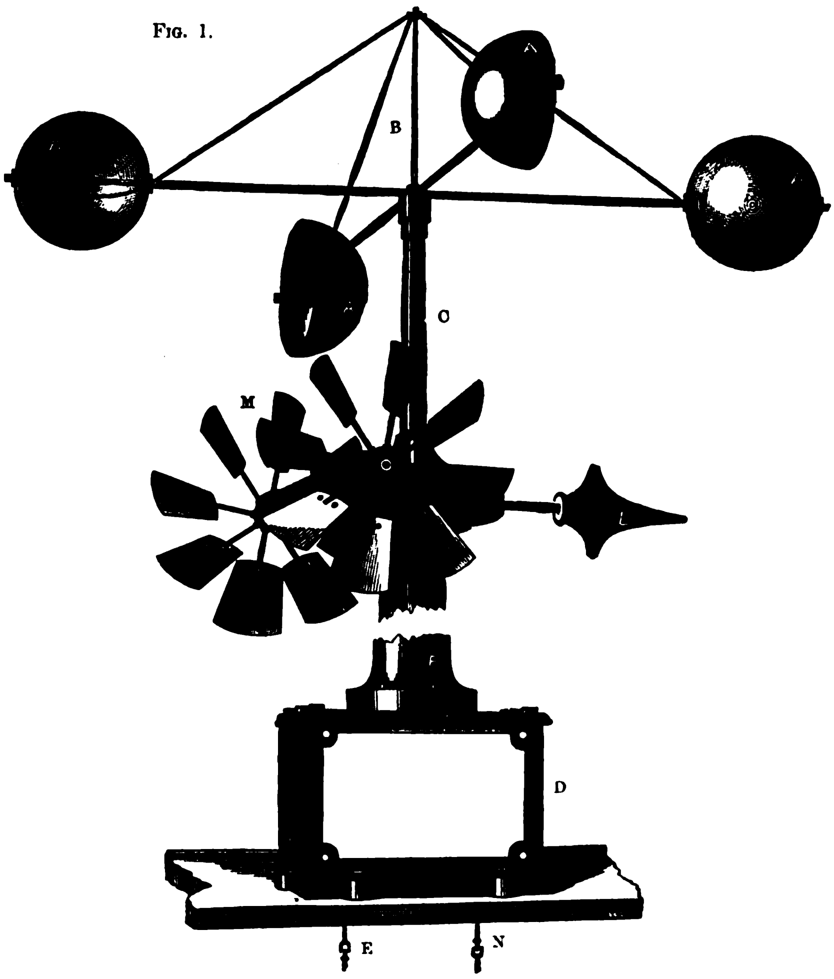
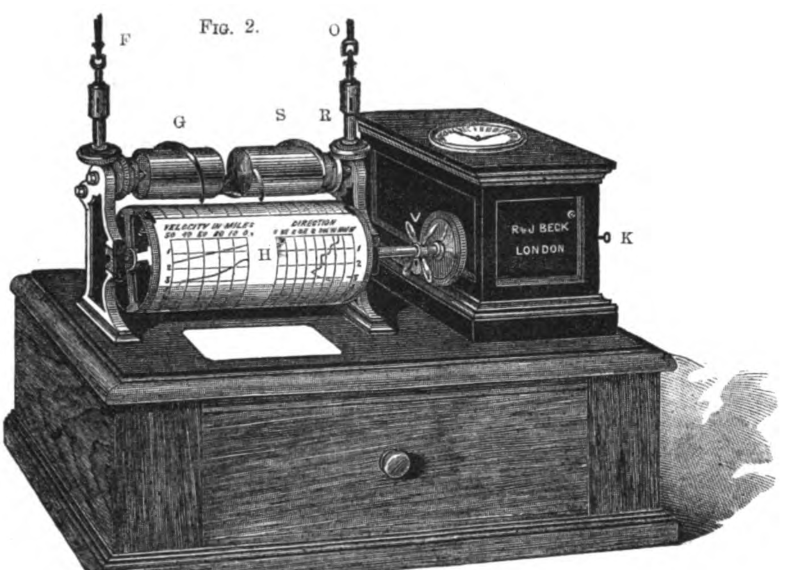


Fig. 2.



SELF-RECORDING ANEMOMETER.

THE annexed engraving represents the self-recording anemometer used by the Board of Trade, and which is the invention of Mr. Beckley. The apparatus was designed to register the velocity and direction of the atmospheric currents from day to day. It consists essentially of two parts; the first—which is shown in fig. 1 drawn to a scale of 1-12th—is fixed in an exposed position on a roof, or elsewhere, and the other (fig. 2), drawn to a scale of 1-6th, may be placed wherever desired, and is connected by light brass tubes to the first portion. Upon the wind moving the hemispherical cups A A, the motion is communicated to the steel shaft B, which passes inside the shaft C, and is fitted at the lower end with an endless screw that works into a series of wheels in the iron box D. The velocity is here reduced, after which it passes out at the point E, and at the required distance is connected with the rod F, where, by means of bevel wheels, it communicates the motion to the spiral brass registering pencil G, which is arranged so that each revolution records 50 miles of velocity upon the prepared paper H, placed on the drum, which is revolved once in 24 hours by the clock K.

The direction of the wind is indicated by the arrow L, which is kept in position by the fans M. These are attached to a spindle with an endless screw attached to the shaft C, and working into a worm-wheel screwed into the column P. This spindle passes into the iron box D, where it works into a tooth-wheel, and emerges at the point N, passes down side by side with the velocity-rod till it reaches the point O, where it is attached to a pair of bevel wheels at R, and communicates the movement to the pencil S, which, in one revolution, records the variations through the cardinal points of the compass on the same paper as that on which the velocity is given. The paper is held on the drum by two small clips, and may be easily changed by unclamping the cross V, without removing the drum or in any way disturbing the instrument.

As the self-recording anemometer is a differential instrument, it will be well for those who desire to have one, to select the same pattern as that established by the Board of Trade as a standard (for the sake of comparison with others). The main features and advantages of this form are:—The convenience of recording both direction and velocity on the same sheet of paper; the advantage of the employment of spiral pencils recording on De la Rue's metallic paper, and which, being made of brass, never require renewal, and register with certainty, however often the wind may shift or however great its velocity; the reduction of the speed of the velocity-shaft before communicating the motion to the long rods, thus avoiding much friction; and, finally, the ease whereby, owing to peculiarity of construction, every working part can be hung and balanced so as to reduce the friction to a minimum. We are indebted for our particulors to Messrs. Beck, of 01, Cornhill, who are the monufacturers of the apparatus.

THE KING'S LYNN DOCK.

FOR many years past the necessity of having a dock at Lynn has been felt, and the question has several times been discussed, without any practical result. When the Ouse had been diverted from its old bed to the famous Eau-brink cut, the Great Eastern Railway Company projected a dock in the old channel. The project, however, was neglected until the Midland Company, by its new line from Peterborough, established a rivalry with the Great Eastern. Then there was a fight for the honour of constructing the dock, in which the Lynn and Sutton Company won the day. In August, 1866, Mr. Abernethy, C.E., reported in favour of the scheme; in June, 1865, the Act was obtained; and in 1868 the Board of Trade advanced £22,000 on debentures, payable in seventeen years, the town of Lynn contributing £20,000. In October, 1867, the first work was begun, and in the December of that year the formation of the dock was actually commenced. The excavation was commenced in November last, and last Wednesday the Prince and Princess of Wales declared the dock open. The area of the dock at the water level, which is 26ft. from the bed, is about 6¾ acres, the length being on the northern side 590ft., and on the southern 780ft., and the width averaging 440ft. The sides of the dock are sloping, and are faced with blocks of artificial stone, made on the spot. There are seven jetties for the use of large vessels, and these jetties are connected by tramways with the railway lines that run round the dock. The capacity of the dock is put down at 50,000 tons of shipping, and vessels of 1,200 tons to 1,500 tons can obtain access at any high tide. During the excavation, which went through alluvial deposit to the Kimmeridge clay, an immense quantity of animal remains was found, among the sculls being those of the wild boar, the wolf, the tiger, the elk, and the beaver. Several specimens of Roman and Saxon pottery were discovered in the same drift, far below which are sunk the foundations of the lock, which is 30ft. deep, 200ft. long, and 50ft. wide, the walls being at the bottom as much as 12½ft. in thickness, and the end walls fully 16ft. The walls are of brick, faced with Bramley Fall millstone gritstone, which is protected by timber fenders; and the lock-gates, made on the spot, are framed in oak, and covered with Dantzic fir. Each leaf measures 29ft. in width by 31ft. in height, and is 2ft. 9in. in thickness. Mr. J. Leslie, C.E., has been the superintending engineer, Mr. W. F. Lawrence the contractor. No work of the kind could have been better done; the whole cost being about £80,000.

A GERMAN chemist, M. Kuhr, proposes a new method for marking linen. It is first saturated with a solution of 1 part of hypophosphite of soda and 2 parts of gum in 16 parts of distilled water. The linen is then ironed, and, when dry, you write upon it with a quill pen charged with a solution of 1 part of nitrate of silver and 6 parts of gum in 6 parts of distilled water.

ON THE MOULDING OF TOOTHED WHEELS.*

By MR. GEORGE L. SCOTT.

THE apparatus for moulding toothed wheels to be described in the present paper has been designed by the writer to supply the means of obtaining strictly accurate castings by machine moulding, with a portable and self-contained machine of small cost, capable of being readily and quickly applied at any part of a foundry. The accuracy and perfection of the teeth of wheels are of great practical importance in all cases of gearing, and especially where large amounts of power are transmitted by them; and it requisite that the transmission of power should be uniform and continuous through the teeth of the wheels, corresponding to the continued frictional contact of two circles rolling upon each other. To maintain this uniform and continuous action in toothed wheels, all the teeth throughout the circumference of the wheel are required to be precise duplicates of one another in form, size, and spacing; and all to be placed in a perfect circle round the centre of the wheel. Should these conditions be imperfectly carried out, the essential continuous contact will be destroyed, and a serious intermittent knocking between the teeth will be caused, leading to the fracture of the wheel, and risking a stoppage of the machinery. Any defective fitting of toothed wheels also involves a waste of driving power from the irregular shocks in transmitting the power; and as a consequence the wheel will not last so long in such a case, owing to the friction causing extra wear of the teeth.

In the earliest method of making toothed wheels, the teeth were chipped out by hand from the solid edge of the wheel, upon which they were set out and shaped to template. Subsequently, the teeth were formed on a wood model of the wheel, and moulded from this model according to the plan in general use, involving the necessity of having a separate expensive pattern for each wheel that differs in form and pitch of teeth as well as in diameter. The result has been a vast collection of toothed wheel patterns to meet the requirements of ordinary trade demands; and this stock has become so costly in the expense of construction and of the storage space occupied, that it has led to an objectionable limitation in the range of pitch of wheels, in order to reduce the extent of the stock of patterns. The use of wood patterns for entire wheels involves further the practical objection of liability to distortion, both in the general contour of the wheel and in each tooth, owing to the irregular effects of expansion and contraction in the component parts of the pattern; as well as the unavoidable risk of variation in the forms and dimensions of the several teeth, in consequence of the different finish that each receives. The uncertainty, too, attending the drawing of an unwieldy pattern from its mould, and the distortion of the pattern that occurs from its lying in damp sand for a considerable time, are additional obstacles to the manufacture of a toothed wheel from the ordinary wood models with the correctness that is desirable.

The only method of overcoming these difficulties is by employing only a small segment as the pattern, and moulding the entire toothed circumference by repetition of this small portion; employing mechanical means for lowering and raising it, and for spacing out the teeth round the circumference of the wheel so as to obtain the same certainty of accuracy throughout, as is shown by a wheel divided and cut in a machine. This process was introduced by Mr. P. R. Jackson, and carried out with the greatest accuracy; and, until the advent of his most valuable machine, it may be said that no really correct toothed wheels were cast.

The object of the wheel moulding machine forming the subject of the present paper is to extend the application of this process by the use of a portable machine, of small size and cost, that can be easily applied for moulding a toothed wheel in any part of a foundry. Having moulded one wheel, the machine can be fixed at another place for use, or be put away until required again, in the meantime leaving the foundry floor clear and in the usual condition for ordinary work. It will enable any foundry to supply with rapidity and economy of manufacture wheels possessing the absolute accuracy which results from the use of a machine.

The machine is made of two sizes, one for moulding wheels from 12in. to 5ft. diameter, and a larger size for wheels from 20in. to 12ft. diameter. The smaller machine is shown in the annexed engraving. Fig. 1 shows an end elevation of the machine, fig. 4 a side elevation, and fig. 5 a plan. A pedestal A, shown separately in fig. 2, supports a centre pin B, which has a collar to bear upon the pedestal, and is provided with a projection that fits into a recess in the top of pedestal, whereby it is prevented from turning in its socket. The spindle C is bored to fit on the centre pin B, and is turned to pass up through the rest of the apparatus, which it supports, as shown in section in fig. 6. Set screws placed in the spindle C are used to fix it firmly on the centre pin B, and this being secured in the pedestal a continuous vertical centre spindle is thus obtained. Loose collars provided with set screws and bored to fit the centre pin B are used for the purpose of elevating the apparatus above the pedestal A, in order the more readily to adapt it for moulding different breadths of wheels. One of these collars is shown at V in fig. 11, and they are of 1in., 2in., and 3in. in thickness respectively.

On the spindle C is carried the head D, shown in section in figs. 6 and 7, and in this head slide the radial arms E E, connected together at their front ends by the transverse piece F, which forms the bed for the vertical sliding ram G. The arms E E are secured to the head D in any required position by four square-headed bolts passing through slots in the arms and through ears cast on the head; these bolts, being screwed up, bind the arms and head firmly together. The spindle C, being firmly secured in the pedestal, forms a stationary centre pillar for the machine, on which the head D is free to turn; and, on the top of the spindle, is keyed the wormwheel H, from which a connection is made to the arms E by the dividing apparatus shown in figs. 1, 4, and 5. This consists of a worm I gearing into the wheel H, and the change wheels J J J, the uppermost wheel being on the worm shaft, and the lowest one keyed on the shaft K, which is carried by brackets on the arm E, and is provided with a loose collar acting as a bearing, so that the shaft may be withdrawn for altering the change wheels when required. The swing frame L carrying the change wheels is sufficient for two intermediate change wheels if required. On the shaft K is fastened a spring handle M, which fits a slot in a disc that is divided to guide the workman in the number of turns to be given to the shaft. The traversing screw O is carried by brackets on the arm E, and passes through the nut N bolted to the head D, so that, by turning the screw O by the handwheel at the end, the arms are moved in or out, to suit the varying diameters of wheels to be moulded.

On the slide bed F fits the vertical sliding ram G, which is held in by the cover R shown in section in fig. 8; and a hand screw S retains the ram in any required position. The bottom of the ram is bored to receive the angle bracket T, which is secured in it by steady pins; and to this is attached the segment pattern U of the wheel teeth to be moulded. The ram is moved up or down by a handwheel Y, having a worm gearing into a wormwheel, on the shaft of which is a pulley Z; from this pulley, two chains pass in opposite directions, the one being secured to the bottom of the ram, and the other to the top, and kept always tight by means of two lock nuts. An adjustable brass collar W is fitted on the ram for indicating to the moulder when the ram is sufficiently lowered. An eyebolt is fixed on the top of the centre pillar C of the machine, for attaching the foundry crane in order to remove the machine.

The process of moulding a wheel with this machine is as follows:—A core box for the arms of the wheel is first prepared, and also two radial boards for strickling the form of the top and bottom of the wheel in the sand, which are shaped to the profiles of the face and back of the wheel. The top board P, shown in fig. 11, has on its lower edge the profile of the back of the wheel; and the bottom board Q has also, on its upper edge, the counterpart profile of the back of the wheel, and, on its lower edge, the profile of the face. A pattern is also made of a segment of the toothed rim of the wheel, consisting of two teeth only, which permits of moulding one space at a time.

A secure and steady foundation for the moulding machine is obtained by sinking in the sand of the foundry floor in the desired situation the pedestal of the machine, which is bolted to a cast-iron base plate, about 4ft. square; sand is then rammed solidly upon it, and the pedestal levelled so as to be truly vertical. Another form of pedestal is shown in fig. 3, which is used for fixing in the sand without a baseplate. The top of the pedestal is placed about 15in. below the floor level, this distance determining the greatest breadth of wheel that can be moulded. The centre pin B of the machine is then placed in the socket of the pedestal for the purpose of forming the mould for the bed of the wheel, and also to mould the top box or other arrangement used to cover the mould for casting; the rest of the machine being laid aside for the present.

In fig. 11 is shown the loose collar V which is placed upon the centre pin B, of such thickness that its upper face is the same depth below the floor level as the breadth of the rim of the wheel to be moulded; so that the back of the wheel is level with the floor for convenience of fitting the top box on. This lower collar V is fixed by a set screw, and an upper loose collar X is also fitted on the centre pin V by a set screw, with its upper face at the same height above the collar V as the breadth of the rim of the wheel; the lower collar thus exactly indicates the level of the bed and face of the wheel, and the upper collar that of the back of the wheel. The hole is then filled up with sand to the level of the upper collar; and the iron trammel carrying the top board P is placed upon the spindle B, and worked round upon the collar X, forming a mould of the back of the wheel, which is then sprinkled with parting sand to form the parting for the top box. An ordinary top box or other sufficient covering is then placed on, and rammed up with sand; and the box is then staked in the ordinary manner, for the purpose of marking its correct position, relatively to the bottom part of the wheel, by stakes driven into the sand, and fitting by the side of corresponding ears upon the top box. The top box is then lifted off, carrying with it the impression of the back of the wheel; which impression is finished by turning the box over, and strickling it again with the second trammel that carries the bottom board Q. A centre is provided in the top box for this trammel by means of a loose collar, in which are two bolts that pass through the top box and are fastened across the bars of the box. This loose collar fits the spindle B, and is drawn from it with the top box, thus fixing a strictly accurate centre. By this arrangement, the centering collar can be readily fixed upon any ordinary top box, giving strict accuracy in the moulding, without requiring any special boxes for the purpose.

For forming the bed of the mould, the top collar X is then removed, and the mould being dug out to the level of the bottom collar V, the sand is strickled with the bottom radial board Q, worked round upon the bottom collar V. This forms the mould for the lower and outer faces of the teeth, and finishes the mould ready to receive the teeth and the cores for the arms; and, as both the back and the face of the wheel have been struck from the same trammel and the same centre, perfect accuracy is ensured in the wheel.

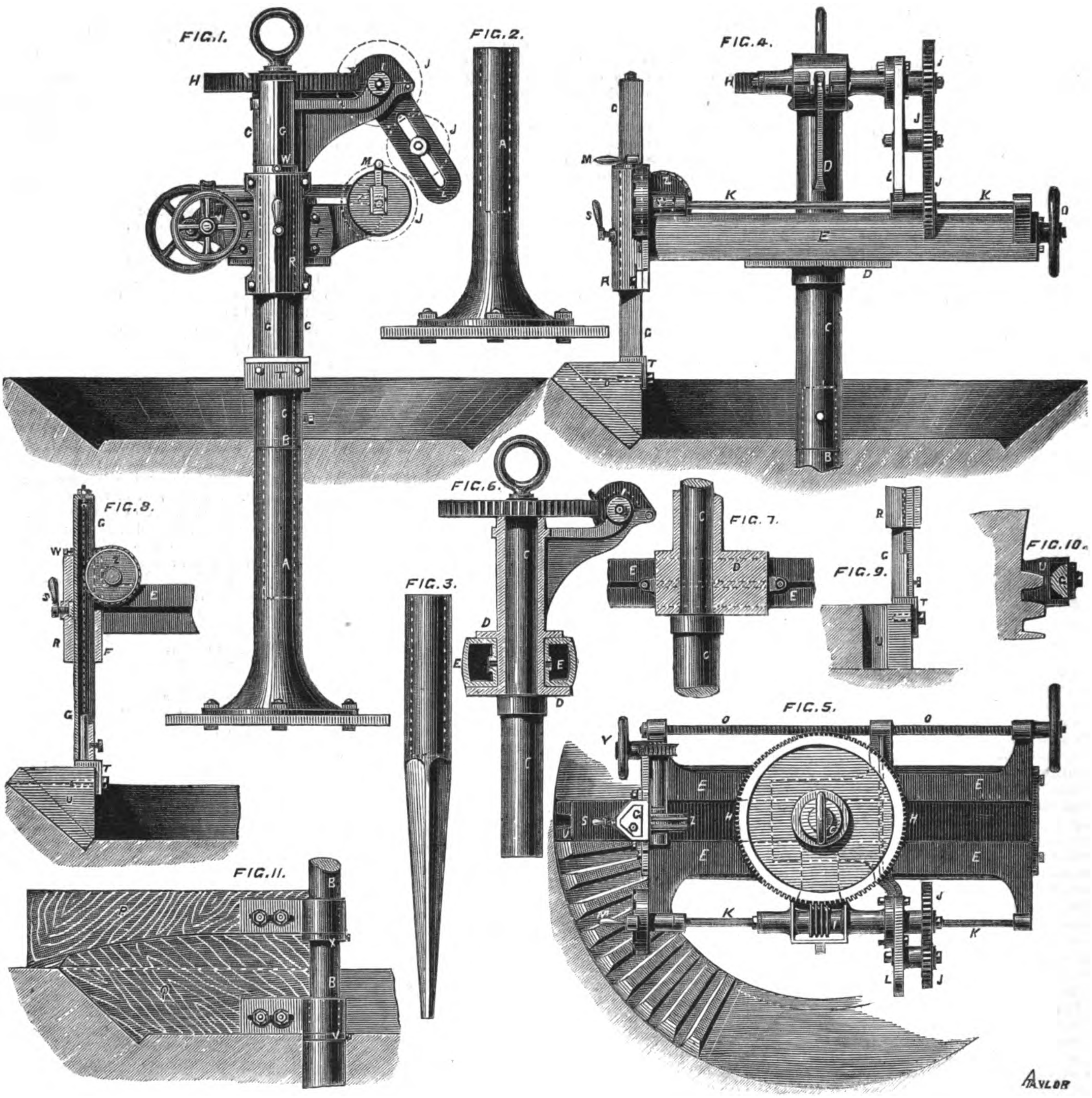
The segmental pattern of the teeth U, figs. 9 and 10, is then fitted truly square and central, and secured by screws upon the angle bracket T of the vertical sliding ram G, fig. 4. The upper portion of the machine is then placed upon the spindle B, the trammel having been removed; and the fixing screws in the spindle are screwed up to maintain the central axis continuous through the machine. The segmental pattern U is adjusted by the traversing screw O, fig. 5, to the correct radius of the wheel, measuring from the top of the tooth to the centre of the machine. The ram G is then lowered to the level of the bed of the wheel, and secured at that point by the locking screw S; and the brass collar W is adjusted on the ram and fixed by a set screw, to ensure the ram always stopping at the same level when lowered for moulding each successive tooth. The locking screw S prevents the ram rising from the pressure of ramming the sand. One space of the wheel teeth is then moulded by ramming sand in the space left between the pattern and the edge of the mould previously formed by the strickle board. The locking screw S being then released, the ram carrying the pattern is raised clear of the mould, and is then traversed round through the exact distance of the pitch of the wheel, by means of the dividing handle and the change wheels previously arranged for the required pitch. The segmental pattern is then again lowered, and a second space moulded as before.

When all the teeth have been moulded, the fixing screws of the central spindle are released, and the whole machine is then lifted away by the foundry crane laying hold of the eye-bolt on the top of the spindle, leaving the mould entirely clear to receive the cores for the arms and boss. The hole in the top of the pedestal is fitted with a cover to keep out the sand, and is then covered over with sand, which protects the pedestal against the action of

* Read before the Institution of Mechanical Engineers.

MACHINE FOR MOULDING TOOTHED WHEELS.

BY MR. G. L. SCOTT.



the hot metal. The centre core for the wheel is adjusted as usual from the circumference, and the cores for the arms are set to their places by means of wood gauges showing the thickness of the arms and rim. The top box is then put on to cover the mould, being placed in its correct position by the stakes previously mentioned; the runner is then formed, the box duly weighted, and the whole is ready for casting.

This mode of moulding wheels gives the certainty of strict accuracy and excellent finish throughout. The trammel revolving on a secure centre ensures a true circle in the circumference of the teeth; the dividing arrangement ensures the correct relative position of all the teeth; the mode of raising the tooth pattern ensures a gradual steady withdrawal from the sand, whereby the mould is left perfectly finished; the tooth pattern, having but one space from which the whole number of teeth are moulded in succession, produces each tooth an exact duplicate of all the others; and the arrangement for forming the mould and the top box from the same centre produces so good a joint, that the occurrence of any fin on the edge of the teeth is prevented. This great superiority in the finish of the wheels moulded by the machine, as compared with hand-moulding from wheel patterns, is accompanied by a very important economy, saving the heavy outlay required for a large stock of costly wheel patterns; thus, in the case of a wheel of 6ft. diameter and 12in. breadth, instead of a complete wheel pattern costing about £10, the whole expense required with the machine for the tooth segment, core box, and strickling boards, will be only about 15s.

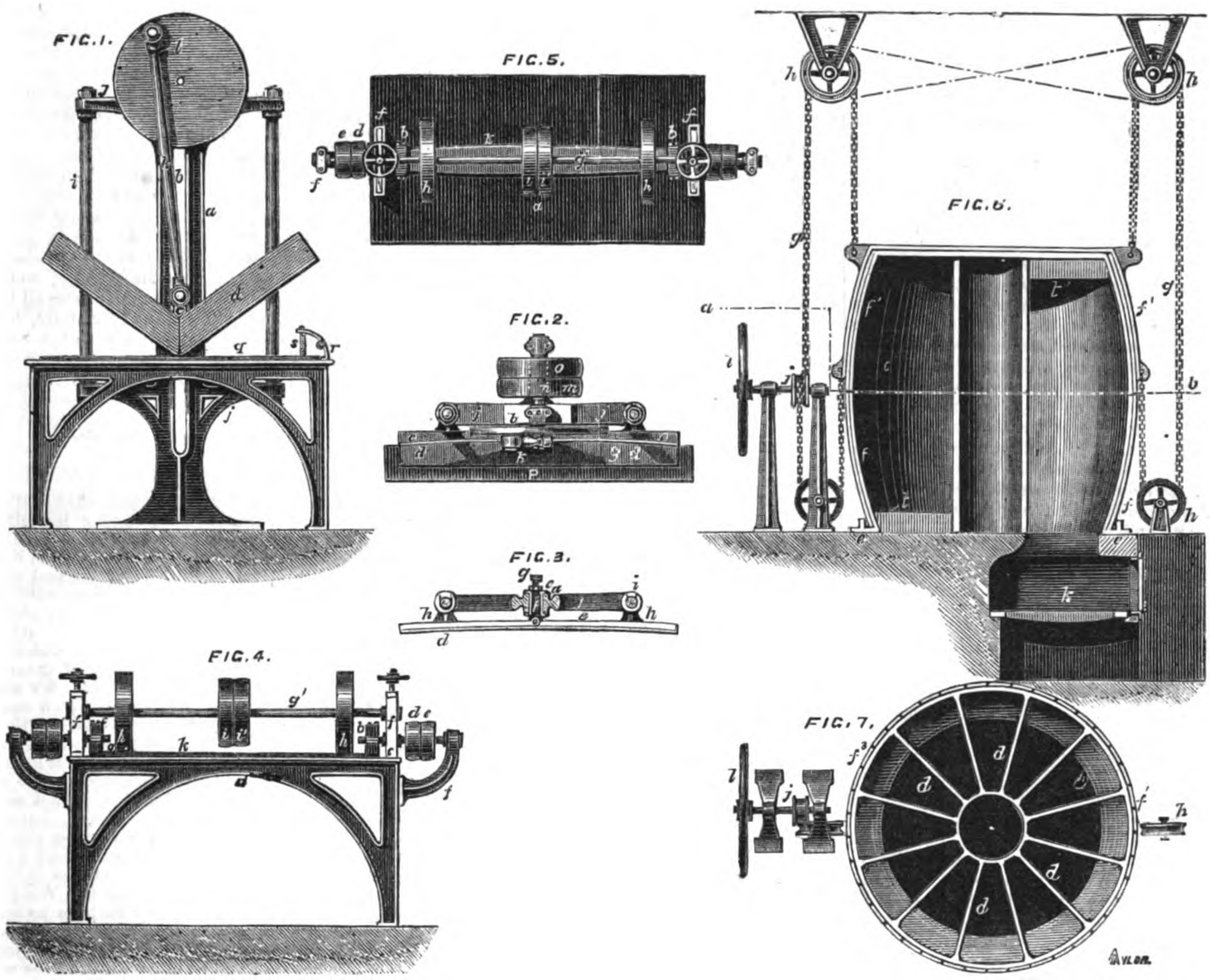
The moulding machine now described has the advantages of great compactness and convenience for use, as it occupies but little room; and being used in the foundry floor, it effects a great saving in the expensive item of boxes. A special feature of advantage is the portability of the machine, which is a point of great importance; and, as a consequence, one machine is made to do the work of several, by simply fixing two, three, or more pedestals in different parts of the foundry floor, upon any one of which the machine can be quickly and readily placed for moulding a wheel; whilst those pedestals that are not required at the time are simply covered with sand, leaving the floor in its usual state, clear for other work. By this means, the moulding of more than one wheel may be in progress at the same time, with the cost of only one machine in the foundry.

An important practical advantage obtained by machine moulding is the power of manufacturing wheels with an unlimited variety of dimensions, pitch, and forms of teeth, so as to meet exactly the requirements of any case that may occur; thereby avoiding the serious obstacles so frequently experienced of having to modify the intended wheel, in order to suit some existing range of patterns and obviate the serious cost and the delay attending the preparation of a new complete pattern.

As an example of the rapidity of moulding large wheels by means of this machine, it may be mentioned that a bevel wheel of 9ft. diameter and 12in. breadth, weighing 3 tons, was moulded and cast within four days from the time of the order being given at the North Moor Foundry, Oldham; and, in another case, at Messrs. Buckley and Taylor's, Oldham, a shrouded bevel wheel of 6ft. diameter and 11in. breadth was moulded in twenty-four hours by two men; and a spur wheel of 9ft. diameter and 8in. breadth, weighing 2 tons, was also moulded in twenty-four hours by two men.

CASK-MAKING MACHINERY.

BY MR. JOHN REID.



REID'S CASK-MAKING MACHINERY.

Mr. JOHN REID, of Glasgow, has recently patented some machinery for cask-making, which forms the subject of the accompanying illustration, for which, with the following description, we are indebted to the "Brewers' Journal." The invention includes improvements in machinery for cutting staves, for bending and heating them, and for "croessing" and dressing their ends. It also embodies an improved method of forming the ends of barrels and also of trussing them. In our engraving, fig. 1 is a front elevation of a guillotine cutting machine, for shaping the staves of casks. Fig. 2 is a plan, and fig. 3 a horizontal section of the same machine, the latter view showing the reciprocating frame and guides. The machine consists of a standard *a*, having a vertical opening *b* formed in it, in which the guide block *c* slides. The cutting or shaping knives *d* are fastened to a curved frame *e*, formed in two parts and hinged at the centre to a block *f*, which slides horizontally in the guide block *c*. The object here is to allow of the adjustment of the cutting knives *d* to any required curve by means of the set screw *g*. Guide brackets *h h* are cast on or attached to the curved frame *e*, and slide upon the rods *i i*, which are fitted to the bracket *j*, cast on the main standard *a*. The knives *d* are actuated by a connecting rod *k*, which is attached at one end of a disc *l*, and at the other end to the guide block *c*. The disc *l* is keyed on to the shaft *m* and rotated by means of a belt actuating the fast pulley *n*; *o* is a loose pulley for throwing the machine out of action.

In cutting the staves, they are placed upon the table *p*, as shown at *q*, figs. 1 and 2; and when one edge has been cut by the descent of the guillotine knife *d*, the stave *q* is turned, and the other edge is cut by the next descent of the knife. To facilitate the production of staves, two of these machines may be used, placed one at the end of the other, and with their front sides turned in opposite directions. In operating with this arrangement, a doubled-armed lever or "kicker" *r*, fig. 1, is used to push the stave from one machine to the other. The "kicker" is so placed that, as the guillotine descends, and while cutting one edge of the stave, the upper arm of the "kicker" is depressed by the curved frame, and compresses the spiral spring *s*, which is instantly relieved when the stave is cut. This causes the "kicker" to rotate and push the stave on to the table of the next machine, where the second edge is cut without the stave being turned. The cutting table *p* is adjusted by means of set screws, so that the edges of the staves may be cut to suit the diameter of the cask which they are to form.

Fig. 4 is a front elevation, and fig. 5 a plan of a "croessing" and dressing machine upon Mr. Reid's plan. The staves are placed upon the table *a*; *b* are the discs in which the cutters *c* are fitted; *d* and *e* are fast and loose pulleys by which the discs *b* are operated; *f f* are brackets fixed to the table *a*, in which the cutter spindles *g* and the feed roller shaft g^1 are carried; *h h* are the feed rollers which are operated by the fast and loose pulleys $i\ i^1$. The staves are placed on the table *a*, as shown at *k*, and are drawn through the machine by the feed rollers *h h*. As the distance between the table *a* and the cutters *c* is preserved uniform for all the staves which are to be used in one description of cask, the grooves in the staves into which the ends will fit are cut more or less deep according to the thickness of the staves. The thickness between the bottom of the groove and the outside of the stave will, however, be the same in all the staves. The inequalities in the thickness of the staves of undressed barrels will thus appear in its interior instead of its exterior, which will have a more finished appearance. The ends of the staves are dressed at the same time that the "croessing" operation is performed. This operation is effected by placing a circular saw on each of the cutter spindles *g*, or on spindles carried under the tables, so as to cut the staves to a uniform length as they pass through the machine.

Mr. Reid's apparatus for heating and bending the staves is shown at figs. 6 and 7, the latter being a sectional view on the line *a b*. This apparatus consists of a chamber *c*, which is constructed in the form of a barrel, and divided radially into vertical passages by the partitions *d*. A T-flange runs round the bottom end of the chamber *c*, and forms a groove *e*, in which the ends of the staves *f* are placed. A cover f^1 is raised or lowered by the chains *g* passing over the pulleys *h*, and actuated by the hand wheel *i* and chain *j*. The chamber is heated to the required temperature by hot air supplied from the furnace *k*, the vertical passages communicating alternately at top and bottom by the openings *l*, fig. 6 forming a flue through which the heated air and products of combustion pass on their way to the chimney. In using this apparatus, the cover f^1 is raised by means of the hand wheel *i*, sufficiently high to allow of one end of the staves being inserted in the annular space between the cover and the chamber *c* and the bottom end into the groove *e*. The cover is then lowered, and the staves *f* are pressed close to the sides of the heated chamber. When the staves are sufficiently heated and bent, they are removed, and the apparatus again filled with staves. We reserve our description of Mr. Reid's machinery for forming the ends of barrels, and of his trussing machine, until our next number.

QUALITY OF THE CITY GAS.

Dr. LETHEBY, the chief gas examiner to the Board of Trade, has reported on the quality of the gas supplied to the City during the months of April, May, and June; and it was found that, when tested in accordance with the provisions of the statute, the maximum, minimum, and average illuminating power in standard sperm candles of the gas of the three City companies had been respectively as follows:—The City of London Gaslight Company, 15·73, 14·10, and 14·87; the Chartered Company, 15·90, 14·10, and 14·98; and the Great Central Company, 15·62, 14·06, and 14·72. With respect to the purity of the gas, the examiner reported that ammonia had been constantly present in the Chartered and Great Central supply, but that the gas of all the companies had been quite free from sulphuretted hydrogen. The following were the maximum, minimum, and average proportions of grains of sulphur in 100 cubic feet of gas:—City of London Company, 23·40, 7·02, and 17; Chartered Company, 21·45, 10·75, and 16·86; and Great Central Company, 26·72, 4·16, and 11·58. Those results indicated a remarkable range in the proportions of sulphur, the minimum proportions being altogether unusual.

GOLD CURRENCY.

THE Master of the Mint and the late master of the Calcutta Mint have reported to the Chancellor of the Exchequer upon the question of the mintage necessary to cover the expenses of establishing and maintaining the gold currency. The gold coinage in circulation in the United Kingdom is generally estimated at about 80 millions sterling, 68-80ths being sovereigns and 12-80ths half-sovereigns. An estimated annual coinage of about 10 millions would be made up of 4 millions of first coinage and 6 millions of renewal. The cost at which a sovereign or half-sovereign is produced may be safely taken at about a halfpenny. By wear, sovereigns fall below the legal weight after a circulation of eighteen years, and half-sovereigns in ten years. Mr. Jevons calculates the annual loss by wear on 100 sovereigns at 8·371d.; on our present mixed circulation of sovereigns and half-sovereigns the annual loss is calculated at £35,000. Some coins drop out of circulation annually by shipwrecks, fires, melting, losses, &c., and, on the other hand, it is estimated that there are about 30 million sovereigns in circulation in foreign countries, part of which may be returned to the United Kingdom for renewal when they become light. The result of the whole calculation is that for our circulation of 68 million sovereigns and 12 million half-sovereigns, an endowment of £1 13s. 6d. for every £100 would suffice for the permanent maintenance of the coin, the first construction, and all future restoration. These results are based upon the mere bullion by itself, and are quite independent of all other considerations.

DYEING AND PRINTING.

AT the present time, sumach is much used in dyeing and printing, in order to cause other dyes to take better on the fabrics or fibres of materials to be dyed or printed. According to an invention lately patented by Mr. J. L. Norton, of Bell Sauvage-yard, Ludgate-hill (whose name is well known in connection with the Abyssinian tube well), an extract of the bark of the hemlock tree is substituted for the sumach, the desired result being thus more effectually and economically attained. The following are the details of the methods by which Mr. Norton operates in order to obtain a number of different colours:—

To dye 20lb. weight of cotton a magenta colour, take 3lb. of Miller's extract of hemlock bark as imported from Canada, and boil it with 20 gallons of water, and then lay the cotton in the liquid for a night. In the morning, add 3 pints of red cotton spirits diluted with 20 gallons of warm water, and work afterwards the cotton in this for 50 minutes. Then bring it out and wash twice with cold water, and afterwards with warm water. Then take 20 gallons of fresh water heated to 160deg., and put 2 pints roseine solution into it, and work the cotton in this liquor till the colour is full enough. Wash the cotton and dry it.

To dye a primula colour, proceed as before, only using a solution of Hoffman's violet instead of roseine, and work at the same temperature (160deg.). A bluer tint may be obtained by increasing the heat, or a redder by lessening it.

To dye a lavender colour, take of extract of hemlock bark 1½lb. to 20lb. of cotton, and work the cotton in the extract diluted with 20 gallons of water for half-an-hour. Rinse and wash in cold water, and then in warm. Take of red cotton spirits 1 pint diluted with 20 gallons of warm water, and work the cotton in it for 15 minutes, then wash in two warm waters. Afterwards work the material in a bath consisting of 1 pint of Nicholson's No. 2 blue solution, with one gill of nitric acid at about 100deg. Wash the cotton and dry it.

To dye a green colour, prepare with 4lb. of extract of hemlock bark mixed with 20 gallons of water. Lay the cotton in this for 1½ hour at a boiling heat; then prepare a bath with 20 gallons of cold water and 2¼ pints of double muriate of tin, and work in this half-an-hour. Wring the cotton out and wash off well to kill the strong acid. Afterwards take 20 gallons of water at a temperature of 170deg. or 180deg., and put into it 1 pint or nearly so of iodine green paste diluted with 1 gill of methylated spirits; if a yellow shade is required add a little picric acid. Work the material in this for about 20 minutes, then wash and dry it.

To dye a gold colour, prepare with ½lb. of extract and 1lb. turmeric dissolved in 2 gallons of water. Work at a heat of about 90deg., then cool down and add ½ gill nitric acid. If the colour is not red enough, add a little annatto; if not deep enough, repeat until the shade required is obtained. To dye black, take 4½lb. of extract of hemlock bark and boil it with 20 gallons of water, and then lay the cotton in this liquid for a night. In the morning take it out and put it into a cold lime water bath of 4deg., and work in this for 10 minutes. Wring out and sodden with 15 gallons of old sumach liquor, 1½lb. of copperas, and 2 gallons of urine. Work it in this for 15 minutes, wring out, and again put it into the lime liquor and work in it for 10 minutes, and then wring out. Afterwards scald 6lb. of chipped logwood with 15 gallons of boiling water, and work in this for 20 minutes, and then give the cotton 3 turns in 15 gallons of cold water, in which 1lb. of copperas has been dissolved. Soap it with 1lb. of soap in 20 gallons of warm water, and wash off in cold water, and dry.

To dye brown, proceed as above, only with 4lb. of the extract, and in the morning take the cotton out and work it for 30 minutes in 20 gallons of cold water, to which add 2¼ pints of red cotton spirits. Then wash off in two cold and one warm waters. Then scald 7lb. of chipped logwood with 15 gallons of boiling water, and let it cool a little, and then work the cotton in it for 30 minutes. Take the cotton out and add 1lb. of alum to the bath, and work the cotton again for the shade required. Wash off in cold water, and dry.

By red cotton spirits is meant a compound of about 2 parts of aquafortis to 1 pint spirit of salts, to which block tin is added for the purpose of killing it before using. The quantities directed to be used of the several aniline dyes are applicable to the usual commercial strengths.

TELEGRAPHY IN THE RIVER PLATE.

THE first public telegraph which has been constructed by the Government of Buenos Ayres was opened on May 4. Cards were issued jointly by the President of the Argentine Republic, Don Domingo F. Sarmiento, and the Governor of Buenos Ayres, Don Emilio Castro. Many of the principal native and foreign residents availed themselves of the invitations. Two Morse instruments (by Siemens Brothers), placed in the drawing-room, worked direct with the main line, and from 2 p.m. to 4 p.m. about 100 congratulatory despatches were transmitted. The President made a speech, in which he said, "The time may not be far distant when the telegraph will unite South America to Europe." The telegraph passes westerly from Buenos Ayres for 100 kilometres, on the Government railway, then northerly for 300 kilometres, crossing several large rivers to San Nicolas de los Arroyos and Rosario de Sante Fé, two ports on the Parana, to which the Liverpool line of steamers can pass. The total length of the line is 405 kilometres of double conductors, being the greatest distance made in South America by one administration. The President has recently contracted for the construction of 800 miles of telegraph, commencing at Rosario, to proceed northward. The tariff of the Government telegraph is, for a simple message transmitted under 100 miles, 1s. 8d.; from 100 to 200 miles, 3s. 4d.; and above 200 miles, 5s. The Congress of the nation was opened on May 5, and, by the President's desire, his speech, consisting of 5,020 words in Spanish, was telegraphed to Rosario, and published there the same afternoon.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE thirty-fourth half-yearly meeting of members of the above Society was held at the City Terminus Hotel, on the 3rd inst. It was fairly but not fully attended, and Mr. Joseph Newton, president, occupied the chair. Mr. Welsh (of Messrs. Ravenhill and Salkeld's), and Mr. Hughes (of Messrs. Burton and Waller's), were elected as ordinary associates, and three new committeemen —Messrs. Bullough, Sherburn, and Ferguson— were appointed. Afterwards, the auditors—Mr. Edmonds and Mr. Bullough—submitted their report and balance sheet of the last half-year. From these official statements it appears that the numerical and financial condition of the Institution is rapidly improving. No less than twenty-five new members have been enrolled since the January meeting, whilst the special and working funds have grown considerably in the same period. The Association now numbers 210 members of both classes, honorary and ordinary, its general fund amounts to £481 15s. 11d.; the superannuation fund equals £1,014 17s. 4d.; and the widows and orphan's assistance fund is £15 4s. The grand total of moneys invested or in hand for all purposes is, therefore, £1,511 17s. 2d. After some slight discussion, the report and balance sheet were unanimously accepted, and the auditors received the usual vote of thanks. Subsequently, Mr. Walker, secretary, put forward a proposition for the establishment of a monthly publication, in connection with the Institution, and to be designated the "Journal of the Association of Foremen Engineers." This, it was suggested, should resemble the "Journal of the Society of Arts," and contain reports, either in full or in part, of the proceedings of each association of the kind indicated by its title in the United Kingdom. The Chairman warmly advocated the scheme, and entered into a lengthened explanation of his own views and anticipations in regard to it. Practically and statistically he demonstrated that such a publication must be successful and of great use to the associa-of London, Leeds, and Manchester, and so, no doubt, it would, if his calculations are all based on sound data. The members generally, however, appeared to be less sanguine than the chairman, and Mr. Walker's proposition, after gaining faint support from them, was adjourned for further consideration on a future day.

ON THE STEAM PIPES OF LOCOMOTIVES.

IN a recent impression, we published a letter from a correspondent, who, signing himself "Student," wrote modestly, as a student should. He stated that the locomotives on a certain line were fitted with steam pipes of 2·3in. internal diameter, and very plainly hinting that he considered these pipes too small, he asked our readers whether he was right or wrong in his conclusion. He has received two replies to the same effect, which will be found in another place, and one of these at least deserves some notice at our hands. We allude to the letter written by Mr. Poole, which contains a very grave attack on the professional abilities of the gentleman who designed the engines in question. We happen to know something of these locomotives and of their performances, although we are not acquainted, and for the present do not care to be acquainted with the designer's name. But even did we know nothing more of the engines than "Student" has told us, we should still know enough to satisfy us that Mr. Poole's accusations of incompetency are not justified by the facts. Whether Mr. Poole is or is not an engineer we have no means of knowing, but we do know, from his own letter, that he has had, no practical experience in the designing of locomotives; and no other acquaintance with the fact that the proper area of steam pipes has been decided long since by experiments than the information derived from Professor Rankine's work, which he quotes. As the questions raised possess some interest, and have a rather close connection with the flow of elastic fluids through orifices—a matter treated of in our last impression—we purpose here to say a few words which may tend to enlighten Mr. Poole, and possibly remove the impression which his words might otherwise convey.

Lest we should be mistaken in any way, we shall begin by stating that the steam pipes in question are unquestionably too small; but paradoxical as it may appear, we argue from this fact that the gentleman who designed them knew rather too much than too little about locomotive engines. If Mr. Poole had only known half as much, he would, we fancy, have eliminated certain very uncivil sentences from his letter. As we have before stated, we know nothing of the designer of the engines under consideration; but certain broad facts stand out prominently in "Student's" letter, and one or two of these are so suggestive that our correspondents might well have stopped to ask their meaning before going on to criticize in a very hasty and uncourteous spirit. One of the first points which will strike the thoughtful reader of the entire correspondence is the singular and abnormal diameter of the pipes criticized. Why should a pipe, the diameter of which cannot be stated without the use of a decimal, be used by a man who, according to Mr. Poole, works only by "rule of thumb?" Why not use a 2¼in. or a 2½in. pipe instead of a pipe 2·3in. in diameter, corresponding pretty accurately to a sectional area of 4in.? Obviously, there should be some reason for this. If it be madness, there is at least method in it; and at the risk of astonishing Mr. Poole, we may say that there are very excellent reasons for adopting this dimension of 2·3in. What these reasons are we shall now proceed to show.

The foundation of all knowledge is experience, and experience is especially valuable in dealing with the locomotive. It is very well to lay down certain premises, and, arguing from them, insist that certain dimensions must be right and certain others must be wrong; but it is obvious that if the premises are false the remaining links of the logical chain must be untrue also. Theoretically, a steam pipe 2·3in. diameter is too small, but in practice it

IMPROVED PLOUGH.

BY MR. A. GUTHRIE.

FIG. 1.

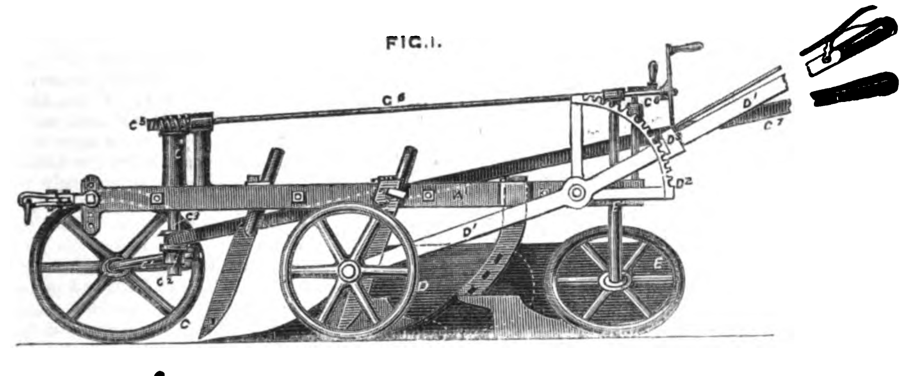
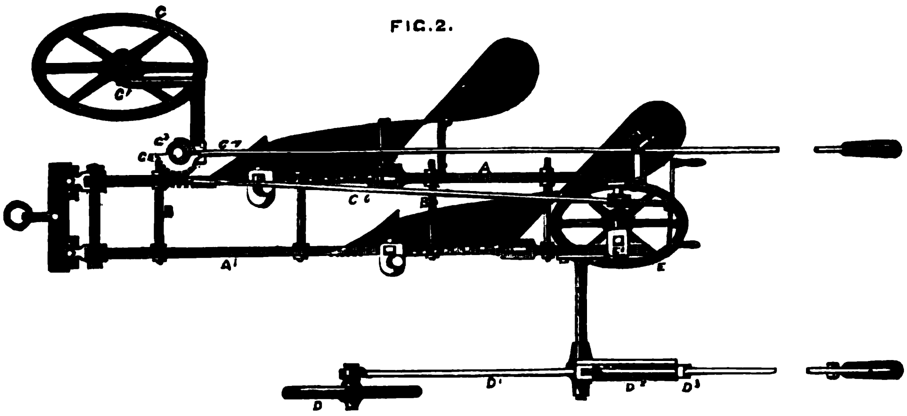


FIG. 2.



has been found that no advantage whatever follows on adopting a larger opening of regulator than one which will give an area of four square inches for a pair of 15in. cylinders, or 1-88th of the aggregate area of the two pistons. The only comprehensive and able paper on the subject with which we are acquainted is to be found in Mr. D. K. Clark's "Railway Machinery," and particulars are there given of numerous experiments carried out on the Caledonian Railway, which conclusively prove that no benefit is derived from increasing the area of regulator opening beyond four square inches. It is naturally to be concluded that as the quantity of steam passed by a pipe is measured by its smallest part, no advantage will be derived from making the steam pipe larger than the regulator. It is evident that the designer of the engines alluded to by "Student" took the results of Mr. Clark's experiments as conclusive, and adopted the 4in. of area stated by Mr. Clark to be as good as any other. We think that Mr. Poole will now begin to see that he has been just a little too hasty in charging a gentleman of whom he knows nothing with gross incompetence. Far from manifesting ignorance on the part of the designer, the engines in question prove that their designer had mastered the results of experiment, and had acted in tolerably close accordance with the rules laid down by one of the best authorities on the subject of locomotive construction.

Having said so much in favour of the engines in question, it is now time to justify the statement contained in a preceding paragraph. We think that 4in. of area is too little for a steam pipe intended to supply a pair of 16½in. cylinders, because it approaches the minimum dimension too closely. It, in a word, runs things too fine. A powerful shunting engine was at one time, and may be still, worked on the Great Northern Railway with a steam pipe only 1in. in diameter. The engine performed satisfactorily; but we do not, therefore, recommend all locomotive engineers to use 1in. steam pipes. The adoption of a 2·3in. steam pipe is the result of a too rigid interpretation of the results of Mr. Clark's experiments; but it is not, as Mr. Poole would have us believe, any evidence of gross incapacity on the part of the adopter.

When our correspondent speaks of "increased coal bills," we begin to doubt the soundness of his own attainments more than ever. The only effect which can follow on the use of too small a steam pipe, is that the pressure in the valve chest will be less than that in the boiler; but it does not ensue as a consequence that the consumption of coal per mile will be materially augmented. The result may, indeed, be the very reverse. Many drivers know by experience that their engines do better, and burn less coal, when they run with the regulator partially closed, than when it is kept full open. Theoretically, this ought not to be the case. The regulator should be full open at all times when the engine is running, the speed being regulated by the position of the links; but, in practice, many engines at all times, and all engines, when working with dirty water, prime continuously, to a greater or less extent, if the regulator is kept full open. When the steam is throttled it finds its way dry and "lively" to the cylinders; when it is wet it moves sluggishly. If the steam is dry, the difference in pressure between the cylinder and boiler may, at thirty miles an hour or so, amount to 16 per cent.; of which loss not more than one-fourth is due to the resistance of the steam pipe and regulator, the remainder being wasted in the ports. If the steam is wet, the loss may rise to as much as 40 per cent. From this it is easy to see that a large regulator opening and a big steam pipe, by inducing priming even in a very moderate degree, may actually entail a loss of pressure which would not be experienced if smaller pipes were used. We need scarcely add that the evil effects of the use of damp steam would not end with a diminished valve-chest pressure; we should have in addition a cool cylinder, a sluggish exhaust, an augmented back pressure, and a heavy consumption of fuel, which means a heavy fire and an increased tendency to priming.

As a general rule, the diameter of a steam pipe cannot be too great, and the area of the regulator should not be less than ten square inches for a pair of 16½in. cylinders. But to this rule there are numerous exceptions. The adoption, for instance, of a 10in. regulator and a 16in. pipe, that is to say, 4½in. diameter, can only be justifiable when the engine has ample steam room, and is worked with clean water. If the engine is a heavy primer, either because the water is dirty, or the design of the boiler bad, then large steam pipes and regulators will do more harm than good, unless they are managed by men who never open the latter fully.—" The Engineer."

APPROPRIATION OF TAXES.

WE last week extracted a few figures from a paper by Mr. Stokes, which showed the war expenditure of various nations and states. We now append, from the same source, a statement showing how the taxes are appropriated in several countries. The revenue of Great Britain is the largest in the known world, yet, with all our wealth, a smaller proportion of it is spent upon the Government itself than in other European States, as the following comparison shows :—

	Per cent.		Per cent.		Per cent.	
In Prussia, they spend	26	on war forces,	17	on debt,	57	on the State.
" Russia "	34	"	12	"	54	"
" Spain "	25	"	18	"	57	"
" Portugal "	26	"	23	"	51	"
" Austria "	29	"	27	"	44	"
" France "	26	"	31	"	43	"
" Great Britain "	43	"	42	"	15	"

From this statement, Mr. Stokes deduces that while those six states spend a large proportion of their national income upon the Government, we spend 85 per cent. of ours on debt and war. There is truly no similar extravagance in the known world. Even China, though but imperfectly civilized, manages the government of 660 millions of mankind with about sixty millions of revenue—that is, about 3s. 4d. per head per annum—but we, with our superior enlightenment, contrive to extract from the pockets of the people no less a sum than £2 5s. per head, for precisely the same work.

GUTHRIE'S IMPROVED PLOUGH.

THE invention illustrated in the annexed engraving relates to improvements in that class of ploughs in which two or more furrows are turned simultaneously, and the whole weight of the implement is supported upon wheels. The improvements have been patented by Mr. Alexander Guthrie, of Craigs, Forfar. The body of the plough consists of a rectangular frame, to which the coulters and mouldboards are fastened in such a manner that they can be readily shifted in position to form any required breadth of furrow. The guiding and landside wheels are attached to this frame by means of adjustable levers, which will admit of the coulters and mouldboards being raised or lowered and guided so as to form two or more furrows simultaneously of uniform breadth and depth. These levers are under the control of the attendant, and can be instantly shifted to suit the varying nature of the soil without the necessity of stopping the horses. The axle of the hind or trailing wheel is attached by a movable bracket to the frame. This bracket is so formed that the trailing wheel can readily be shifted to a greater or less angle, so as to have more power over the mouldboards.

In our engraving, we have shown these improvements as applied to a two-furrow plough, fig. 1 being a side elevation, and fig. 2 a plan of the same. The rectangular frame forming the body of the plough is composed of two beams A A^1 of malleable iron, connected together by transverse screw bolts B B. This frame is carried by three round-rimmed wheels C, D and E. The leading or guiding wheel C has for its axle the extremity of a cranked arm C^1, which is attached to a sliding boss or clutch C^2. This clutch slides upon an upright spindle C^3, which is carried by the fixed bracket C^4 on the beam A. Keyed to the top of this spindle C^3 is a toothed sector C^5, which is actuated by a worm on the shaft C^6. Fitted to the rear end of this shaft, which extends beyond the back of the frame, is a crank or hand wheel which is used for the purpose of guiding or turning the plough and altering or straightening the furrow without stopping the plough. The width of the furrow is regulated by turning the nuts on the transverse screw bolts B B, which connect the two sides of the frame, and thus contracting or increasing the space between the sides. The cranked arm C^1 can also be shifted outwards or inwards, to or from the frame, to suit various widths of furrow.

The guiding or leading wheel C is raised or lowered by means of a forked hand lever C^7, which is adjusted and held securely in its place by a vertical screw C^8 attached by a swivel joint, and turning in a tapped bracket bearing projecting from the frame. By turning this screw C^8 by means of a winch handle keyed thereto, the depth of the off-side furrow will be regulated. The land-side wheel D is carried by a hand lever D^1 pivoted to a projection on the beam A^1, to which projection is also affixed a notched quadrant D^2. This wheel D, when lowered or raised, regulates the depth of the land-side furrow. The lever D^1 is adjusted and held in position by means of a sliding spring catch D^3 which it carries, engaging with the notched quadrant D^2. The hind or trailing wheel E is carried by an inclined spindle attached to the movable bracket E^1. This spindle is acted on by a half-round bead or strip attached to the frame, and forming a fulcrum for the bracket to rock upon. By screwing up either of the clamping bolts of the bracket, the wheel is made to take less or more of an angle to the vertical, so as to give power to the mouldboards to press up the furrow.

The mode of working the plough is as follows: —In cutting the first set of furrows, the leading wheel C will be raised to the same level as the land wheel D, viz., the depth of the furrow above the "sock." The width of the furrows being determined, the coulters and mouldboards are set to correspond thereto by means of the nuts on the transverse screw bolts B. The first set of furrows are now cut, at the end of which the leading wheel C and land wheel D are depressed by means of their respective hand levers, so as to raise the mould-

boards out of the ground. On returning to cut a second set, as the leading wheel will now run in the furrow nearest to those about to be cut, it is lowered to the same level as the trailing wheel, which is the depth of the furrow, the land wheel D being, of course, kept up on the unploughed land to regulate this depth. The advantages of this plough are the simplicity of the several parts, and the diminution of friction in its action, thus allowing, except on very heavy or stony land, of the cutting of the two furrows being done with as much ease as with the ordinary plough making only one furrow. It requires very little attention on the part of the ploughman when once adjusted, the levers only requiring to be raised or depressed a little to suit any inequalities in the land, or when turning at the ends into a new set of furrows.

THE UNITED STATES' SIGNAL SERVICE.

DURING the late war two novel attempts were made to procure and convey military information in the field. One was the enterprise of a shrewd Yankee aeronaut, who undertook to spy out the secrets of the hostile camps along the Chickahominy by soaring over their heads and looking down upon them from the secure elevation of a balloon, which was attached to a cord and reeled in and out at pleasure. The idea secured for its author the rank and pay of a Colonel, but its results were not otherwise particularly brilliant. We "U. S. Army and Navy Journal" do not remember that anything of value was obtained of the enemy; while, on at least one occasion, they were near possessing themselves of the army balloon and an unlucky general officer, whose aerial steed had run away with him, and was in danger of carrying him, either into the enemy's camp, or on an involuntary trip to the mountains of the moon. Another novelty in these days was the Signal Corps, whose flags were seen flying from the tree tops, from the roofs of the buildings used as head-quarters, and from the summits of lofty towers which were extemporized in the woods along the picket lines of the army. Unlike the balloon enterprise, this signal service has stood the test of time, and, after rendering most important service during the war, has secured for itself a place in the permanent organizations of the army and navy. For the establishment of this corps we are indebted to the present Chief Signal Officer of the army, Brevet Brigadier-General A. J. Myer. General Myer is a gentleman of fortune and leisure, who, previous to the breaking out of the war, had devoted himself for years to perfecting a system of signalling. This system he early brought to the attention of the War Department. It was subjected to a thorough trial, which resulted in a favourable report; the system was eventually adopted, its author appointed Signal Officer of the Army of the United States, with the rank of major, and, in 1863, the Signal Corps was organized by an Act of Congress, and Major Myer appointed its chief, with the rank of colonel.

In spite of strong official opposition, Colonel Myer succeeded in maintaining his position and in establishing the Signal Corps on a firm foundation. He has also devoted much of his attention to perfecting his system of signalling. The result of his labours in this direction are before us in a manual of signals for the use of signal officers in the field and for military and naval students, military schools, &c., which has just made its appearance in a new and complete edition. This manual shows the perfection to which the business of transmitting intelligence by signals has finally been brought. Instead of a single code, we have here examples of ten different codes, all capable of easy application, and forming together a complete sign language sufficient for all possible needs of an army. Though a simple apparatus is employed, none is absolutely essential except such as can be readily extemporized. For official messages, a cipher is employed, and a cipher disc is furnished which is mechanical in its action and admits of innumerable changes, each made in a few seconds, and each forming a complete cipher. At the close of the rebellion, the chief signal officer at Richmond admitted that his best men had not been able to detect our cipher, while our officers claimed that they had seen no cipher which they could not read. As the movements of an army extend over sections of country where the usual signals cannot be used, or are not sufficiently rapid, a field telegraph train was organized early in the war, as an essential part of the Signal Corps' equipment. In addition to the instruments, the field trains carried, in ambulances or light waggons, rolls of insulated wire and light lance-poles on which the wire was elevated. This wire was wound on reels containing one or more miles, and could be run out rapidly by hand when the formation of the ground or other circumstances rendered the use of the waggon difficult or impossible. At Fredericksburg it is claimed that the field telegraph was first brought into operation on the field of actual battle, and worked under fire by the Signal Corps with gratifying success.

The flying telegraph was repeatedly and very extensively used on the marches and in the campaigns of the various armies of the United States, each army being furnished with one or more trains. Telegraphic lines were often erected by the corps with a rapidity which was remarkable. Though not nearly complete, and worked with many difficulties, these trains achieved a fair success, and were the models on which have been formed the flying telegraph trains now prepared for the army, and the use of which is taught at the Military Academy. Our signal officers also rendered important service to the navy during the war, and the formal thanks of the navy department were won at Fort Fisher. The plans of signalling are now taught to the midshipmen at Annapolis, and are given in the naval signal books for use throughout the service. In the signal manual, ingenious and simple modes of communicating between vessels, or between the shore and vessels, are given, in which lanterns, bells, rockets, guns, or flags are used. A special code, ingeniously arranged, for application to the message codes now in use, is also given, and the system of chronosemic signals, originated in the navy, fully explained.

A late regulation of the army provides for the issue of signal equipments and glasses to every military post in the United States, and a system of instruction to embrace the whole army, in the manner prescribed in the manual, is contemplated. This includes the application of the principles of signalling to the electric telegraph. The "General Service Code," given for the army and navy, can be used over the electric wires nearly as rapidly as the Morse system, and can be learned in a few days. Two foreign nations, Sweden and Denmark, have sent their representatives here, by permission of our Government, and made themselves acquainted with the practical workings of this signal system, for the purpose of adopting it in their several armies. France has adopted a field telegraph system, and teaches it at the camp of Chalons, and the time is not far distant when every military nation will avail itself of both semic and electric telegraphy.

PREPARING FIBRE FROM BAMBOO OR CANE.

AN improved method of preparing fibre from bamboo or cane for the manufacture of textile fabrics has been patented in England by M. Sautter, of 50, Rue de la Chaussée d'Antin, Paris. M. Sautter first removes the knots or joints and then splits the bamboo longitudinally into strips by means of sharp-edged instruments arranged for the purpose. After this, the lower and tougher portions of the bamboo are separated from the remainder, since the hard and tenacious fibre that grows nearer the ground requires a treatment which for the present purpose would be injurious to the upper and more tender parts. The bamboo is then boiled in caustic alkali of about 60deg. Beaumé, in an open boiler, until the siliceous and gummy matter is softened. This operation requires from six to ten hours, according to the age and quality of the bamboo. In this part of the process the time occupied will depend upon the character of the lignin, the tougher and more tenacious portions requiring the more vigorous treatment. The next stage in the process is to press the bamboo while hot, for the purpose of expelling the water, and so much of the siliceous and resinous matter as may be held in solution or combined with the bamboo; also to prepare it for the subsequent boiling and cleansing process.

The bamboo is then again boiled in a weak solution of caustic soda for about three hours, and afterwards for about two hours in soap and water, which cleanses and softens the fibre without reducing it to a pulpy condition or impairing its strength, which would be the result if longer boiled in caustic alkali. The bamboo is then washed in hot water until all the foreign substances are removed from the fibre, when it is prepared for carding by passing it through a machine hackle. It is next subjected to strong cards which reduce the fibre to a proper condition for spinning. It is necessary that the fibre be in a moist state during the operation of carding, but if water is employed for that purpose, the fibre is weakened and will be destroyed while passing through the cards; the fibre is, therefore, saturated with oleaginous vapours, which renders it pliable and lubricates it without impairing its strength. It can then be carded with facility, and a length of fibre retained of sufficient length and strength to be applicable to and valuable for textile manufactures and purposes.

It is well known that large quantities of what is commonly known as flock is used in the manufacture of woollen goods, and that the article is obtained from the cropping or shearing of cloth or woollen rags, which are first ground and reduced by a suitable machine to a short fibre. Now, it has been ascertained by repeated experiments that flock of superior quality can be prepared from the fibre of cane or bamboo, and at a trifling cost as compared with that produced from any previously known article. The cane or bamboo undergoes the same process as that above described in reference to the preparation of fibre for textile fabrics, and this additional application offers this advantage, that such part of the fibre obtained that does not answer fully the purpose for producing a good yarn may serve for the preparation of flock. In this case, such part of the fibres that has been put aside for making flock, or the whole of the fibres produced if flock only is to be prepared, is placed, after the boiling in caustic alkali has been completed, and, when ready for washing, into a rag engine provided with revolving knives, and so arranged that, while the cleansing process is being performed, the fibre is gradually brought into a suitable condition for the purpose specified. It is next dried and passed through a machine provided with pickers, which open and separate the fibre and prepare it for the principal operation of flocking.

ON THE USE OF SALT APPLIED TO AGRICULTURE.

AS the all-absorbing preoccupation of agriculturists is the discovery of manure, trade and industry have sought in every direction whence they could be obtained. It has been ascertained that the sea, which is known to contain so much wealth in its basin, is also an immense receptacle of manure. Sea wrack and other weeds are extensively employed in the agricultural improvements of many parts of the coasts of Brittany, Normandy, Provence, &c. Sea water has also been used for manure. The use of salt for agricultural purposes has especially attracted the attention of agriculturists, and, in consequence, of governments. The Paris papers, and notably the "Univers," have informed us ("Le Credit International") that the Financial Committee of the Council of State heard a few days ago the report of their chairman, M. de Laveney, on the abolition of the tax on salt used in food for cattle, and in the improvement of land. The Minister of Finance has earnestly accelerated the labours of the commission to which three years ago he entrusted the care of finding out the means of sophisticating in an effective manner the salt applied to agricultural purposes. This was the only objection of M. Magne to the amendments relating to the abolition or reduction of the salt tax. The essential point was to find the means of concilia ting the great interests of agriculture with those of the Treasury, to whom this tax yields an average annual income of from £750,000 to £875,000. Delegates from this commission have been sent to Germany, Russia, and other parts of Europe to study the application of salt to agricultural purposes. The problem appears to be nearest to its solution in Russia. The practical observations of agriculturists in Russia and in several farming districts of Prussia have served the commission of the Ministry of Finance as rules to help them in their experiments. They have obtained—not, however, without laborious study, and after a series of unceasing efforts—a result which will allow the realization of the innovation sought for simultaneously by farmers, by graziers, and by saline districts. The process of sophistication does not deprive salt of its tonic and vivifying properties, and fraud becomes therefore very difficult, if not impossible. It would entail so much trouble, so much expense, that none would venture to run the risk of prosecution for so small a profit. The inquiry of the Council of State will only have reference to the economical and administrative statutes. The enactment intended to remove the present *statu quo* will be the object of a special decree.

ARCHITECTURAL ENGINEERING.

THE following article upon the above subject, which we find in the "Scientific American," contains a fund of common sense well worth pondering upon. Our able contemporary observes that the sister arts of engineering and architecture are commonly considered as being distinct, and in one sense they are distinct; but there is a class of building which, while it gives scope to all skill in design which the finished architect possesses, also involves considerable knowledge of civil and mechanical engineering. We allude to the designing of buildings and works for manufacturing purposes. In many kinds of manufacturing, long established and systematized, there exists a regular method of building so far as interior arrangement is concerned, never modified except in unimportant details. The exteriors of such buildings vary greatly in the degree of beauty and appropriateness of their designs; but a large number are totally destitute of either, being simply stiff and ungraceful masses of masonry, which if not without form, are certainly destitute of comeliness. Others would be good designs were it not for their inappropriateness.

But it is not of exterior designs that we are about to speak. There is a field in which the highest success can only be reached by uniting the special requisites of skill in mechanical and civil engineering with the skill of the architect. In many industrial establishments strict adherence to one type of building is neither requisite or desirable. Circumstances connected with the location, the materials available for the erection of buildings, the character of the site, and other particulars not necessary to be enumerated, must, in some cases, and may, in any case, render more or less change necessary. As an illustration of this fact, we have in mind a case where a large industrial building, requiring very heavy walls to support the machinery, was erected on the side of a clay hill. The work was about two-thirds completed when it was found that the building and its foundations were gradually but surely sliding down hill. Of course, nothing was left but to tear down, and either begin over again upon a better foundation, or change the site of the building. Here was a grave error committed by an architect, of no mean reputation, simply by not taking into proper account the effect likely to be produced upon the clay basis by such a great weight as was necessary.

Our readers will doubtless recall some instances of terrible disasters arising from want of proper strength in manufacturing buildings, of which the fall of the Pemberton Mill, at Lawrence, Mass., was a most notable and lamentable example. We have, in our observations of different industrial works, often wondered that more such disasters did not befall, rather than so few. It is common to meet with errors in building arising from obvious ignorance of the practical working of machines, and their effects upon buildings in which they are placed, together with a total disregard of the effect likely to be produced by rhythmic movements and their attendant vibrations. We have seen power printing presses placed in positions, on top floors, where the ultimate destruction of a building, by their effects, would only be a work of time; and drop presses placed upon foundations so weak that they could not, by any possibility, be expected, by an expert, to remain *in situ* more than a week at the outside.

We believe that there is now, and has been for some time, a requirement for a special profession of architectural engineering. Because a man can build handsome churches, design a splendid front for a bank building, or erect an elegant villa, it does not follow that he is competent to build or superintend the building of a grist mill, or even a saw mill. To properly design and complete works of the latter character requires a knowledge of the machinery to be used, the nature of the work they are designed to perform, the points of the structure likely to be subjected to strain, and knowledge of the resources whereby such points may be adequately strengthened. We are aware that there are some architects who have devoted themselves to this speciality, and have acquired skill in it, but they are too few to meet the requirements of the public, and, consequently, much of the work, which only such experts can properly perform, goes into the hands of men who, however skilful in other departments, are certainly incompetent to win enviable fame in this.

Legal Intelligence.

THE EDMUNDS CASE.

THE Court of Arbitration, consisting of Mr. Manisty, Q.C., umpire; the Hon. G. Denman, Q.C., and Mr. C. Pollock, Q.C., arbitrators, appointed to inquire into all matters in dispute between Mr. Edmunds and the Crown, met at the Court of Common Pleas, Westminster Hall. Mr. Digby Seymour, Q.C., Mr. Napier Higgins, and Mr. Haviland Burke, appeared for Mr. Edmunds; and the Attorney-General, Mr. Field, Q.C., and Mr. Archibald for the Crown.

Mr. Denman briefly explained that he and Mr. Pollock, acting under an order of the Court of Common Pleas, had chosen Mr. Manisty as umpire in this case, and they had agreed to act as arbitrators in this case, and that they had thought it desirable they should sit together. They had no feeling in the matter either for the one side or the other, and sat therefore as unbiassed arbitrators between Mr. Edwards and the Crown. He (Mr. Denman) knew nothing whatever of the case beyond what had been publicly rumoured. It would, no doubt, occupy some considerable time in investigating, and, looking at its importance, he thought it very desirable that the Court should sit *de die in diem*. He and Mr. Pollock had consulted together upon this question, and they had come to the conclusion that, if agreeable to all parties, Thursday, October 21, would be a suitable day for opening the case, and then to go on *de die in diem*.

The Attorney-General quite agreed to the course proposed. He would, however, venture to suggest that, as the Crown would have to establish the case, the accounts of Mr. Edmunds should first of all be investigated.

After some discussion, it was agreed that the Court should meet again on Thursday, October 21, in the Court of Common Pleas, Westminster.

Correspondence.

THE INFERIORITY OF OUR COFFEE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—My attention has been drawn to an article in a leading daily paper expatiating on the great nferiority of coffee used by us as a beverage, cwhen compared with its excellence in some other ountries, and the writer fortifies his remarks by bserving that "a cup of good coffee is as rare, in England, as a blue diamond." Without going into the entire analysis, untold adulterations and general treatment of coffee in these islands—which might be too long for insertion—a few remarks on its proper and improper torrefaction must not be regarded as offering any extenuation of, or in any degree accounting for, the very inferior article supplied us in the ground state under the name of coffee, but to inform those who may be desirous of preparing their own; and to induce scientific men to direct their attention to this most important subject.

That, to all that have visited the Continent, a cup of good coffee is as rare in England as a blue diamond is an incontrovertible fact, for, although the finest coffee the world produces is brought here, we English, if even we procure the choicest quality and grind our own, have but a vague conception of what a cup of good coffee really is; hence, it is evident, some "radical defect" must, as has been stated, underlie our mode of preparing the berry. Considering the vast importance of this article, socially and commercially, and the great strides science has recently made, it appears incredible the cause of this defect has never been thoroughly investigated, and an improvement in its preparation suggested by one or other of our great analytical chemists. At the first blush, it would appear to be a grave reflection on our wives, cooks, and housekeepers, but a very little scientific elucidation will dispel any such idea.

The coffee berry is roasted in this country not only in comparatively close iron cylinders, but also in large quantities at a time, by which means the grosser elements, instead of being evolved and evaporated, become condensed; and from the chemical action of the chlorogenate of potassa upon the cellulose or woody fibre, the generation of a new and most acrid bitter substance, called tannin, is formed (never to be found in its natural state) which completely deprives coffee of its true flavour. The method adopted by the natives of Ceylon, who only take the quantity of berries required for present use, and roast them in an earthern pot, though simple, is the only compatible and philosophical process; for by preparing coffee in small quantities, in open vessels, all the mineral and azotized substances are freely evaporated, and the formation of tannin entirely prevented, whereby the caffeine is retained in its pristine purity.

Now, caffeine being to coffee what theine is to tea—the primary principle—its complete preservation should be our chief aim; consequently, the infinite superiority resulting from this primitive mode of treating the berry in Ceylon and other oriental countries where labour is cheap, at once explains our radical defect, and reveals the true secret of its more exhilirating properties and full aromatic flavour. From the foregoing deductions, it is but too manifest that until the hand of science devise some means of preparing the berry in perfect accordance with its constituents, and in quantities commensurate to the requirements of a commercial community, coffee as it ought to be, must ever remain with the multitude, "as rare as a blue diamond!"—I am, Sir, yours, &c.,

London, July 6. G. MARK.

THE CHANNEL TUNNEL.

SIR,—Referring to the application recently made by a deputation of the promoters of the Channel Tunnel, who waited upon Mr. Bright to request a Government guarantee on £2,000,000 sterling, for the purpose of making experiments to test the practicability of boring a submarine tunnel under the Straits of Dover, and noticed in your last issue, I beg to draw your attention to a statement which appeared in the "Moniteur" of the 30th ult., a translation of which I enclose, containing some facts, in connexion with that undertaking, which I think may be of interest to your readers.—I am, Sir, yours, &c.,

HENRY STEAD, Sec.

18, Old Broad-street, E.C., July 7.

[TRANSLATION.]

Several English papers have announced that Mr. Bright, the English President of the Board of Trade, has received a deputation of the promoters of a proposed submarine tunnel under the Pas de Calais (Straits of Dover), who stated to him that the official commission of engineers appointed by the French Government had reported favourably on the scheme, in consequence of which the promoters ask the two Governments to guarantee them 2½ per cent. upon the 50,000,000f. (£2,000,000 sterling), which the preliminary experiments connected with this project are expected to cost. The commission declared, in effect, that the construction of a tunnel would not be impossible, without offering any opinion as to the outlay of time and money involved, and supposing there were no percolation of water. The promoters have made use of this declaration to ask for a guarantee of interest; but, in its later meetings, the commission completely rejected this demand, and it is difficult to imagine that the Government would be disposed to authorize an outlay of 50,000,000f., which would be 25,000,000 (£1,000,000 sterling) for France, to make experiments on this project, which, even if it could be carried out, would be open to great objections. This scheme, besides, is no other than that of M. Thomé de Gamond, which was rejected twelve years ago because the commission declared, before offering an opinion, that it would be necessary to expend 500,000f. (£20,000), in preliminary experiments. It is clear, then, that an outlay a hundred times larger, for the same purpose, would not be authorized unless success were absolutely secured.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. S. H.—R. T.—L. O. A.—C. J.—R. M. and Sons—J. W. and Co.—H. S.—R. P.—W. S.—S. and A. —C. and S.—R. H.—P. T.—G. C.—W. L.—E. H. F.—G. and B.—J. N.—G. W. H.—R. E.—C. B.—C. C. H.—S. M.—L. and P. S.—R. J.—C. C.—R. and C.—G. M.—G. E. P.—W. H.—J. S.—J. N.—S. M.—R. and Co.—H. V.—G. D.—T. H. G.—F. L.—B. W. G.—R. M.—E. R. and F. T.—E. B. —T. C.—H. D. P.—H. S.—G. W.

Meeting for the Week.

WED.—Aeronautical Society of Great Britain.—Reading and Discussion of Papers, at 8 p.m.

Naval, Military, and Gunnery Items.

THE field telegraph waggons have arrived at Aldershot from Chatham, and will henceforth be worked in concert with the troops, under the direction of Captain Stodhart, Royal Engineers.

THE Viceroy of Egypt is said to have the intention of creating a foreign legion to be recruited in Europe, but principally in France. This corps will be in garrison at Suez and Ismail, and its special mission will be to guard the canal and the isthmus.

A TEN-INCH columbiad gun has been placed on the spot where Generals Grant and Pemberton arranged the terms for the surrender of Vicksburg, an inscription denoting the fact being engraved upon it. The marble monument which was originally erected there had been hacked and marred by vandal relic seekers.

WE understand that the Admiralty have determined upon continuing the command of the "Island of Ascension" and Her Majesty's ship "Flora" under the pennant of a commander, and not of a captain, as heretofore. Under these altered conditions, Captain Arthur Wilmhurst will retire for the present upon half-pay, and the appointment given to an officer of the junior rank.

Colour Serjeant Montgomery, of the 30th Middlesex (Ealing), was trying a new breech-loading small-bore on Wednesday week, and incautiously placed his hand over the muzzle of the rifle, when a discharge unexpectedly took place, and the contents passed through his hand, damaging it fearfully. He was the winner of the £100 Wimbledon Cup last year, but it is feared may not again be able to use his rifle.

The soldiers' monument at Westborough, Mass., was dedicated June 17. The monument is a granite shaft 28ft. high, hand somely sculptured, and bearing on its sides the names of the soldiers of the town who fell during the war; also the motto—"Pro Patria mortui sunt." The soldiers' monument to be erected at Plymouth, Mass., will be placed in position at an early day, and will be dedicated about August 1.

The "Donegal," screw line-of-battle ship, which has been serving as coastguard and reserve ship at Rockferry, Birkenhead, was put out of commission yesterday week at Portsmouth, and her officers and crew turned over to the "Resistance," 4½-inch plated iron frigate, 3,700 tons, 600-horse power, 18 guns, and another ironclad—albeit a thin-skinned one—was thus added to the number of vessels forming the Coastguard and Reserve Fleet on duty in home ports.

The Board of Trade has awarded a gold watch and chain to Captain Stefano Trifliette, of the Italian barque "Anita Tagliavia," for his humane services to the crew and passengers, 98 souls in all, of the British ship "Omar Pasha," whom he received on board his vessel on the occasion of their own vessel being burnt at sea on the 22nd of April last. They have also awarded a gold watch and chain to Captain R. Niemeyer, of the "Hamburgh barque Pyrmont," in recognition of his humane services to the passengers and members of the crew (31 in all) of the late ship "Blue Jacket," of Liverpool, whom he picked up at sea on March 16, 1869, on the occasion of their vessel being burnt in lat. 50 26 S, long. 47 W.

The following telegram respecting the Bermuda Dock was received at the Admiralty on Wednesday afternoon from the commander of her Majesty's ship "Helicon," at Lisbon:—"Helicon" arrived at Lisbon, July 6, at 6 p.m., and sails for Devonport with dispatches at 8 p.m. Captain Boys, of her Majesty's ship "Warrior," off the island of Porto Santo, July 4, sends the following communication:—Bermuda dock arrived at Porto Santo at 2 p.m. on 4th inst. Light breezes and calm all the passage. Proceeded this evening (4th) on voyage to Bermuda. No difficulty whatever experienced.

The successful candidates who passed the examination for commissions in the Royal Marines in November last were informed on January 15 that their names were placed on a list in the order in which they passed, and that commissions would be offered to them, provided they have not attained the age of 20 when the vacancies for commissions occur. Every week officers are placed either on the full-pay or half-pay list, but no communication has been made to the disappointed candidates, who feel that faith has been broken with them after fulfilling the required conditions and passing a very severe examination.

Admiral of the Fleet, Sir William Bowles K.C.B., died last week. The deceased officer entered the navy very shortly after Nelson, whose career terminated nearly 65 years ago. Sir William was not fortunate enough to have figured prominently in any great naval engagement, but it is generally admitted that he possessed great administrative talents. He was promoted to the rank of captain in 1807, and held office under successive Boards of Admiralty at Whitehall, and at the Custom House as Controller of the Coastguard. He was also repeatedly employed afloat. His last appointment was as Commander-in-Chief at Portsmouth. Sir William Bowles was an ardent supporter of the Royal Naval School at New Cross, and only a few weeks since attended a meeting of the corporation and made an interesting speech on the various points at issue.

Miscellanea.

At a general assembly of the members of the Royal Academy, held on the 30th ult., at Trafalgar-square, Mr. E. M. Barry was elected a Royal Academician.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending July 3, was 4,948. Total number since the opening of the Museum, free daily (May 12, 1858), 1,597,782.

Three sheep were found buried in a snow drift last week in one of the recesses of the mountain High Street, in Westmorland. They were recovered alive. Snow was still lying in some of the shaded parts of Skiddaw last week.

A dispatch from Nimes reports an explosion by firedamp on Tuesday week, at the coal mines of Bessegos, by which eight persons were killed and thirteen others dangerously injured.

Some Californian gold bars which recently arrived at Southampton by the steamers "Donau" and "Bremen," came to New York by the Pacific Railroad. They were delivered in London within 20 days from the time of their dispatch from San Francisco.

The number of Cornish pumping engines reported for May is 18. They have consumed 1,377 tons of coal, and lifted 10·2 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 50,100,000lb., lifted 1ft. high, by the consumption of 112lb. of coal,

The most rapid redistribution of races ever witnessed seems likely to occur during the present generation in the influx of Eastern people to the Western States of America on the Pacific. During the year 1866 the arrivals in California from China and Japan were 2,300, in 1867 they were 3,300, and in 1868 they were more than 10,000, while this year they are expected to exceed any previous total.

The little English sparrows, which have been introduced in the vicinity this season, have already done a marvellous work of cleansing, says the "New York Times." In the upper parts of the city, in Jersey City, in Hoboken, and especially in Brooklyn, which hitherto has been the very paradise and elysian fields of worms, the pest of former years is hardly noticeable.

A quantity of native tobacco, grown in Metcalfe, has been brought into Jamaica in an unmanufactured state. It has been pronounced by good judges worth 1s. per lb., though inferior to some specimens of native growth already brought to this market. This tobacco growing and curing business is worthy of encouragement, for we see no reason why, under proper management, Jamaica cannot be made to produce as good an article of tobacco as any obtained from Cuba.

An unfounded report has been in circulation to the effect that the British residents in Paris had subscribed £6,000 in aid of the ex-Railway King. The object his friends have in view is to realize a fund of £4,000, which will purchase for him an annuity of £500 per annum for life. The necessary amount has not yet been obtained, but it is to be hoped that many additional contributions will be placed on the list.

A special committee has been formed at Amsterdam for the reception of workmen coming to visit the Exhibition of Domestic Economy in that city. Lodgings have been provided at the rate of 60 Dutch cents for bedrooms of a better kind, and 40 for the second, for the special benefit of Belgian artizans and workmen provided with certificates of good character, signed and delivered by the Brussels committee.

In Great Britain the quantity of coal-dust remaining unemployed is calculated at 28,000,000 tons. Various methods have been attempted to convert it into useful fuel by compressing it into cakes, but the operation is not sufficiently remunerative. In Belgium they follow another plan, which seems to answer better. They mix coal-dust with 8 per cent. of tar, and then press it into cakes, which are found to make excellent fuel for steam engines.

Three new streets are ordered to be pierced in that quarter of Paris known as Les Ternes, beyond the Arc de Triomphe at the end of the Champs Elysees; these streets are to be named after Lebon, Torricelli, and Faraday. There are already several streets in Paris bearing the names of distinguished foreigners, and the fact deserves to be recorded as an instance of international recognition and courtesy worthy of imitation.

A pleasant relief to the dull appearance of the river frontage of the New Palace of Westminster has just been effected by placing 50 large hansome boxes of evergreens on the terrace. These evergreens have been brought from the Royal gardens at Kew, and have been placed where they now stand under the direction of Mr. Smith, the head gardener. If this experiment is successful, next spring a considerable addition will be made.

Lloyd's agent at Buenos Ayres reports the following accident on May 24 at the fete given in commemoration of the anniversary of the declaration of freedom:—An aeronaut, named M. Baraille made an ascent in a balloon from the centre of the Plazza. It remained stationary over the city for some time, there being no wind, and on descending fell into the harbour. A number of boats and a small steamer named the "Cavour" put off to the rescue of the aeronaut, who was drowning in his car. By some misfortune the balloon in rolling about came in contact with the funnel of the steamer, and, the gas getting ignited, exploded with terrible force, blowing the crew overboard, as also those in the boats. The steamer was set on fire, and sustained much damage. The Buenos Ayres papers state that eight persons were fatally injured and 25 were much burnt and injured.

The following is a return of the quantity of coal exported from Grimsby, in June, 1869:—To Belgium, 762 tons; Denmark, 4,090; Egypt, 1,494; France, 5,513; Hanseatic Towns, 899; Holland, 499; Norway, 223; Prussia, 839; Russia, 8,488; Sweden, 978; Spain, 241; and Turkey, 253; total, 24,284 tons; coastwise, 2,246 tons—26,530 tons; corresponding period of 1868, 24,802 tons; ditto, coastwise, 3,102 tons—27,904 tons, decrease, 1,374 tons.

At a meeting of the Royal Horticultural Society, held on Tuesday, Mr. W. Wilson Saunders, F.R.S., in the chair, the following candidates were elected Fellows of the Society, viz., Captain Cotton, Messrs. Samuel Dobson, Thomas Hoblyn, and Edward Horne, Dowager Countess of Shannon, Major-General Henry Blois Turner, &c. This was by far the most interesting meeting of the season, the Council-room abounding in rich and beautiful flowers.

The number of visitors to the South Kensington Museum during the week ending July 3, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 21,906; Meyrick and other galleries, 7,489; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 6,608; Meyrick and other galleries, 243; total, 36,246. Average of corresponding week in former years, 12,030. Total from opening of Museum, 8,596,076.

M. Fontana, architect to the Czar's Ministry of the Household, is charged to construct, on the model of the London Crystal Palace, the building for the exhibition which is to take place at St. Petersburgh next year. A sum of £27,000 is allowed for this structure; the number of workmen employed is at present 400, but will be speedily augmented, for the building must be completed externally by September 1 next, and entirely by May 1, 1870.

The dross accumulated in iron works, to the amount of millions of tons, is known to contain from 25 to 50 per cent. of iron, but the difficulty of extracting is very great, the metal being intimately combined with various silicates and other substances which are not easily separated by fusion. Lime, indeed, will decompose these silicates, but the iron thus obtained is brittle. Nevertheless, M. Fleury has recently made a successful attempt to obviate this drawback by slaking the lime used for the purpose in water containing a certain proportion of some alkaline chloride.

Some years ago, the Emperor of the French was astonished at the great space occupied by flour when packed in sacks in the usual manner, and imagined that it might be compressed into a much smaller bulk, and be thus rendered of easier transport. He at once authorized some experiments to be made on the subject, which resulted in the flour being submitted to powerful hydraulic pressure, and served to the various regiments in tin cases, not only occupying a very small bulk, but protecting the flour from the damp of the atmosphere, and so preventing it from becoming mouldy.

Dr. Carriere, of St. Jean du Gard, in reply to the offer of the Marquis d'Orches, of a premium of 20,000 francs, for a practical method of determining death, furnished the following, which he says he has practised for forty years:—Place the hand with the fingers closely pressed one against the other, close to a lighted lamp or candle; if alive, the tissues will be observed to be of a transparent, of a rosy hue, and the capillary circulation of life in full play; if, on the contrary, the hand of a dead person be placed in the same relation to light, none of the phenomena are observed—we see but a hand as of marble, without circulation, without life.

The produce of the numerous slate quarries of North Wales is estimated at the present time to be not far from 350,000 tons annually, representing in money value about £865,000, or an average of early £2 10s. per ton. The produce is made up, as follows:—Festiniog and surrounding veins, 98,000 tons; Penrhyn and surrounding veins, 109,000 tons; Llanberis veins 75,000 tons; Nantille veins, 40,000 tons; Corris veins 20,000 tons; making a total of 342.000 tons. The number of hands employed, including shippers, men on new works, and all about the quarries or dependent on quarrying, is estimated at 9,400. Of this total the Festiniog veins employ 2,900, Penrhyn 2,500, Llanberis 2,000, Nantille 1,300, and Corris 700.

Last Thursday evening the Society of Arts gave a conversazione at the Kensington Museum. The grounds presented a picturesque appearance, being illuminated with variegated lanterns, and lamps were tastefully disposed in the flower beds. Between four and five thousand responded to the invitation, and some time before the opening of the galleries a long line of carriages were waiting to set down their occupants. Refreshments were served in several rooms during the evening. The band of the Grenadier Guards, under the direction of Mr. Dan Godfrey, and the band of the Chatham Division of Royal Marines, under Mr. Kappey's conductorship, were in attendance, and performed a choice selection of music in the interior and exterior of the building.

A NOBLE addition has been made to the entrance hall of the British Museum, in the shape of a vase of great beauty and fine proportions, which was discovered in the course of excavations made just 100 years ago, in the villa of Hadrian, at Palestrina. It about 10ft. in height, including its base, and probably dates from the early part of the second century of our era. The vase in the last century appears to have belonged to a certain Mr. John Boyd, probably a Scotchman, though resident in England; but it was purchased only a few years since by the trustees of the Museum from a gentleman named Hugh Johnson, and until recently, it was lying, in a sadly mutilated state, among the Halicarnassian and other marbles, under the unsightly sheds which still disfigure the façade of the Museum. It has been carefully restored under the superintendence of the Keeper of the Greek and Roman Antiquities, the broken parts being rejoined with copper fastenings.

THE annual conversazione of the Royal Institute of British Architects, held on Thursday evening week, was numerously attended by members of the architectural profession, and by artists and scientific men. The rooms of the society in Conduit-street were expressly decorated for the occasion, and filled with choice works of art (many of which were lent by the President, Mr. W. Tite, M.P.), including some beautiful specimens of majolica, Salviati's mural mosaics, Venetian glass, and other specimens of art manufacture lately reintroduced in this country. Among the paintings on the walls were some by Messrs. E. W. Cooke, R.A., S. Hodges, Marks, Holiday, Donaldson, the late C. Stanfield, and David Roberts. An interesting collection of original sketches by E. Goodall and H. W. Brewer, and two busts (one of the Earl of Derby, and the other of the President of the Institute), by Mr. Theed, attracted much attention. The band of the Coldstream Guards attended and performed during the evening under the direction of Mr. F. Godfrey.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3832
BUILDINGS AND BUILDING MATERIALS—3833, 3839, 3845
CHEMISTRY AND PHOTOGRAPHY—3843
CULTIVATION OF THE SOIL, including agricultural implements and machines.—3830
ELECTRICAL APPARATUS—None.
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3803, 3808, 3813, 3820, 3834, 3855, 3861, 3864, 3866
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3846, 3852
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—3802, 3805, 3809, 3810, 3814, 3821, 3837, 3838, 3840, 3854, 3858
GENERAL MACHINERY—3801, 3804, 3806, 3817, 3824, 3836, 3844, 3847, 3853, 3869
LIGHTING, HEATING, AND VENTILATING—3812, 3818, 3826, 3829, 3843, 3865, 3868
METALS, including apparatus for their manufacture—3822, 3828, 3842
MISCELLANEOUS—3807, 3811, 3816, 3819, 3826, 3827, 3831, 3833, 3835, 3849, 3850, 3867, 3870
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3813, 3825, 3841, 3863
SHIPS AND BOATS, including their fittings—3851, 3856
STEAM ENGINES—3815, 3848, 3857
WARFARE—3859

3801 A. WATT, Gracechurch-street. *Rollers.* Dated December 15, 1868.

The inventor constructs the rollers, cylinders, or metallic surfaces of zinc, type metal, or any suitable compound of mixed metals, turning or facing them to a smooth surface in a lathe or other suitable machine. The surfaces, whether cylindrical or otherwise, thus smoothed are thoroughly cleansed by immersion in a bath, formed, by preference, of a solution of cyanide of potassium, and afterwards completely coated with copper by immersion in a bath formed by a solution of cyanide of potassium mixed with a solution of cyanide of copper, or cyanide of potassium, mixed with a solution of nitrate of copper, or cyanide of potassium mixed with a solution of sulphate of copper. He then subjects them to the process known as electro-coppering by the battery until a coating of copper of sufficient thickness to allow for the said surfaces to be turned, filed, or polished to a smooth and even face.—Patent abandoned.

3802 J. H. BROWN, Romsey. *Helmets, hats, &c.* Dated December 15, 1868.

The inventor uses the cuttings, fleshings, and shavings obtained during the manufacture of leather from the skins of the calf, sheep, buck, doe, goat, and kid. These cuttings, fleshings, and shavings having been first thoroughly picked over to free them from dirt and other impurities, and from any pieces of what is termed the grain side of the skin, are well washed in a weak solution of soda or other suitable lixivium, and having been mixed together in proportions which are regulated as required, and with reference to the desired application, are next reduced to a filamentous fibrous pulp by suitable machinery (that used for the production of paper pulp being preferred), warm or cold water, according to the temperature of the weather, being used therewith. When the pulp has been reduced to about the consistency of that used in the manufacture of strong writing paper, it is passed through a machine called a "knotter," or through a sieve or other suitable contrivance, to free it from all knots and unreduced particles. During the latter process, to every 100lb. of the materials above mentioned, 1½lb. of sulphuric acid, diluted in two gallons of water, is added, and, when well incorporated, 5lb. of dry animal size reduced to a fluid in two gallons of warm water, and 5lb. of alum dissolved in two gallons of water are added. When these ingredients are well mingled with the pulp, the whole mass is then in a fit condition for the production of the required articles. —Patent abandoned.

3803 C. MATHER, Salford. *Cleaning cotton.* (A communication). Dated December 15, 1868.

This consists in the application of a stationary plate or bar between the ordinary fine-toothed cylinder and the revolving fluted guard. The edge of this plate or bar is sharp, or nearly sharp, and the seeds or other impurities are held against the stationary plate or bar, while the revolving fluted guard strikes them off the fine-toothed cylinder. When the seeds or other impurities are free from fibres they drop out of the machine, and the fibres are removed from the fine-toothed cylinder by a revolving brush in the usual manner.—Patent abandoned.

3804 H. A. BONNEVILLE, Sackville-street. *Motive power.* (A communication). Dated December 15, 1868.

This consists, first, in the suppression of the ordinary distributing valves of apparatus for obtaining motive power, and in replacing them by pistons. Second, in a mode of distributing and heating the air. Third, in the introduction of and mode of introducing air by the upper part of the furnace. Fourth, in a manner of mending with fuel the furnace. Fifth, in a combination of parts which allows of the said apparatus being regulated automatically, and of increasing or diminishing at will the combustion in order to obtain this regulation. Sixth, in a peculiar arrangement of the furnace.—Patent completed.

3805 H. WILLIAMSON, Denton. *Hats.* Dated December 15, 1868.

This consists in dispensing with stitching the silk, cotton, or other lining together before placing it in the crown of hats, and forming the lining of such hats with any suitable fabric by coating one surface of such fabric with any substance which would become soft and adhesive, and yet not be injured by means of heat applied to it, so that such fabric map be cut into pieces to suit the shape of the crown, and be caused to adhere to the inside of the crown by means of heat and pressure applied by the ordinary india-rubber bag used in the hydraulic machine for pressing hats, thus lining such hats to the exact shape of the crown without any stitching being required.—Patent completed.

3806 G. BAUMANN, Wurtemburg. *Valves.* Dated December 15, 1868.

This consists in the addition of another slide valve to the two slide valves now generally in use. The valve of the engine is actuated by connecting it to a special piston working in a special cylinder. The admission of pressure to and the exhaust of the latter is governed by the combined effects of a second and third slide valve, the second slide valve being the piston itself, and the third slide valve being actuated by a special piston working in a special cylinder having pressure and exhaust in common with the cylinder of the engine through ordinary steam ways.—Patent completed.

3807 R. S. GARDEN, Piccadilly. *Cartridge pouch.* Dated December 15, 1868.

This consists in adapting and fitting loosely in the interior of a cartridge pouch or box two rows of cells or receptacles for the cartridges, capable of being readily moved in and out of the pouch or box, and made of metal or other suitable material, one row being over the other, and is so attached to the other at each end by a connecting piece or pieces of metal or other suitable material, that when the cartridges in the top row have been used the lower row of cells or receptacles filled with cartridges can be readily moved up into its place.—Patent abandoned.

3808 W. BYWATER, Holbeck. *Manufacture of felt.* Dated December 15, 1868.

This consists in the application of two instead of one eccentric shaft, as heretofore used, both shafts working uniformly together, so as to produce like endway motions to these rollers, by which a more uniform or even felting will be obtained with less wear and tear to the machinery employed. It relates, second, to a method of syphoning out the water of condensation from the steam heated rollers in such hardening machines. For this purpose, the inventor introduces at one end of the copper, steam heated rollers a hollow tube open on one side, into which opening he inserts a thin plate of copper the length of the tube, for the purpose of dividing it into two channels, so as to operate whichever way the roller revolves; the plate being fastened to the inside of the periphery of the steam heated roller, conducts out the water therefrom through a tube in the axle of such roller so soon as motion is given thereto.—Patent completed.

3809 J. W. CHILCOT, Portsea. *Stays.* Dated December 15 1868.

This consists in the employment of metal eyelets inserted in the seams or bones, or in both, whereby the seams and bones are materially strengthened, and the stitches are prevented from breaking away.—Patent abandoned.

3810 C. A. B. POCOCK, Durham. *Bedsteads.* Dated December 15, 1868.

The frame of the bedstead is formed of tubes, by which means great strength is obtained together with lightness. Across the frame is stretched a piece of canvas, or like material, which is laced to the sides of the frame, the lacings being passed around the tubes, and by reason of the tubes being round, or it may be oval, in section, the lacings will not chafe or cut through. To the side tubes of the tubular frame suitable legs are attached by means of bolts or rivets, upon which the legs can turn, so that when the bedstead is out of use the legs may be turned down to lie in the same plane as the oblong tubular frame. The legs are made to fold up inside the frame and towards the ends; when the bedstead is required for use the legs are turned out from the frame. When they have been turned through somewhat more than a quarter circle, a pin or stop projecting out from each leg comes against the under side of the tubes which forms the sides of the frame, and the legs are thus stopped from turning further. A head rail may be similarly jointed to one end of the frame, so that it may either be caused to lie in a plane parallel with the frame, or to stand up from it nearly at right angles, it being for this purpose turned round through somewhat more than a quarter circle.—Patent abandoned.

3811 C. E. BROOMAN, Fleet-street. *Diving.* (A communication). Dated December 15, 1868.

The chief object of this invention is to enable persons engaged under water in any form of subaqueous machine or apparatus, to hold conversation with persons above water. The inventor places a plate or partition of metal or other material across or at either end of a speaking tube, one end of which communicates with the person above water, and the other end with the person below water, or the plate or partition may be a fixture to the subaqueous machine or apparatus, or form part of it, or be fixed to or form part of an apparatus above water. The object of such plate or partition is to prevent the compressed air in the subaqueous machine from escaping, and at the same time allow the sound to pass with only a slight diminution in its force.—Patent completed.

3812 M. LOCKHART, Douglas. *Ventilating.* Dated December 15, 1868.

This consists in leading a pipe down the chimney; this pipe is turned up at its lower end, where it terminates in a box or series of tubes, or holes are formed in a corrugated plate or otherwise, each box, tubes, or plate, being situated above the stove, or elsewhere, at the chimney bottom. The top of the pipe extends a little above the chimney, and carries a horizontal cup fitted with a vane which always keeps the open end of the cup to the wind. A portion of the pipe is free to revolve with the cup, and carries a guard, the back of which is always kept to the wind. The invention also applies to mine shafts, tunnels, &c.—Patent completed.

3813 M. BROWN-WESTHEAD and R. SMITH, Manchester. *Bobbins.* Dated December 15, 1868.

Upon one end of the bobbin or spool is a disc of cardboard or thick paper, through which a pin passes, and is driven into the filled-up centre of the bobbin or spool, it being made up solid for that purpose, but the pin is not sufficiently driven in for the head to bind upon the disc, so as to prevent it from turning. The end of the thread or twine is passed through a perforation in the disc; when therefore, a length is drawn off for use, the disc is caused to revolve, but as it requires some degree of force to cause that motion, it acts as a drag, and tends to prevent the thread or twine from unwinding beyond the required length. In a modification of the previous arrangement, a portion only of the disc is used and formed of metal. It is confined to the bobbin by the pin, as before described, and is in like manner provided with a perforation through which the end of the thread or twine passes.—Patent completed.

3814 J. FRAZER and W. NAAR, Bayswater. *Mattresses.* Dated December 15, 1868.

The chief object of this invention is to provide for the adjustment of the upper surface of spring matresses, so as to set the head of the mattresses higher than the foot. For this purpose the mattress is made with a base and an upper frame, which are connected together by the springs; and applied to the ends of the frames are fastenings (straps and buckles or their equivalent) for drawing the frames together, so that the foot of the mattress may be depressed and the head elevated at pressure.—Patent completed.

3815 P. KOTZO, Pesth. *Steam engines.* Dated December 15, 1868.

The chief object of this invention is to construct a condenser for steam engines which will work efficiently without the aid of an air pump. The condenser consists of a case rectangular in plan at its upper part, but partially extended laterally at its base to form a broad and steady bearing for the steam engine cylinder. This cylinder is cast with or has fitted to it a rectangular extension, which fits the top of the condenser. This casting is formed at its opposite ends with valve chambers, which connect respectively with the ends of the cylinder and with the outer compartments of the condenser. These compartments open into a central compartment, but are closed by means of valves. Leading from the bottom of the central compartment is a water discharge pipe, and at top it is closed by a cover, which has cast in it a steam exit pipe. There are valves for admitting the exhaust steam from the opposite ends of the cylinder into the condenser, and pierced pipes for discharging cold water in the form of spray into the steam to be condensed.—Patent completed.

3816 T. WILSON, Birmingham. *Signalling.* Dated December 15, 1868.

It is best to describe this invention in connection with railway carriages. On each end of the carriage the inventor fixes a metallic or other air chest or chamber, into which chambers the ends respectively of the signalling tube running along the carriage open the ends of the tubes opening into the backs of the chambers. In the front of the chamber are two openings; one of the openings is closed by a spring valve, and to the other opening a flexible coupling tube is attached of sufficient length to extend from carriage to carriage. To the free end of this tube a metallic or other tubular coupling plug is fixed, the plug containing a spring valve. The spindle of the valve is situated in the axis of the tubular coupling plug, and projects a short distance from its end. When the projecting valve spindle is not pressed upon, the valve in the tubular coupling plug is closed by its spring.—Patent abandoned.

3817 J. T. GRICE, Birmingham. *Tubes.* Dated December 15, 1868.

This consists in making the sides of the rolls of a zigzag or other figure, which will accord with the pattern or design to be formed on the tube or rod. For example, if the pattern or design consists of or contains a series of lozenge-shaped divisions, the inventor makes the sides of the rolls of a zigzag figure, corresponding to one side of the series of the lozenge-shaped divisions, and by the operation of the rolls the line produced at the junctions of the rolls follows the lozenge-shaped pattern or design instead of forming a straight line. He varies the shape of the sides of the rolls to suit the particular pattern to

be produced. The ornamental rolls made according to this invention gear into one another at their peripheries, the projecting part of the side of one roll engaging with the depressed part of the side of the adjacent roll.—Patent completed.

3818 J. E. SCRIVEN, Mulhuddart. *Heating.* Dated December 15, 1868.

This relates to that class of apparatus in which the furnace or firebox is composed of a series of iron rings or short vertical casings placed one above another. The inventor forms the base plate with a ledge around it, so that its central portion rises somewhat within the lower ring or vertical casing, the bottom of which rests upon the aforesaid ledge of the base plate. This lower ring or casing, which is provided with an adjustable door or doors, constitutes the sides of the ashpit, and is formed at its upper edge with a broad rim or shelf, having a small vertical ledge running around its outer edge. This rim or shelf receives and supports the firebars, as also a second ring or vertical casing whose lower edge rests upon the broad rim or shelf of the ashpit casing in the space between the firebars and the small vertical outer ledge. This ring or vertical casing is formed with a small hopper-shaped opening, through which a stoking iron may be passed by clearing away the clinker and other stoking purposes; it is furnished with a door, the position of which is adjustable by a rack or other suitable means, so as to regulate the quantity of air admitted in an uniform manner.—Patent abandoned.

3819 J. MILL, Southampton. *Heating press plates.* Dated December 16, 1868.

This consists in employing in connection with the said screw press an apparatus of rectangular form, composed of perforated tubes or passages, supplied with gas through the medium of a flexible pipe or otherwise, of corresponding suitable dimensions to the plates to be made hot, which are also enclosed within a rim or outer case for the purpose of concentrating or confining the heat from the lighted jets of gas more effectually to the plates placed horizontally in sets immediately above the same, so as to admit of the apparatus being readily removed on the plates being sufficiently heated for the operation of pressing to be formed in the usual manner.—Patent abandoned.

3820 W. COTTON, Loughborough, and E. ATTENBOROUGH, Nottingham. *Fabrics.* Dated December 16, 1868.

The improvements relate to that class of machinery for the manufacture of looped fabrics in which the needles point in a vertical direction, or nearly so, from their leads upwards, and the work produced passes away at or near a horizontal direction. The needle bar is actuated by suitable cam movements, to give the needles a movement to and fro of the presser, as well as vertically for knocking off, whilst the sinkers are independent and supported to move horizontally in suitable guides formed for them, for the sinking and drawing of the loops, and in which both narrowing and widening, commonly called fashioning, may be effected to the fabric during its manufacture by the aid of extra instruments.—Patent completed.

3821 W. N. NICHOLSON, Newark-upon-Trent. *Mangle.* Dated December 16, 1868.

This consists of two rollers of small diameter geared together with toothed wheels having a winch handle to actuate the same direct without any intermediate wheels.—Patent abandoned.

3822 W. A. VERREL and J. CAMERON, Glasgow. *Copper.* Dated December 16, 1868.

This consists in reducing the persalts of iron which attack and waste the iron afterwards used for inducing the precipitation of the copper to protosalts, by treating the solutions with sulphurous acid or gaseous mixtures containing it, such as may be obtained by burning sulphur or pyrites or other substance containing sulphur. This sulphurous acid combines with the surplus oxygen of the persalt, and in reducing such salt to a protosalt, is itself converted into sulphuric acid.—Patent abandoned.

3823 O. HOLLINGWORTH, Hereford-road. *Carriages.* Dated December 16, 1868.

This consists of making the body of the carriage of wicker work or other suitable light material, and of attaching thereto a hood of leather or other similar material with a movable driving box and dickey. When used as a park phæton, the hood is folded back on either side, and the dickey placed behind, with driving irons in the front. When used as a brougham, the hood is raised, doors are fitted in, and the dickey is removed to the front, to form a driving box for the coachman.—Patent abandoned.

3824 L. B. EVERARD, Leicester. *Drilling.* Dated December 16, 1868.

This consists of a cylinder with its necessary valve chest, valve piston, piston rod, guides, and slides, mounted on a metal ring, on opposite sides of which ring pivots are fastened, which work into bearings or carriages adjustable upon another ring, called the outer ring, which is made of a circular form, and arranged centrically with the cylinder.—Patent abandoned.

3825 T. O. FIDDER, Ventnor. *Railways, &c.* Dated December 16, 1868.

Each pair of wheels is mounted on a separate frame or truck, except in cases where it is expedient to mount two or more pairs in any one truck, and any number of such trucks, not less than three, are connected together to form one articulated frame. One such articulated frame may form the frame of a locomotive or traction engine or engines, of an engine and tender, of an engine and carriage or carriages, of a carriage or carriages, or of any waggon or waggons. For the purpose of coupling two or more pairs of wheels, or for the purpose of preventing vertical oscillations, or for the purpose of diminishing the load on each pair of wheels, two or more pairs of wheels may be mounted in any of the trucks, and when this is done, all the wheels in the truck, except one pair, may be without flanges.—Patent completed.

3826 L. DESENS, Charing-cross. *Safety lamps.* Dated December 16, 1868.

This consists in an improvement on the patent granted to the same inventor, No. 2891, dated September 19, 1868. The inventor lowers the gallery in the interior of the body of the lamp, so as to admit of the whole of the mechanism being closed in by the platform, which in this case is raised above the gallery, the object being to prevent any tampering therewith, and the more effectually to prevent the miners, in the event of their successfully opening the lamp, from relighting the same.—Patent abandoned.

3827 R. WAPPENSTEIN and R. RAY, Manchester. *Checking omnibus conductors, &c.* Dated December 16, 1868

For omnibuses, the inventors employ for each journey or stage of the journey, a double meter for the inside, and another double meter for the outside, one division of each meter being used for indicating the entrance, and the other the departure of the passengers, and in one or more conspicuous positions they place dials and fingers to be used as checks or tell tales. Each division of the meter is worked by a catch lever, put in motion by the hand or foot of the conductor, when a passenger enters and leaves the omnibus, each movement causing a bell to be struck and the indicating finger moved one division of the dial.—Patent abandoned.

3828 A. M. CLARK, Chancery-lane. *Ornamenting metals* (A communication.) Dated December 16, 1868.

The inventor takes any article in bronze, copper, aluminium bronze, or other metal or alloy, of a different colour to gold or silver, and paints on the surface in gonache colour any kind of ornamental design (flowers or figures) after previously cleaning the surface. This being done, the different parts of the surface not occupied by the design are next covered with a varnish, such as is used in aquafortis engraving, and the article is then placed in a bath of acetic acid at 12deg. Beaume in communication with the positive pole of a battery. The salt of lead of which the gonache colour is composed then dissolves, and the metal of which the article is composed is attacked. When the depth of the channels thus formed is considered sufficient, the article, after having been raised, is placed in a weak bath of cyanide of silver or gold, in connection with a battery. After the precious metal has become deposited in sufficient quantity, the operation is discontinued, and the varnish removed, after which, the article is polished by hand, so as to remove any excess of the metal inlaid, and make both surfaces perfectly level and smooth. The article is then bronzed, dark colours being chosen, in order to better bring out the gold or silver design.—Patent completed.

3829 J. WORRALL, Manchester, and J. KERSHAW, Wandsworth. *Stoves.* Dated December 16, 1868.

The inventors fit both stories with a railway to receive severally a lapping machine provided with flanged wheels to run thereon. In the frame or carriage of this machine they mount transversely a card roller, of a length almost sufficient to extend across the stove from one side to the other. One end of the cloth or other fabric to be introduced into the stove is led over this card roller, and by its rotation the cloth is lowered down for a certain distance between the transverse bars or rollers, which are intended to keep it suspended in the form of loose laps. The machine commences its operation at the far end of the stove, or the opposite end to that which it enters, and retreats step by step as it lays the cloth over the transverse bars or rollers.—Patent completed.

3830 T. AVELING, Rochester. *Steam cultivation.* Dated December 16, 1868.

The inventor proposes to construct the engines in pairs or as counterparts the one of the other, so far as respects the driving gear, so that the two engines when placed opposite each other in the field will both drive as well as draw from the land side—Patent completed.

3831 F. RYLAND, West Bromwich. *Lids.* Dated December 16, 1868.

This consists, first, in making the body and rim out of one piece of sheet metal. This is effected by first raising a disc or blank into the figure of a shallow cylindrical cup or dish, with a flat or slightly concave bottom, and applying pressure to the top of the cup or dish, so as to force out a flange or hollow ring near the bottom of the said cup or dish. The flange or hollow ring being flattened forms the projecting edge of the lid, which rests upon the top of the vessel with which the lid is used, the unchanged open end of the cup or dish forming the rim which fits in the vessel; the bottom of the cap or dish constitutes the top of the lid. The invention consists, second, in machinery or apparatus to be employed in the manufacture of the lids. The machinery or apparatus consists essentially of the following parts:—A die, fixed on the bed of a press or machine, is provided with a depression proper to receive the bottom of the shallow cylindrical cup or dish before referred to, which cup or dish is raised by dies and pressure, in the ordinary way. A plunger, of a size proper to fit accurately the interior of the cup or dish, has a rising and falling motion over the die, and upon the plunger a collar or ring slides. The upper part of the collar works freely but closely upon the plunger, while the lower part of the said collar is of somewhat larger internal diameter. There is thereby left between the lower part of the collar and the plunger an annular space, in which the upper part of the cylindrical cup or dish can enter.—Patent completed.

3832 S. C. LISTER, Manningham. *Boilers.* Dated December 16, 1868.

This consists in making the tubes of different materials, so that with equal temperatures the inner tube would expand more than the outer. It is preferred to make the inner tube of copper and the outer of iron. Also with the same object the inner or outer pipe is in some cases corrugated, also to reduce the strain resulting from any unequal expansion which may remain, and make the perforated connecting rivets longer than heretofore; they may advantageously be an inch and a half or more in length, and the patentee makes them of copper in place of iron.—Patent abandoned.

3833 G. RITCHE, Folkestone. *Compositions.* Dated December 16, 1868.

The inventor takes flock which has been reduced, cut, or ground to a short fibre, but sufficiently long to lay hold of the fabric upon which it is to be used, and to leave a proportion raised upon its surface. The fibre would thus vary from 1-24th part of an inch to 1-8th, or more, according to the purpose for which it may be applied. Having thus reduced or prepared the flock, the inventor mixes it with a cement of india-rubber, coloured or otherwise, and with or without varnish or gum. He reduces it to a consistence suitable for spreading upon surfaces by means of camphine or other well-known solvents, to which small quantities of a pigment, of proper colour and spirit, varnish or gum, may be added.—Patent completed.

3834 S. C. LISTER, Manningham. *Wool.* Dated December 16, 1868.

This consists in adapting and using, in treating such fibres, the intersecting screw gill, in which the gill teeth strike into the fibre in opposite directions, and subsequently carding or combing the fibre.—Patent completed.

3835 J. T. HALL, G. CRITCHLEY, Lancaster, and H. B. FOX, Chester. *Racks.* Dated December 17, 1868.

This consists in attaching to a hinge, or to any article where a hinge is required, a thin piece of metal of a segmental form, cut as a rack for nearly its entire length, one end of which is made fast and the other end wider than the racked portion, and which is guided by a fixed pin working in a slot of a piece of an irregular pentagonal form swivelled near its centre, the longest angle of which is a catch for the rack, and which is held in position by a spring or lever forcing it against the rack until thrown out of gear by the broader portion of the segmental piece, and which is restored to its working position by a pin striking it down upon a fixed piece, which also acts as a bearing for the catch piece, and the combination of the whole or part of these for the purpose set forth.—Patent abandoned.

3836 J. THORNILEY and G. WING, Massachusetts, U.S.A. *Files.* Dated December 17, 1868.

The inventors wash the files in a solution of warm water and concentrated potass until thoroughly cleansed, and then rinse them in warm water. They now put one pint of warm soft water into a wooden box, into which are put as many files as the water will cover, and then add to the above 2oz. of borax and 2oz. of blue vitriol, well pulverized together, to which they add 7oz. of sulphuric acid by weight. They now stir up the files and then add ½oz. of pure wine vinegar, after which the files become red, and when the files are stirred gently for a short time they resume their natural colour, and the restoring or renewing is completed.—Patent abandoned.

3837 G. HADFIELD, Lancaster. *Varnish.* Dated December 17, 1868.

The inventor takes about thirty gallons of turpentine and filters out or allow to subside the impurities, and removes the fifteen gallons of turpentine in excess of a much purer quality. These proportions will, of course, slightly vary according to the quality of the gum used and of the varnish required. He also takes varnishes prepared according to the ordinary process, and improves their drying properties by passing through them a stream of ozonized air or ozonized oxygen. This he prefers to do in a solution of them in an excess of turpentine, where the viscosity of the varnish will not permit of the use of this process without such dilution.—Patent completed.

3838 J. ROBERT-THEURER, Chause de Fonds, Switzerland. *Watches.* Dated December 17, 1868.

The bow of the watch instead of being, as usual, fixed to the case, is attached to a curved base or plate, corresponding to and fitting over the circumferential curve of the case. Into the bow one end of an arm is let, the other end of which is pivoted to the centre of the movement. This arm carries two pawls, which, by their engagement with the teeth of a ratchet wheel on the barrel arbor, effect the winding of a barrel if a to and fro movement be given to the bow.—Patent completed.

3839 A. PERRY, Dartford. *Windows.* Dated December 17, 1868.

This consists in placing artificial light with reflectors on the exterior of the building so as to produce a more brilliant light outside the window than on the inside of it, whereby the designs and colours will be effectually illuminated and will be seen from the interior of the building.—Patent abandoned.

3840 W. H. LENNOX, Hampstead-road, J. W. PEARMAN, and W. J. PEARMAN, Castle-street. *Printing music.* Dated December 17, 1868.

The inventors propose to employ a plate of soft metal or alloy, such as lead, pewter, or type metal without the addition of antimony, on which the lines required for music are to be engraved or cut, with the spaces between them for the impression of the notes. The plate is then to be stamped with dies of the various designs necessary to produce on the plate the notes and symbols of music printing, with the bars and the words of a song all reading the right way. After which a stereotype is to be made from the stamped or embossed plate. This stereotype may be composed of any suitable material or compound, but it is preferred to use ebonite on account of its firmness and the facility with which it may be moulded in a plastic form and pressed into the spaces cut in the plate, and when the ebonite has become hardened and set, the pressure is to be removed and the stereotype separated from the plate.—Patent abandoned.

3841 W. MANNERS, Nottingham. *Signals.* Dated December 17, 1868.

The inventor employs a pulley in form somewhat resembling a dolly peg, which is placed in a flanged socket, and is let through the top of a railway carriage into each compartment, as required. A rope, chain, or equivalent contrivance may pass through the signal pulley to the engine driver, to the guard, or to the engine driver only, and be attached to a bell or other alarm signal. These signal pulleys are fitted on a shaft, which passes through a socket placed in or near the top of the carriage.—Patent abandoned.

3842 G. H. BENSON and W. G. VALENTIN, Staleybridge. *Iron.* Dated December 17, 1868.

The inventors have discovered that the required temperature may always be maintained if the furnace be heated by a combination of highly heated combustible gases, and a blast of heated air introduced and maintained therein, under pressure, so as to prevent the ingress of the external air through any of the doors, cracks, crevices, or other openings in the furnace, and which air would lower the temperature of the furnace, and cause the molten iron to thicken, and their invention accordingly consists in heating the furnace as above indicated.—Patent abandoned.

3843 G. H. BENSON and W. S. VALENTIN, Staleybridge. *Manufacture of gas.* Dated December 16, 1868.

The inventors employ a close vessel or furnace, built of refractory material, such as firebricks, ganister, or other suitable material, and resting on columns. It may be built of a round, square, rectangular, or other suitable form or shape, and be provided with a hopper or hoppers for feeding the fuel. They prefer to make the portion of the furnace or gas generator which contains the upper portion of the fuel rectangular and oblong. The sides are inclined inwards at their lower part at an angle of about 45deg. These slopes or inclined planes are sometimes made of iron boxes, which can be kept full of water, and may be constructed either as close or open vessels.—Patent completed.

3844 T. INGLIS and T. INGLIS, War-Office. *Cylinders.* Dated December 17, 1868.

Cylinders or tubes constructed according to this invention are composed of at least two tubes, drawn the one over the other. The outer tube is formed of a close

helical coil of wrought iron, steel, or other metal, on the inner surface of which is cut a screw thread of quicker pitch than that of the coil, and running in the same direction. If two tubes only are used, the inner one may be either formed of a similar close helical metal coil or of a simple tube, a screw thread corresponding to that of the other tube being in either case formed on the exterior of the tube. The two tubes thus prepared are screwed together, care being taken, if the inner tube be a coiled one, that the coils of the outer and inner tubes shall break joint.—Patent abandoned.

3845 J. H. KNEVITT, Cornhill, and H. HAZARD, Cheapside. *Shutters, &c.* Dated December 17, 1868.

This consists in the peculiar means whereby the laths or slats are "louvered," or adjusted angularly to admit or exclude the light. The laths or slats are provided at one or both ends with two pins or projections. Each of these two pins or projections works in one part of a compound or double groove on the frame of the window, doorway, or other aperture. The compound groove is so constructed that the distance between the two parts of the same may be increased or diminished, as desired, to open or close the slats or laths, the laths being so connected or jointed together as to allow of their free division or action in louvering. In order to keep the two parts of the groove always parallel with each other, it is preferred to connect them by arms or links in the same manner as any ordinary parallel rule, or the adjustable part or parts of the groove may be provided with studs, which work in curved slots or guideways.—Patent completed.

3846 J. C. WALKER, Gainsborough-square. *Flour, &c.* Dated December 17, 1868.

This consists in producing an acid powder by diluting hydrochloric acid with water, until it attains a specific gravity of about 1·09deg. Beaume; this is poured into or sprinkled amongst any comparatively dry farinaceous or amylaceous substance, in the proportion of about 4oz. of the acidulated water to one pound of the farinaceous or amylaceous substance, rice flour. The flour as it is mixed with the acid water, should be stirred until the acid is thoroughly diffused throughout the mass. It is then run through a moderately fine sieve, to separate it from any sticky lumps it may contain, which are thrown aside as being unfit for use.—Patent abandoned.

3847 R. HALLIMOND, Bishop Auckland. *Lubricators.* Dated December 17, 1868.

This consists in adapting to the sides of a tub used in mining operations, an arrangement for lubricating the axles or bearings of the wheels on which such tubs run, so that each time the tub comes to "bank," a few drops of oil shall fall on to the bearings of the axles. A hollow vessel is formed of any shape, and with a hemispherical bottom, at the centre of which is a hole or seat into which fits a loose solid ball of metal or spherical valve. In connection with the aforesaid hole, other holes extend right and left and into these two holes pipes are screwed and fitted, each with a plug or valve for regulating the quantity of oil that shall escape or pass out on to the bearings of the axles, the outer and open ends of the said pipes being arranged immediately over the bearings of each axle.—Patent completed.

3848 J. QUICK and J. SAMPSON, Southwark. *Pistons* Dated December 17, 1868.

The block or body of the piston is formed with small holes or passages, the number of which may be varied to suit the size of the piston, and these small holes are properly packed and capable of moving therein, when influenced by any excess of pressure at one side of the piston over that at the other side. The apparatus is so arranged that in the normal position of these small pistons, any change in pressure on the respective holes or passages in the block or body of the main piston, will be communicated from them through the cap top plate or junk ring of the main piston, or through suitable T-pieces or equivalent devices, to the packing ring or rings, so as to force the latter against the inner surface of the cylinder.—Patent completed.

3849 F. POUNCY, Dorchester. *Printing pictures.* Dated December 17, 1868.

The inventor first applies the required monochrome colour all over the surface of the material on which the picture is to produced, and the negative is then to be applied to the prepared or non-prepared surface, when the light hardens the colouring matter, the parts not acted upon by light remaining soluble, and are to be dissolved off, either by spirit or water, or both, according to the nature of the preparation of the paper or surface on which the picture is produced. The solution to be adopted for giving transparency to the paper or other material used, consists of oil or other matter, such as oils, wax, and glycerine, it not being necessary always to use all these ingredients.—Patent completed.

3850 C. LIEBERMANN and C. GRAEBE, Berlin. *Colouring.* Dated December 18, 1868.

The following is the manner in which it is preferred to proceed for preparing the anthrakmon or oxanthracene. The inventors take 1 part of anthracenie 2½ parts by weight of bichromate of potassium, and from 10 parts to 15 parts of concentrated acetic acid, and heat these substances together in a vessel, either of glass or clay, to from 100deg. to 120deg. Cen., till nearly all the bichromate of potassium is dissolved, and the liquid has acquired a deep green colour. They then recover the acetic acid not consumed in the reaction by distillation, and treat the residue with water to remove the chromic acetate. From the insoluble mass they obtain the anthrakmon in a pure state, by distilling the whole in a retort of glass or iron.—Patent completed.

3851 E. T. HUGHES, Chancery-lane. *Vessels.* (A communication). Dated December 18, 1868.

This consists in arranging cylindrical or other suitably shaped bodies beneath and partially above the water line of such vessels, and either at the bow, stern, or other desirable position.—Patent abandoned.

3852 E. T. HUGHES, Chancery-lane. *Urns.* (A communication). Dated December 18, 1868.

This relates to a patent, dated November 28, 1867, No. 3370, in an urn in which the tea or coffee is drawn through a cock or faucet; it is now not found necessary to tip the urn, hence the communication from the water joint out or down is not required.—Patent abandoned.

3853 J. W. BRIERLEY, Oldham. *Nuts.* Dated December 18, 1868.

This consists in a machine which, by the simple movement to and fro of a headstock upon a slide or bed shapes, flattens and cuts off the nuts from a heated bar and delivers them sufficiently hot for the workmen to finish them with a few strokes of the hammer on a "swage" of suitable form attached to the anvil. The machine consists mainly of three parts, viz., a bed or slide, a fixed headstock, and a mowing headstock. The latter slides to and fro on the bed, and is actuated by means of an eccentric cam or crank on the main driving shaft which revolves with a slow motion.—Patent completed.

3854 W. F. THOMAS, Cheapside. *Sewing machines.* Dated December 18, 1868.

This relates to a patent, dated June 20, 1867, No. 1798. In place of arranging the awl, so as to enter the leather or other material on the same side as that on which the needle enters it, the inventor now causes the awl to enter on the opposite side, that is, on the same side as that on which the shuttle or equivalent contrivance is situated. Or he arranges the needle and awl on the same side of the material, in combination with a shuttle on the other side, and he carries them by a slide or by two separate slides to which a reciprocating lateral motion is imparted, so that by such motion, the awl and needle are consecutively brought over one and the same place.—Patent completed.

3855 J. HODGSON, Bradford, H. BOTTOMLEY, Low Moor, E. COCKCROFT, Bradford. *Weaving.* Dated December 18, 1868.

The improvements relate to means by which rotary motion may be given to rotary shuttle boxes, containing in the order desired series of shuttle chambers with capability for missing or "skipping" one or more of the shuttle chambers, in the selections of the shuttle to be brought into use. For this purpose, there are clawker rods to act one on each side of a stud or peg wheel, affixed on the end of the series of shuttle boxes or chambers, to cause them to make partial rotation in either direction, and each of these clawker rods is connected to one end of a separate lever, the other end of which is connected to a separate rod, extending by preference upwards, and these rods have formed on each of them a notch or projection adapted to be caught, so as to raise these rods by one end of a lifting lever, actuated by tappet or otherwise, in order to be lifted when they are brought into contact with it, during its rising motion.—Patent completed.

3856 E. T. GRIFFITHS, Sheerness. *Anchors.* Dated December 18, 1868.

A pennant is employed, one end being attached to a shackle on the anchor, and the other end attached by a loose shackle to the cable. When the anchor is weighed, the pennant passes with the cable through the hawse pipe; the pennant is then released from the cable, and attached to a rope, by which it is drawn back out of the hawse pipe; by then hauling on this rope, the anchor is raised up to a davit, which has a block over which the rope passes; the anchor can then be stowed on board. The pennant may have a long link about its middle for use if the anchor fouls. The anchor may be suspended by a slip stopper.—Patent completed.

3857 T. B. SALTER and J. SILVESTER, West Bromwich. *Steam gauges.* Dated December 18, 1868.

The inventors fix the axis on which the index finger turns to the back of the case. Another axis is fixed to the back of the case on which an arm or lever turns in a plane parallel to that in which the index finger works. On the under side of the bush of the index finger is a slot in the direction of a radius from the centre of the bush. A pin on the end of the arm or lever described engages in the slot, and a slight motion in the arm or lever, causes the pin on its end to act on the bush of the index finger and move it through a considerable angle. A rod, bearing at one end against the corrugated or other plate deflected by the pressure, and at its other end against the arm or lever, transmits motion from the former to the latter. By this arrangement, the motion of the said plate is transmitted to and largely multiplied in the index finger. In gauges, in which the pressure deflects a flat tube, the inventors fix the axis on which the index finger turns on one end of the tube, and they fix the pin which engages in the slot in the bush of the index finger on the other end of the tube. Or they fix the axis of the index finger to the case of the instrument, and the pin to one end of the tube.—Patent completed.

3858 J. EDRIDGE and J. MERRELL, Birmingham. *Pins.* Dated December 18, 1868.

The inventors dispense with the use of acid or cleaning solutions or fluxes in solution and they use a dry flux, namely, powdered salammoniac. The pins or articles, on leaving the machine in which they are made, are simply cleaned in dry sawdust, and transferred to the tinning pot, where, by the use of salammoniac, the proper adhesion of the tin is secured.—Patent completed.

3859 S. REMINGTON, Ilion, New York. *Firearms.* Dated December 18, 1868.

The inventor takes a tube of sufficient length to form two or more shoes, and of the proper diameter and calibre. The tube may be formed of any of the present known methods of making metallic tubing. The said tube is then bored throughout its entire length to the proper size to receive the breech bolt, and is also turned on its exterior. He then cuts the tube into pieces or sections of the required length to form the shoes. Apertures may be made in the shoe for admitting the cartridges, and for allowing the handle and other projections of the bolt to move in the required directions, and the end of the shoe may have a screw thread cut in it to secure the end of the barrel in the ordinary manner. The tail or tang of the shoe may also be shaped and adapted to the stock and to the breech mechanism as required.—Patent completed.

3861 T. SPENCER, Bolton-le-Moor. *Yarn.* Dated December 18, 1868,

This consists in an arrangement of shafts, wheels, and pulleys, fixed in a frame, and principally of a new form of spindle box and spindle and apparatus, and appliances for working the same, and has for its object the saving of room and space and the substitution of the spinning and roving machinery now in use.—Patent completed.

3862 G. D. ROBINSON, Gray's Inn-road. *Carriages.* Dated December 18, 1868.

This consists in making one half or a portion of the front seat movable, so that access to such seat may be obtained from the rear of such vehicles, by simply moving such portion of the seat and replacing the same.—Patent abandoned.

3863 E. P. H. VAUGHAN, Chancery-lane. *Rosin oil* (A communication). Dated December 18, 1868.

This consists in incorporating with the rough or crude oils produced by the distillation of pure rosin a quantity of lime or other oxide of the alkaline or alkaline earthy metals, such as potash, soda, and magnesia, and then submitting the mixture thus formed to distillation. By this treatment the impurities contained in the rough or crude oil remain, in combination with the lime or other reagent employed, whilst the oils distil over one after another, according to their several densities, in a state of purity. The quantity of lime or other reagent employed in this process depends on the degree of impurity of the rough or crude oils under treatment, but, as a general rule, should be about 1-10th part by weight of the latter.—Patent completed.

3864 E. PAVY, Paris, and J. CLARK, Manchester. *Treating yarns and fabrics.* Dated December 18, 1868.

This consists in a chemical treatment of fibrous materials, such as jute, china grass, and cotton, either in the raw state or when made into yarn or cloth, whereby the fibre is deprived of glutinous, resinous, or other such matters, and is in a certain degree disintegrated. The inventors take the raw material, yarn, or woven fabric, and boil it from three to four hours in caustic alkali, of the strength of about 2½deg. Twaddell, after which the material is washed in either hot or cold water. They now immerse the material in a weak solution of sulphuric acid, say one pint to 100 gallons of water, and allow it to remain for about half an hour, and then wash with water. After this they boil the material for about an hour in soap and water, say 20lb. of soap to 100 gallons of water, and then repeat the washing in water. They then steep the material for about half an hour in a solution of sulphate of ammonia, of the strength of about 5lb. of the sulphate to 100 gallons of water, again repeat the washing, and when dry the materials are ready for bleaching, dyeing, or printing. The following is another treatment which they have found to answer. The materials are boiled from one to three hours in a mixture of water and muriatic, sulphuric or nitric acids, in proportions, say, from one to five pints to 100 gallons of water, or the materials may be immersed from one to three hours in the same mixture the solution being cold. The materials are then washed and may be treated with a weak solution of alkali to get rid of the last traces of acid. After washing and drying the materials are ready for bleaching, dyeing, or printing —Patent completed.

3865 J. PETRIE and W. T. CHEETHAM, Lancaster. *Warming apartments.* Dated December 18, 1868.

This consists in the use of steam at atmospheric pressure, or substantially so, for heating and evaporating purposes. The inventors employ a boiler which is fed with water by an adjacent vessel, the communication between the two being always open, and the water level being the same in the said boiler and vessel; and to maintain this condition they use an outlet of sufficient area to allow the passage of the steam as it is generated, and it may flow through pipes or other ordinary apparatus used for heating purposes.—Patent abandoned.

3866 M. BROWN, Westhead, and R. SMITH, Lancaster *Threads.* Dated December 18, 1868.

The inventors employ, first, a clip or drag, which is capable of revolving and also of traversing the length of the bobbin, spool, or other surface. One method they propose is to employ a bead or eye, through which the thread or twine is passed twice, and in another arrangement they pass the thread or twine once through a bead or eye, which is drawn towards the bobbin, spool, or other surface by an elastic ring or other medium According to another plan, they supply the bobbin, spool, or other surface with a spindle carrying an arm, through which the thread or twine passes. This spindle being held by hand or otherwise, when the thread or twine is being drawn off the bobbin or other such surface, is caused to revolve while the said arm retains the end.—Patent abandoned.

3867 H. E. LEROY, Paris. *Obtaining publicity.* Dated December 19, 1868.

This consists in placing in juxtaposition to the front and back of a sheet of thick paper another sheet of stout paper, embellished with various ornaments and designs and cut out in geometrical or fanciful figures, under each of which openings is placed a sheet bearing the advertisements. The cut-out sheet on both faces of the intermediate and uncut sheets and this latter are kept together so as to form but a single and same sheet by means of strips of stout paper pasted on three sides of the margin, and traversed on the fourth side by two screws with studs screwing on both faces of the sheet, so that to introduce the cut-out sheet and the advertisements and place them in juxtaposition on the intermediate sheet it is only necessary to unscrew these two studs. Each sheet thus prepared is fastened to another similar sheet so as to form a twin sheet by the aid of a double band of linen in which is a strip of stout paper, arranged so as to form a joint and permit the volume when open to remain perfectly flat. Each twin sheet is then sewn by the linen band to the back of the cover of the volume or album. —Patent abandoned.

3868 J. BRIERLEY, Blackburn. *Ventilation.* Dated December 19, 1868.

An earthenware or other material vessel of cylindrical or other form, having two branch arms thereto, the one connected with the drain as usual and the other above the highest water line in the trap, is connected with a "stain pipe," or pipe specially arranged and employed for conducting the noxious gases to a safe point of discharge. It is preferred to have a pipe specially arranged for the purpose of discharging the gases, and provided with a receptacle for charcoal or other deodorant through which the gases pass on their way to the point of discharge. The lid or cover of the trap is provided with a pipe of such length as at once ensures the proper degree of immersion, it being no longer dependent on the care of the workman; all that is required is, on the trap being fixed, the insertion of the end of the sink or other pipe in the pipe attached to the lid of the trap, which pipe is conical or bell mouthed to facilitate the introduction of the sink pipe into the same.—Patent abandoned.

3869 M. S. MAYNARD and R. GRIME, Preston. *Motive-power engines.* Dated December 19, 1868.

This consists in combining the actions of two governors, one of which becomes stationary only at the required speed, but continually changes its position so long as that speed is deviated from, and is therefore commonly called an isochronal governor, and the other takes a definite position corresponding to and depending on the rate of speed, a type of which is to be found in the ordinary ball governor. One arrangement of parts for carrying on this

invention consists of a lever hereafter described as the "combination lever," one part of which is attached to, or otherwise connected with, the throttle or other valve or starting gear; a second part of the lever is similarly connected with the first named or isochronal governor, and the third part of the lever is also similarly connected with the last-named or ordinary ball governor. By this means the throttle or other valve or starting gear partakes of the joint motion of both these governors, thereby securing a better governing action. A second arrangement consists of a weight placed upon a horizontal lever attached to the rocking shaft connected with the ordinary governor, this weight being made to slide or change its position upon the horizontal lever by the action of the isochronal governor, thus assisting the balls of the ordinary ball governor to rise or fall, and so move the throttle or other valve or starting gear as may be required.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated June 29, 1869.

1958 G. C. Haswell, Edinburgh. Improvements in water directors for fire engines, garden engines, and hose, and for nozzles for force pumps.

1959 C. L. V. Yon, Boulevart de Strasbourg, Paris. A new kind of portable camping trunk, containing in a small bulk a light tent with all the required furnitures and implements necessary for military, rambling travellers, and emigrants.

1960 W. Cowan, Kittybrewster, Aberdeen. An improvement in locomotive engines.

1961 W. Blackburn, Manchester. Improved standards or supports for branches, desks, and tables.

1962 E. T. Hughes, Chancery-lane. Improvements in the manufacture of sugar, and in apparatus employed therein.

1963 W. Bartram, Sheffield. Improvements in apparatus for filling and closing cartridges.

Dated June 30, 1869.

1964 H. Yates, Rue Lafayette, St. Pierre les Calais, France. Improvements in means or apparatus applicable to bobbin net or twist lace machinery, or other machinery arranged and operating in a similar manner.

1965 R. H. Courtenay, Meyrick-road, Clapham Junction, Surrey. Improved processes for producing printing surfaces.

1966 B. Templar, Holly Bank, Tetlow Fold, near Manchester. A combined apparatus for damping and cleaning slates, sharpening slate pencils, and wiping pens.

1967 M. Turnor, Birmingham. Improvements in the manufacture of metallic and other boxes.

1968 R. Brown, Glasgow. Improvements in the manufacture of iron, and in apparatus therefor.

1969 W. E. Gedge, Wellington-street, Strand. An improved carriage spring.

1970 W. E. Gedge, Wellington-street, Strand. The incorporation of extract of meat with all kinds of sweetmeats or comfits, with syrups or any sweet or glucose matter, with quinine wine, and all kinds of wines prepared with quinquina.

1971 D. Hebson, Liverpool. Improvements in steam engines.

1972 R. Knowles and J. Lindley, Manchester. Improvements in the manufacture and ornamentation of ladies' night-dress cases, bed-head bags, watch pockets, and other similar articles.

1973 R. Heyworth, Manchester. Improvements in water-closets, wash basins, and urinals, and in self-acting apparatus for the same.

1974 W. H. Bailey, Albion Works, Salford, Lancashire. Improvements in cutting and slicing machinery, and in adjustable feed apparatus therefor.

1975 R. Boyd, Strand. Improvements in switches and signals, and in the mode of working same.

1976 J. Robinson, Martin's-lane, City. Improvements in means or apparatus for preserving animal and vegetable substances.

Dated July 1, 1869.

1977 A. Walker, Heriot, Mid Lothian. Improvements in agricultural implements.

1978 W. E. Gedge, Wellington-street, Strand. An improved safety brake for railway vehicles.

1979 R. W. Whitehead, Ashton-on-Mersey, Chester. Improvements in coupling or jointing pipes or tubes.

1980 W. Coleman, City, and S. Turton, Heaton Norris, Lancashire. Improvements in feeding bottles.

1981 R. Porter, Birmingham. Improvements in furnaces.

1982 T. Atwater, Paris. An improved band for ladies wear.

1983 J. Stringfellow, Chard, Somersetshire. Improved apparatus for affording protection from bullets and other missiles.

1984 J. D. Dougall, St. James's-street, Westminster, and W. Bartram, Sheffield. A new or improved apparatus for filling cartridges.

1985 J. H. Johnson, Lincoln's Inn-fields. Improvements in breech-loading firearms.

1986 A. Barclay, Kilmarnock, Ayrshire. Improvements in motive-power engines.

1987 L. F. Banks, Royal Hospital, Kilmainham, Dublin. Improvements in markers for the game of croquet.

1988 A. V. Newton, Chancery-lane. An improved manufacture of nail or spike, and machinery for making the same, which machinery is applicable to the forming of bolts and spikes of the ordinary construction, and other articles having screw threads, and also to the straightening of shafts, rods, and pipes.

1989 A. Turner, Leicester. Improvements for utilizing waste strips of india-rubber.

1990 H. Larkin, Torriano Cottages, Leighton-road, Middlesex, and W. White, Thurlow-road, Hampstead, Middlesex. Improvements in the production of sodium and potassium.

1991 E. Roe, Nottingham. Improvements in the manufacture of looped or knitted fabrics, and in the machinery or apparatus employed therein.

Dated July 2, 1869.

1992 T. Jones, Handsworth, Staffordshire. A new or improved method of attaching or uniting together the body and barrel of repeating firearms.

1993 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved billiard and bagatelle room convenience.

1994 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved motive power.

1995 E. Scott, Manchester. Improvements in weighting motions used in machinery for preparing, spinning, twisting, and doubling fibrous materials, and for other similar purposes.

1996 S. Smithson, Heckmondwike, Yorkshire, and G. Senior and J. Inman, Brighouse, Yorkshire. Improvements in valves or valve taps for regulating the discharge or flow of water or other fluids or gases.

1997 S. Brooke, Brighouse, Yorkshire. Improvements in, or applicable to, machinery or apparatus for carding and otherwise preparing wool or other fibrous substances for spinning.

1998 G. White, Queen-street, Cheapside, City. An improved rotary steam engine.

1999 O. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the mode of, and materials for, preparing corks for rendering them impermeable under the action of wines and other liquids, either when charged with gases or not.

2000 H. Turner, jun., Leicester. Improvements in weaving plain and elastic terry fabrics.

2001 W. Frazer, East Parade, Newcastle-upon-Tyne. Improvements in the preparation of materials for fettling or lining puddling furnaces, and other like uses.

2002 W. R. Lake, Southampton-buildings, Chancery-lane. An improved combined travelling bag and chair.

2003 J. Smithers, Dawson-street, Dublin. Improvements in galvanic batteries.

2004 W. A. Biddell, Edward-street Parade, Birmingham, and J. Redgrave, Newhall-street, Birmingham. Improvements in the manufacture of ornamental articles in glass alone, or in combination with other materials, and in the application thereof to various purposes.

2005 A. V. Newton, Chancery-lane. Improvements in preparing flax, hemp, and other fibres, and in converting the same into slivers.

2006 H. E. Newton, Chancery-lane. Improvements in meters for measuring liquids.

2007 J. Steward, Wolverhampton. Improvements in pianofortes.

2008 Alfred Foucant, Orleans, France. Improvements in telegraphic cables.

Dated July 3, 1869.

2009 P. G. Gardiner, New York, U.S.A. Improvements in springs for railroad cars, buffers, and various other purposes.

2010 N. Mole, Calvert-street, Shoreditch, Middlesex. Improvements in boots and shoes.

2011 A. Angell, Rio Janeiro, Brazil. Improvements in machinery for hulling and polishing coffee, rice and other berries or seeds.

2012 A. H. A. Durant, Avenue-road, Shepherd's Bush, Middlesex. Improvements in the mode or means of preparing or treating castor and other oleaginous seeds or berries for the manufacture of oil, and in the manufacture of oil from the seeds or berries so prepared or treated.

2013 T. Grahame, Lansdowne-place, Leamington, Warwickshire. Improvements in the construction of barges, boats, floating batteries, and other floating structures.

2014 I. James, Cheltenham, Gloucestershire. Improvements in machinery or apparatus for crushing or breaking stones, bones, and other hard substances.

2015 G. Palmer, Reading, Berks. Improvements in the manufacture of biscuits.

2016 J. Hart, Leamington, Warwickshire. Improvements in the mean of, and apparatus for, separating, distributing, and utilizing sewage.

2017 T. Butler, Nottingham, and R. F. Carey, Nottingham Park, Nottinghamshire. Improvements in the manufacture of lace made on bobbin net or twist lace machines.

2018 C. Churchill, Darnley-crescent, Hackney, Middlesex. An improved implement for drawing nails.

Dated July 5, 1868.

2019 J. Clark, Paisley, Renfrewshire, and A. Ewing, Glasgow. Improvements in feeding steam boilers or generators, and in the apparatus or mechanism employed therefor.

2020 T. Smith, Birmingham. An improved means of utilizing the waste heat of puddling and ball furnaces for the calcination of cinder into bulldog for furnace fettling, and an improved means for preventing the adhesion of the same substance in large masses.

2021 W. Duckworth, jun., Liverpool. Improvements in taps for general purposes.

2022 F. W. Grune, Berlin, Prussia. Improvements in transferring photographs to wood, metal, ivory, and other surfaces.

2023 T. Wilson, Birmingham. Improvements in constructing and working velocipedes.

2024 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in water meters.

2025 L. Falisse, Liege, Belgium. An improved breech-loading firearm.

2026 W. E. Newton, Chancery-lane. Improvements in the manufacture of bar iron, and in the machinery for rolling the same into various forms.

2027 J. Knight, Huntingdonshire. Improvements in four-wheeled vehicles.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1735 J. Imray and J. Ellis
1775 T. Sagar and T. Richmond
1776 J. Brotherton
1790 C. Heptonstall
1793 C. Harvey
1880 W. Clark

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1918 C. Lungley
1935 G. Bedson

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

795	1829	1870	1880	1890	1897	1904	1910
885	1831	1871	1881	1891	1898	1907	1914
893	1854	1872	1882	1892	1899	1908	1916
1679	1863	1873	1883	1893	1900	1909	1917
1751	1864	1875	1885	1894	1901	1910	1918
1781	1865	1876	1886	1895	1902	1912	1921
1790	1866	1877	1887	1896	1903	1913	1922
1825	1867	1878	1889				

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," July 6, 1869.

552 J. B. Rushbrook
560 J. Johnson and W. Gill
571 W. Williams
574 J. I. Vaughan
585 W. Parkinson
592 H. J. Ledger
593 H. Harburg
596 J. Cheetham
610 J. H. Johnson
617 L. G. Lysons
618 P. S. Regnauld
622 W. E. Gedge
631 C. E. Brooman
649 W. Howes and W. Burley
650 H. A. Bonneville
665 W. Betts
666 J. Gough
[illegible] W. R. Lake
7[illegible]4 H. Mason, G. Hartley, and J. Hindle
747 W. Betts
827 A. de Pindray
839 C. G. Bonehill
8[illegible]4 J. H. Johnson
918 T. Sowden and J. Newton
922 H. Downie and L. B. Harris
944 A. Clark
1079 J. A. Miller
1134 W. E. Newton
1156 C. T. Swanston
1180 J. H. Johnston
1197 H. Aitken
1442 B. Latham
1464 E. V. Gardner and P. M. Crane
1498 F. Kohn
1522 J. Woodward
1526 E. C. Warburton
1687 A. Rushworth
1691 H. Browning
1732 E. M. Syer
1739 H. Downie and L. B. Harris
1740 E. G. Brewer
1756 J. G. M'Kirdy
1763 E. Tavernier
1773 V. J. Four
1790 G. Fry
1822 J. G. Tongue
1826 A. W. Moss
1836 W. Yates
1862 J. H. Banks
1871 T. Bourne
1882 J. Bullough and C. Catlow
1914 R. Moreland and D. Thomson
1917 D. B. Park
1923 R. Caunce and M. G. and B. Bradley

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 2, 1869.

24 L. Hannart
26 W. Prosser
27 E. W. and J. Voce
29 J. J. Hays
30 J. Balbirnie
36 S. Remington
42 K. Walter
43 A. Tyler
45 G. Eveleigh
50 F. R. A. Glover
65 M. Wilkin and J. Clark
67 W. E. Gedge
70 M. Saunders and H. Forrest
118 A. M. Clark
154 N. Voice
159 G. R. Postlethwaite
739 A. Moncrieff
960 H. Y. D. Scott
1081 R. J. Morison
1200 H. Y. D. Scott
1260 J. Major, W. Wright, and G. H. Jones
1430 W. R. Lake

Sealed July 6, 1869.

3739 G. Cooper and J. Cotterill
60 R. Wigram
63 T. B. Sydserff
71 E. Gray
80 J. Petrie
86 C. M'Dougall and C. H. Eden
89 A. P. Price
91 Sir F. Sykes
104 J. Schlosser
111 T. Mortlock
121 C. H. Lea
146 W. Thomas
150 W. R. Lake
164 A. M. Clark
186 H. A. Bonneville
206 A. Maw
212 W. Burgess
246 C. Gil
248 C. Mather
366 C. G. Hill
472 B. J. B. Mills
570 W. A. Ives
789 F. Brady
915 W. R. Lake
1098 J. Hynam
1404 G. N. Mansfield
1408 J. G. Tongue
1409 F. C. Knowles
1426 W. E. Newton
1431 H. Bessemer
1433 H. Bessemer
1434 H. Bessemer
1435 H. Bessemer
1452 P. W. and W. Flower

LIST OF SPECIFICATIONS PUBLISHED

For the week ending July 3, 1869.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
3218	0 4	3471	0 10	3517	0 8	3583	0 4	3601	0 4	3636	0 4
3332	0 4	3472	0 8	3526	0 8	3586	0 4	3604	0 4	3639	0 4
3376	0 10	3482	1 4	3530	0 6	3587	0 4	3605	0 4	3640	0 4
3400	0 10	3485	0 10	3566	0 4	3589	0 4	3617	0 4	3641	0 4
3419	3 6	3486	0 6	3569	0 4	3591	0 4	3623	0 4	3642	0 4
3424	0 6	3487	0 10	3570	0 4	3592	0 10	3624	0 4	3643	0 4
3442	1 4	3488	1 4	3576	0 4	3595	0 4	3627	0 4	3645	0 4
3450	0 10	3492	0 8	3577	0 4	3597	0 4	3630	0 4	3647	0 4
3462	2 6	3507	0 10	3580	0 4	3598	0 4	3631	0 6	3651	0 4
3464	1 0	3508	0 6	3581	0 8	3599	0 4	3632	0 4	3652	0 4
3467	0 10	3514	0 6	3582	0 8	3600	0 10	3633	0 4	3718	0 4
3469	1 2										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JULY 16, 1869.

THE FAIRLIE STEAM CARRIAGE.

THE name of Mr. Robert F. Fairlie has, for some time past, been brought prominently before the public in connection with the economical working of railways. The Fairlie engine is well known to our readers, and a brief description of his steam carriage has also appeared in our pages. A trial of this carriage—details of which we reserve for next week—was made yesterday, at the Hatcham Iron Works, which successfully demonstrated the practicability of working the system upon railways, with curves of only 50ft. radius. The steam carriage exhibited yesterday, and which was not quite completed, was designed to work on a metropolitan railway, at the terminal stations of which sufficient space could not be given for laying down rails on a curve of 25ft. radius for the standard carriage to run itself round; consequently, the standard carriage had to be altered in dimensions to allow of its being turned on an ordinary 40ft. turntable. Hence, instead of seating, as is intended, the 100 passengers in the standard carriage, the carriage under trial only gave seating space for sixteen first class and fifty second class, in all 66 passengers. The accommodation per passenger is as good as is given on the best lines, and infinitely superior to the stock usually worked on branch lines. The length of the carriage is 43ft., including a compartment near the engine for the guard. The engine, carriage, and framing all complete, in working order, but exclusive of passengers, weighs under 13½ tons, and including its full load of passengers 18½ tons only. The carriage when finished complete will have a broad step or platform on each side, extending its entire length; this step is protected by a hand rail on the outside, with an arrangement for lifting it on the platform side at the doors to allow the passengers to get in and out. The object of this platform is to enable the guard to pass completely round the train at all times, and while doing so, he is perfectly safe from any accident. Passengers can also pass along the platform to the guard, so that in this manner there is an easy and perfect mode of communication between passengers and guard.

It is intended, however, in the standard steam carriage to provide a central passage inside the entire length of the carriage, leading direct from and to the guard's compartment; thus there is the most direct means of communication between the passengers and guard. The compartments in the carriages will be quite as separate and distinct as they are at present, or as the most fastidious could desire. The guard passes through the carriage at pleasure. Those in the higher classes can pass to the lower, but the lower cannot get to the higher, while all can pass to the guard when required. The standard carriage will have two compartments first class, to seat 16 persons; three compartments second class, to seat 30 persons; and four and a-half compartments third class, to seat 54 persons—in all, 100 passengers. The machine complete, in working order, will weigh about 14 tons, and with the 100 passengers, from 20 tons to 21 tons. These carriages will convey their full complement of passengers at forty miles per hour up gradients of 1 in 100, and, as demonstrated, will pass round curves of 50ft. radius at twenty miles an hour with perfect safety.

There are few trains on any of our railways which convey more passengers per mile than can be accommodated by one of these steam carriages. In fact, it is known that the average number of passengers, taken from the Parliamentary returns, give only about eighty passengers conveyed altogether by each passenger train in the United Kingdom, from the time it starts until it completes its journey; and this only gives about an average of 30 to 35 passengers at any one time in the train, for each mile travelled. Of course, there are exceptions to this number on our principal main lines, but even in these cases, a greater number is the exception, and not the rule. The weight per wheel of the steam carriage being only about 2½ tons, it follows that very light rails may be used, with everything light in proportion. The passage of such sharp curves so easily will enable us to make lines very inexpensively; we need no embankments or cuttings or heavy masonry works of any kind; therefore, lines will be made cheaply and stocked cheaply. Under these circumstances, there is no reason why every village should not have its line either direct or in communication with some of the main lines, to which these light railways would act as feeders, and not like the present branch lines, which really act as suckers and not feeders. Many of these branch lines have actually cost a larger sum per mile than the parent line, over which the traffic from the particular branch would not represent more than 5 per cent., if so much, of the total traffic. Then how, in the name of wonder, can such lines pay? When a gentleman desires to open up an estate for building or agricultural purposes, the first thing he considers is the making of suitable roads through it. Now, instead of roads, there is no reason why these light railways should not be made. In time it will come to this.

We are only, in a sense, beginning railways; we must have double, aye, treble the mileage we have at present, but everyone of these miles must not only be constructed but worked in a very different manner to that in which they have been, and are being at present. We have only to consider this simple fact: the steam carriage, with 100 passengers included, weighs about 20 tons, while the tender which accompanies the ordinary locomotive, and which is perfectly useless, except to carry food for the locomotive, weighs as much, if not more. The usual passenger trains average in weight, exclusive of passengers, about 80 tons; therefore, it follows if to work 80 tons it takes 30lb. of fuel for the locomotive per mile, to work only 20 tons one-fourth of the fuel would be required. The reference to fuel means oil, tallow, and every material required to maintain the engine; it means also the same proportionate reduction in the cost of maintenance of permanent way, and all charges connected with the working of railways. The proper method of working railways is to take the largest possible loads, and, consequently, fewer numbers of goods trains; so that instead of earning about 6s. per train per mile at a cost of 50 per cent., netting 3s., these should earn double the amount—say 12s. per mile—while the cost would not exceed 1s. over the 3s. spent to earn the 6s., giving a net production of 8s., instead of 3s., or about 280 per cent. more.

Then, again, the passenger trains which now earn under 5s. per train per mile, and costing 50 per cent. of the amount, or 2s. 6d. to earn it, could be worked with the steam carriages at a cost of about 1s. 6d. per mile, thus adding 40 per cent. to the net receipts on passenger traffic. It is to be remembered that these percentages are pure gains to railway companies, the cost of management and other charges being taken as remaining the same, the profits arising solely from the improved mode of working. The Fairlie engine can haul double the ordinary loads of goods per train, without injuring the permanent way so much as is now done by the ordinary engine; and allowing for the increase in the consumption of fuel for the load taken, all other expenses remaining the same, the extra cost on each train could not exceed even 6d., although 1s. is placed against this item—therefore the profit must certainly be very great.

While on the subject, we may notice the Fairlie engine "Little Wonder," which has been built for the Festiniog Railway Company, and which has obtained very considerable notoriety from its being the narrowest gauge passenger railway worked by locomotives in existence. The line has been worked now about five years, and during that time there has not been the slightest accident of any kind; in fact, it is considered a most extraordinary line, not only on account of its gauge, which is only 2ft., but because of its success commercially. The traffic hauled last year over this miniature line of twelve miles in length amounted to 130,000 tons of goods, and 145,000 passengers, which would be considered a very handsome traffic for a full-sized railway of the same length, and the wonder is, how it has been done. The credit is due to the able management of Mr. C. E. Spooner, managing director and engineer. The traffic has so increased that the ordinary engines are getting too small to pull the loads, and hence the adoption of the Fairlie engine, which at once enables the train loads to be doubled, without, but in a very small degree, increasing the cost of each train. The Festiniog line is, for about eleven miles, one continuous ascent of about 1 in 80, with very many curves, some of which are as small as 100ft. radius. The "Little Wonder," although weighing but 19½ tons, fully equipped with fuel and water for the road, will haul after it 140 tons, at a speed of fifteen miles an hour for the whole eleven miles; a feat, considering the gauge and weight, that could not be accomplished by other than the Fairlie engine. The engine has eight wheels, in two separate groups of four each, each group being acted on by a pair of cylinders 8½in. diameter. The wheels in each group are 2ft. 4in. diameter, and are coupled together.

The extreme wheel base is 18ft.; consequently, the engine will run with remarkable smoothness. At the same time, the wheel base of each bogie being but 5ft., the engine will pass round curves of 50ft. with the utmost safety at 20 miles an hour. The principle in this respect is precisely similar to that of the steam carriage passing curves of 50ft. The fact of either steam carriages or engines being constructed to run with perfect safety round curves of 50ft. is unprecedented in the history of railways, and places the railway world under a considerable obligation to Mr. Fairlie, who has spared no pains to perfect a system to which we wish every success.

THE ROYAL AGRICULTURAL SHOW AT MANCHESTER.

THE thirtieth annual meeting of the Royal Agricultural Society is held this year at Manchester. Old Trafford, the locality in which the show will take place, is two and a-half or three miles from the centre of the city, and within a comparatively limited radius there has been found not only abundance of accommodation for the show yard proper, but also a farm upon which over 100 acres of rye, grass, clover, and winter oats were ready for the implement trials. The show ground extends over a length of three-quarters of a mile, and is on the western side of the South Junction Railway; the crops being situated on the other side of the line. Last year, at Leicester, the competition was in ploughs and implements of culture. This year, the trial is for mowing, reaping, and haymaking machines. There is also a ploughing competition, in which all the best plough makers are represented. The trials of mowing and reaping machines commenced on Mon-

day last. Many of the reaping machines were new, and showed much ingenuity in cutting and in self-delivery. The judges selected thirteen reaping machines with self-delivery in swathe, eighteen reaping machines with self-delivery in sheath, nine reaping machines without self-delivery, and eighteen are horse reapers, to take part in the trial. The mowing machines were tried in a large rye-grass field some distance from the barley upon which the reapers were tried. There were twenty-five machines, each of which in rotation mowed half an acre in the presence of the judges. The final decisions will be known at the end of the week. On Monday next, the entire show yard will be opened at eight o'clock in the morning, when we shall be able to obtain all particulars of novelties in machinery, and place them before our readers in due course, as usual. The show is expected to be one of the largest the Society has held. There are 365 exhibitors and 7,724 entries, and the catalogue occupies over 500 pages. If our readers, who intend proceeding to the show from London, follow our course they will proceed by the Midland Railway, which will deposit them in the centre of Manchester, which they will make their head quarters. There are ample means of conveyance to Old Trafford, and in Manchester there is much to be seen in the way of spinning machinery that would alone repay a visit to the Cotton City.

WIMBLEDON, 1869.

WIMBLEDON Common presents the usual features which have been given to it for several years past by the proceedings of the National Rifle Association. The Queen's prize has this year been carried off by Mr. Cameron, who won it in 1866 with 69 points, but who has this year made the unprecedented score of 71 points. The breech-loaders are not in such full force as they were last year, but some excellent shooting has been made with them. Of course, the Martini-Henry was there, as well as the Henry rifle. There were also a Westley-Richards, a Carter and Edwards, and a Soper rifle. There was also a new rifle of very simple construction, by Mr. Restall, which we shall describe fully upon another occasion. The Martini-Henry made some good scores, although, on more than one occasion, we noticed miss-fires, and twice in thirty-eight rounds the top of the exploded cap came off and jammed the breech-block. These mishaps were entirely owing to the cartridge—the Boxer pattern—and were in no way attributable to the rifle itself. Some excellent shooting was done with the Henry rifle, especially by Mr. Farquharson at 800 yards. At other ranges its superiority also showed itself, notably at the 200 yards. With the Westley-Richards-Henry some excellent shooting was made at this range by Sir C. Shakerley, who scored in the three minutes four bull's-eyes, seventeen centres, and twenty outers, equal to 107 points; and at the 500 yards, with the same rifle, he made one bull's-eye, seventeen centres, and twelve outers, his score showing forty-one shots seventy-nine points. Captain Burt also tried a Westley-Richards-Henry and made eighty-four. Pace, with the Henry, scored eighty-seven, and there were other scores nearly as good. The Soper-Henry was fired for the first time at 207 yards, and made 103 points. In the 200 yards breech-loading competition some excellent scores were made on Wednesday, the highest being that of Mr. Hay, of the London Scottish, with the Martini-Henry rifle, who fired forty-four shots in the allotted time (three minutes), making eleven bull's-eyes, nineteen centres, and fourteen outers, total 127; this is the highest score which has been made in this competition. Serjeant Gilder scored 124 points, firing thirty-eight shots; his score as shown by the butts was 128, but it appears that through some misunderstanding the disc indicating five shots was exhibited instead of that indicating three, thus giving Serjeant Gilder two shots more than he actually fired; the mistake has, however, been rectified, and his score stands at 124. Serjeant Frost, of the 26th Kent, scored 110 points in forty-seven shots; the foregoing scores are for the Martini prizes. For the Duke of Cambridge's prize 113 has been scored with the Soper direct-action rifle, in forty-six shots; and with the same rifle, the extraordinary number of fifty-four shots in the three minutes has been made by Serjeant Warwick, scoring, however, only 111 points.

On leaving the camp, our attention was attracted to three boilers—two vertical and one horizontal—at the back of Messrs. Spiers and Pond's capacious refreshment department. These boilers, we found, on enquiry were used to supply steam to the cooking department. By the courtesy of the proprietors, we inspected the arrangements for providing the camp with sustenance. The ice room, in which the ice, beer, and provisions are stored for use, is partly excavated in the earth and partly constructed of walls 2ft. thick made of earth and boarded, the roof being formed in the same way. The cooking and other departments are well arranged, and every facility is afforded for supplying the demands of the appetites that present themselves from early morn to late at night. The pressure on the resources of the establishment is sometimes very great. For instance, on Saturday and Sunday last, we were informed that the consumption of articles of food was as follows:—8,000lb. of bread, 16,000 rolls, 5cwt. biscuits, 1,000 fruit pies, 4cwt. fresh butter, 5,000 eggs, 4cwt. cheese, 2,500 lettuces, 1½ ton of potatoes, 600 quarts of shelled peas, 5 tons of ice, 600 quarts of ices, 780 gallons of tea, 130 gallons of coffee, 350 gallons of milk, 100 tongues, 169 hams, 5cwt. of salmon, 156lb. of eels, 20 turbot, 480 lobsters, 900 head of poultry, 6 tons of meat, 80 hhds. ale and stout, 760 gallons of claret cup, besides a large quantity of wines, spirits, liqueurs, and aerated waters. This great quantity of provision was distributed by an experienced staff, so that the little colony at Wimbledon have no drawbacks so far as catering is concerned.

THE STEAM SHIP "MALTA."

ATTENTION has recently been drawn to a screw steam ship, which was launched on the 29th of May last, from the ship-building yard of Messrs. Oswald and Co., Pallion, Sunderland. This has arisen not so much from her size—although that is considerable—as from the circumstance that she marks an era in ship-building upon the Wear. Previously, work had been sent past that river to the Clyde, by reason of the Scotch builders putting in the cost of the hull at a low figure, and laying it on upon the engines which they built within their own establishments. It is, therefore, desirable that the Wear builders should be induced to engine their steamers, and the port of Sunderland owes no small amount of thanks to Messrs. Oswald for the spirited example they have set their brother builders, in having both built and engined the "Malta"—the subject of the present notice—which is the first steamer so completed by a single firm on the Wear. The "Malta" was built for Messrs. Young, Ehlers and Co., of London, and the following are her principal dimensions:—Length over all 221ft.; breadth, 32ft. 2in.; depth, moulded, 17ft. 10in.; builders' measurement, 919 tons. Her engines are of the inverted direct-acting type, and on the surface condensing, high pressure, expansive principle, with improved expansive valves. The other dimensions and particulars are as follow:—Diameter of cylinders, 39in.; stroke, 33in.; nominal horse-power, 99; indicated horse-power, 659; consumption of coal per day, 9¼ tons; working pressure, 45lb.; steam superheated to 320deg.; vacuum, 26; revolutions per minute, 63; speed in knots per hour, 10½; draught, forward, 7ft. 6in.; draught. aft, 10ft.; classed 18 years at Liverpool. Yesterday week the "Malta" made her trial trip, and although we have no detail particulars of working to hand, yet we are able to state in general terms that she gave every satisfaction to her owners, and reflected great credit on her builders. The engines were objects of general attention. The compact manner in which the whole of that portion of the ship is arranged differs entirely from the ordinary run of north-country boats. The engineer may almost grasp his engine with one hand, and throw open the furnace doors with the other, while the ventilation proved to be very perfect, the engine-room being kept remarkably cool. The consumption of coal on a run of 200 miles is stated to be only 20cwt., which shows a very great economy. This is the first complete job that has been turned out from one establishment on the Wear, and having proved so satisfactory, will assuredly not be the last, but will, we trust, prove the means of opening up a good trade for the builders on the Wear generally, and Messrs. Oswald and Co. in particular.

IMPROVING THE NAVIGATION OF THE DANUBE.

THE formation of river deltas has always been a feature especially interesting to the student of physical geography and the geologist. Generally, these natural accumulations have to be sought for in the larger and more important rivers of the Continent and the New World, but it is probable that if the present system of discharging the London sewage into the Thames be continued, our geologists may have an opportunity of studying the formation of deltas at home. However interesting these fluvial deposits may be, viewed in a scientific and palæontological light, they constitute formidable obstacles to the navigation and commercial utility of the rivers in whose channels they are formed. For some years back the improvement of the Lower Danube has occupied the attention and the labours of a commission, the results of which now present tangible signs of progress. The principal objects to be accomplished by the commission were, firstly, the examination and amelioration of the different mouths, with a view to select the one most suitable for forming the main channel of navigation; secondly, the establishment of a regular system of water intercommunication; and, thirdly, the construction of the numerous and extensive works in connection therewith. That the contemplated project was upon a scale of considerable magnitude may be deduced from the fact that a whole year was employed in making a survey of the delta, and in obtaining the plans and soundings and levels necessary to enable a proper estimate to be formed of the *embouchure*, the best adapted for the intended purpose. At a short distance above its junction with the Black Sea, the Danube trifurcates, discharging its waters by a northern, southern, and intermediate channel, named respectively Kilia, Saint George, and Soulina. Of these three, the last was that generally used previous to the organization of the commission, and the first examination was directed towards ascertaining its capabilities. Some works of a temporary character were also constructed along its banks, pending the investigation in progress respecting the neighbouring channels. The northern branch, Kilia, has the advantage of possessing the greatest volume of water, but its many other disadvantages totally precluded any idea being entertained of adopting it for navigable purposes. Among these may be mentioned its subdivision into

no less than eight smaller channels, which, in addition, are continually shifting their course, and have, strictly speaking, no fixed mouths or outlets into the sea. To render these suitable for the navigation of vessels would have required the expenditure of an amount of money that would have been, in every sense, utterly unjustifiable. Moreover, supposing, for the moment, that other circumstances were favourable to the selection of this branch, its geographical position so much to the north would render it extremely inconvenient to vessels trading to the Bosphorus, as it would seriously lengthen their voyage.

The majority of the members of the commission were of opinion that it was both possible and necessary to improve the St. George's branch, the channel of which is wider and deeper than that of Soulina, without at the same time attaining to the proportions possessed by that of the northern outlet, Kilia. While nearly unanimous in finally reporting upon the feasibility of improving the southern branch, there was a good deal of discussion respecting the necessary works proposed in conjunction with the undertaking. This question was ultimately referred to the proper authority upon such matters, namely, the engineers, who advised the cutting of a canal having flood gates opening seawards. There were two objections to the execution of this scheme. One was that the accommodation would be totally inadequate to the exigencies of the navigation, and the other that the cost would reach the sum of £300,000. This latter impediment was fatal to the undertaking, and the further inquiry into the merits of this particular channel was postponed *sine die*. Having disposed of the claims of two of the branches under consideration, it only remained for the commission to concentrate its efforts upon the remaining one of Soulina, where, as already stated, provisionary works had been constructed. The final decision of the commission was, therefore, in favour of vigorously pushing forward all works that might be necessary towards rendering this channel adapted for a more important and extensive system of navigation than had yet been developed on the Danube. In order to effect the principal object, namely, the deepening of the water, the preference was given to the excavation of parallel trenches, instead of to dredging, as more likely to ensure permanent results. The depth of water at the bar was increased in this manner from 9ft. to 18ft., and has since been maintained at that datum. It is expected that in four years the works will be completed, and a free and uninterrupted communication established between the fertile provinces of the Danube and the ships of European commerce. At present, a vessel of 400 tons burden can easily pass the bar of Soulina, whereas formerly one of 200 only effected the passage with the greatest difficulty. Another very important advantage is to be found in the reduction of the dues, which are diminished nearly to one-half of their former amount.

To the fertile provinces situated along the route of this splendid river Europe is indebted for a large portion of its cereals. They are essentially corn-bearing provinces, and, if necessary, could feed nearly the remainder of the Continent. Owing to the exertions of the commission, Soulina has become the safest port in the Black Sea, and a continually increasing number of vessels entering its waters bear testimony to its value. Seven years ago, scarcely 20,000 tons were loaded at this port; now more than 120,000 tons are annually stowed away. The construction of a port and the improvement of the channel leading to it, should be so effected as not merely to afford increased accommodation to shipping of all kinds, but also so as to reduce to a minimum the chance of accidents to the ships frequenting it. During the last six years the percentage of wrecks at Soulina has decreased from 0·80 per cent. to 0·25, and when the works are completed it is confidently anticipated that the percentage will be still further diminished. The extension of the commerce of the Black Sea has had a considerable influence upon the tariff prevailing between the Danube and foreign ports. For example, a reduction of 3s. per quarter has been made between Galatz and England, which is quite sufficient to make itself felt in the market prices of flour and corn. During last year a vessel of 1,500 tons sailed up the river, a fact that some years ago would have been regarded as next to impossible.

THE ROYAL INSTITUTION.

ON Friday, May 28, Mr. J. Norman Lockyer, F.R.S., gave a most interesting lecture on "Recent Discoveries in Solar Physics made by the Spectroscope." He said that on March 4, 1866, he first applied the spectroscope to his telescope to examine the spots on the sun, in order to see if such a course would clear up the dispute between English and French philosophers, as to whether the spots were caused by the down rush of a comparatively cool absorbing atmosphere, or whether they were holes in the photosphere, as supposed by the French. The result was that plenty of evidence of absorption was seen, but not the bright lines which would be visible in a spectrum thrown by radiating gases; hence the opinion of Dr. Balfour Stewart and others, that sun spots are due to absorption, was corroborated.

In the autumn of last year, Mr. Lockyer succeeded in seeing the red prominences round the sun, which prominences had hitherto been visible only during total eclipses, when the overpoweringly brilliant rays from the limb of the sun were cut off by the dark body of the moon. The Astronomer Royal, Mr. Huggins, F.R.S., and Mr. Stone, of Greenwich Observatory, had all previously made attempts to see the prominences without an eclipse, but unsuccessfully, because the intense light of the photosphere completely eclipsed the light from the flames. The light from incandescent solids and liquids gives in the spectroscope a continuous spectrum; hence, by using a great many prisms, the light from the limb of the sun may be infinitely diluted and weakened, but the same spectroscope will not dilute the light from the prominences to the same extent, because radiating gases give bright lines instead of a continuous spectrum. On this principle, Mr. Lockyer first saw the light from the prominences without an eclipse, the appearances presented to the eye by his instruments being the solar spectrum, with a few bright lines projecting here and there from its upper edge. In some cases, these bright lines above corresponded in position with some of the dark absorption lines in the ordinary spectrum below, whereby it was at once ascertained that the prominences consist principally of burning hydrogen gas. About the same time that Mr. Lockyer discovered in England this method of viewing the prominences, Dr. Janssen, of Paris, did the same in India. By this plan, the lines C and F of hydrogen are seen without difficulty, and so are two of the hydrogen lines in the violet. Another line of hydrogen can only be seen when the weather is very fine, and in the early observations it was thought to be missing altogether. The F line widens out as it approaches the limb of the sun, and the experiments of Dr. Frankland and Mr. Lockyer prove that this widening out is due to the pressure of the sun's atmosphere at different elevations, also that the said pressure, even at the surface of the photosphere, is very slight—considerably less, in fact, than the pressure of the atmosphere upon our earth. In the lecture, Mr. Lockyer gave no technical description of his spectroscope, nor did he state what the experiments were which gave Dr. Frankland and himself the stated results, nor has any such practical information yet been published. Very soon after the discovery of this method of viewing the prominences, Mr. Lockyer found out that there is a sea of fiery gas all over the sun, outside the photosphere, and that the prominences are merely gigantic eruptions of this fiery sea. This newly discovered sea of flaming gas is about 5,000 miles in thickness, and has received the name of the "chromosphere." When the chromosphere is examined during a sun storm, the spectroscope reveals that large quantities of magnesium and other vapours are upheaved into it from the photosphere below. Mr. Lockyer also pointed out that the shifting of the hydrogen lines from their normal position towards the violet or red end of the spectrum is a measure of the velocity of the motion of the flames themselves, to or from the observer. Mr. Lockyer, by means of his apparatus, can see the prominences themselves, as well as their spectra, and the following are his words on this point:—

Hearing from Mr. De La Rue, on February 27, that Mr. Huggins had succeeded in anticipating me by using absorbing media and a wide slit (the description forwarded to me is short and vague), it immediately struck me, as possibly it has struck Mr. Huggins, that the wide slit is quite sufficient without any absorptive media; and during the last few days I have been perfectly enchanted with the sight which my spectroscope has revealed to me. The solar and atmospheric spectra being hidden, and the image of the wide slit alone being visible, the telescope or slit is moved slowly, and the strange shadow forms flit past. Here one is reminded, by the fleecy, infinitely delicate cloud films, of an English hedgerow with luxuriant elms; here of a densely intertwined tropical forest, the intimately interwoven branches threading in all directions, the prominences generally expanding as they mount upwards, and changing slowly—indeed, almost imperceptibly. By this method the smallest details of the prominences and of the chromosphere itself are rendered perfectly visible and easy of observation. With regard to seeing the prominences, I find that, when the sky is free from haze, the views I obtain of them are so perfect that I have not thought it worth while to remount the oscillating slit. I am, however, collecting red and green and violet glass, of the required absorptions, to construct a rapidly revolving wheel, in which the per centages of light of each colour may be regulated. In this way I think it possible that we may in time be able to see the prominences as they really are seen in an eclipse, with the additional advantage that we shall be able to see the sun at the same time, and test the connection or otherwise between the prominences and the surface phenomena.

Although I find it generally best for sketching purposes to have the open slit in a radial direction, I have lately placed it at a tangent to the limb, in order to study the general outline of the chromosphere, which in a previous communication I stated to be pretty uniform, while M. Janssen has characterized it as "*a niveau fort inegal et tourmenté*." My opinion is now that perhaps the mean of these two descriptions is, as usual, nearer the truth, unless the surface changes its character to a large extent from time to time. I find, too, that in different parts the outline varies: here it is undulating and billowy; there it is ragged to a degree, flames, as it were, darting out of the general surface, and forming a ragged, fleecy, interwoven outline, which in places is nearly even for some distance, and, like the billowy surface, becomes excessively uneven in the neighbourhood of a prominence. According to my present limited experience of these exquisitely beautiful solar appendages, it is generally possible to see the whole of their structure; but sometimes they are of such dimensions along the line of sight that they appear to be much denser than usual; and as there is no longer under these circumstances any background to the central portion, only the details of the margins can be observed, in addition to the varying brightnesses. Moreover, it does not at all follow that the largest prominences are those in which the intensest action, or the most rapid change, is going on,—the action as visible to us being generally confined to the regions just in, or above, the chromosphere, the changes arising from violent uprush or rapid dissipation, the uprush and dissipation representing the birth and death of a prominence. As a rule, the attachment to the chromosphere is narrow and is not often single; higher up, the stems, so to speak, intertwine, and the prominence expands and soars upward until it is lost in delicate filaments, which are carried away in floating masses.

Since last October, up to the time of trying the method of using the open slit, I had obtained evidence of considerable changes in the prominences

from day to day. With the open slit it is at once evident that changes on the small scale are continually going on; it was only on the 14th inst. that I observed any change at all comparable in magnitude and rapidity to those already observed by M. Janssen. About 9hrs. 45min. on that day, with a tangential slit I observed a fine dense prominence near the sun's equator, on the eastern limb. I tried to sketch it with the slit in this direction; but its border was so full of detail, and the atmospheric conditions were so unfavourable, that I gave up the attempt in despair. I turned the instrument round 90deg. and narrowed the slit, and my attention was at once taken by the F line; a single look at it taught me that an injection into the chromosphere and intense action were taking place. At 10hrs. 50min., when the action was slackening, I opened the slit; I saw at once that the dense appearance had all disappeared, and cloud-like filaments had taken its place. The first sketch, embracing an irregular prominence with a long perfectly straight one, which I call A, was finished at 11hrs. 5min., the height of the prominence being 1min. 5sec., or about 27,000 miles. I left the observatory for a few minutes, and on returning, at 11hrs. 15min., I was astonished to find that part of the prominence A had entirely disappeared; not even the slightest rack appeared in its place; whether it was entirely dissipated, or whether parts of it had been wafted towards the other part, I do not know, although I think the latter explanation the more probable one, as the other part had increased.

Mr. Lockyer threw a fine picture of this storm in the sun upon the screen.

NOTES ON RECENT SCIENTIFIC DISCOVERIES, AND THEIR PRACTICAL APPLICATIONS.

THE PASCAL-NEWTON FORGERIES—RENOVATING OLD FILES AND RASPS—ECONOMY OF USING LIME GROUND TO POWDER—THE DENSITY OF HYDROGENIUM.

WE alluded in our number for June 4 to a process for copying old writing, which was said to enable us to decide approximately on the age of a written document, and mentioned the willingness of M. Chasles to submit some of the letters said to have been written by Pascal to this test. The operation was confided to M. Balard, who has found that dilute hydrochloric acid has no effect upon the ink, from which circumstance he is disposed to infer the antiquity and genuineness of the documents. It is hardly necessary to say that we regard the test as altogether inconclusive. The clumsiest forger would never think of imitating ancient writing with modern ink; and although, as we said, inks containing iron have been known in Europe from a very early time there can be no doubt that the composition most commonly employed was prepared with some form of carbonaceous matter as its colouring base. It resembled, in fact, Indian ink. On such a preparation, hydrochloric acid would have no effect. If it were worth the trouble, an experiment might be made on some of Chatterton's forgeries, which are still, we believe, in existence. With regard to this pretended Pascal-Newton correspondence, invented to deprive our great philosopher of the honour of his chief discoveries, we need only say that at the last meeting of the Academy of Sciences, M. Le Verrier conclusively proved its unauthenticity from the internal evidence of the letters themselves. The sources from which the matter of many of them was taken was clearly shown, and the exposure of this most audacious forgery of modern times was complete.

We make an addition to the notice we gave a few weeks back of a process for renovating worn down files and rasps. The tools, when immersed in the mixture of nitric and sulphuric acids and water, are connected with the positive pole of a battery, and the negative pole is formed of a spiral of copper riband surrounding the tool. Ten or twenty minutes' action with a dozen of Bunsen's cells suffice, in general, it seems to eat out the cuttings so as to restore the file or rasp to a useful condition. Without having much faith in the process, we mention it because we are told that it is employed with success in some large workshops in Paris, and that one railway company renovates by its means "some thousands of files every week."

The economy of using lime ground to powder instead of slaking it in lumps is the subject of an able report by a French engineer, who estimates the loss in lumps at 25 per cent. Besides this saving of material, it is clear that the mortar will be more easily made, and, being smoother, will be spread with greater facility, thus saving time. It is said further that the mortar sets quicker and more solid. Lime in powder is also transported more easily than in lump, and we read that the works on the Suez Canal have been executed with the powder shipped from Marseilles. The assertion that lime keeps better in powder than lump is, we think, open to doubt. Still, we are quite willing to believe that many advantages may be derived from the use of the material in fine powder.

We may add a few words in extension of our notice last week of Mr. Graham's new researches on hydrogenium. When hydrogen is occluded by palladium wire, the wire elongates. When the hydrogen is expelled by the application of heat the wire retracts again, and to less than its original length. Thus Mr. Graham is led to suppose that when the hydrogen enters the palladium molecules retract, and since the permanent retraction is just about equal to the temporary elongation, the hydrogen would appear to occupy double space it might be supposed to occupy if the elongation only be considered. It is for this reason that Mr. Graham now concludes that the density of hydrogenium must be assumed to be about half that he originally stated. A series of experiments made with alloys of palladium with other metals—platinum, gold, silver, and others—supports this opinion. When, for example, hydrogen is occluded by an alloy of palladium and platinum, no retraction follows the expulsion of the gas by heat, although the expansion is about twice as great as with pure palladium. It would seem, then, in this case, that the platinum sustains the palladium, that no retraction of the molecules of this metal takes place when the hydrogen enters, and thus there is no permanent retraction when the gas is expelled. Corresponding results were obtained with alloys of palladium with gold and silver, which occlude smaller volumes of the gas than the alloy previously mentioned. All the results, however, point to the conclusion that "0·73 may be accepted provisionally as the approximate density of hydrogenium."

PARLIAMENTARY NOTES.

THE sanitary condition of the School of Musketry at Hythe appears open to improvement, if we may judge from Lord Kinnaird's remarks, when moving for a report upon the subject in the House of Lords on Monday evening. His Lordship wished also to know the number of officers reported sick between March 1 and April 30, 1869, and the cost of maintaining the establishment of the School of Musketry there for one year. In moving for this return, he wished it to be distinctly understood that he did not in the least degree wish to disparage the great importance of this school for the British army. Considering the marked improvements that were being made in the small arms, it was absolutely necessary that the British soldier should thoroughly understand their use, and that the officers should know how best to turn them to account. In the spring, his attention was called to the outbreak of fever at Hythe, and he accordingly paid a visit to that place. He found that the drainage of the town flowed into an open canal belonging to the Government, which was originally constructed for the purposes of defence, which was covered with decayed vegetable matter. The canal runs at the foot of the barracks, and under the barracks was a ditch partly open and partly covered. There was refuse matter 18in. deep in the open parts, and he would leave their lordships to imagine what state the covered parts were in. He was informed that in hot weather, with a south-west wind, the smell was very unpleasant. It was only right to say that the medical officer did not attribute the outbreak of fever to bad drainage, but to the officers throwing off their winter clothing owing to the hot weather suddenly setting in; but it was singular that thirty or forty men should have been attacked in a similar manner to the officers by fever which very much resembled the jungle fever of India. To some extent, the medical officers stated the place was unhealthy, and that the men from India, with weakened constitutions, could not stand the severity of the two months' drill at Hythe, and it was necessary, he (Lord Kinnaird) understood, to cram three months' drill into two in order to accommodate a proper number of men within the year. The lecture room was in a garret close to the slates, in which 150 men were seated at a time, and these had to succeed each other so rapidly in classes that it was most unhealthy for the men. He considered that Fleetwood contrasted most favourably with Hythe, and he suggested whether it would not be desirable to reopen it as a school of musketry.

In the House of Commons, on the same evening, Mr. Alderman Lawrence asked the Secretary of State for the Home Department if the attention of the Government had been directed to the late accident in the neighbourhood of Carnarvon, caused by the explosion of nitro-glycerine; and, if so, whether they would take means to prevent so dangerous and explosive an article as nitro-glycerine, which was almost exclusively used for mining purposes, being either stored within or transported through the metropolis.

Mr. Bruce said he was not at all surprised at the question of his hon. friend, because he could not but admit that his anxiety is very well founded. Legislation in reference to the transport of nitro-glycerine already existed, but it was not effectual in the case of the explosion at Carnarvon, for, so far as he was aware, no breach of the regulations took place. If it had occurred in a populous district, or a large town, a large sacrifice of human life might have taken place, and immediately after he received intelligence of the sad misfortune he directed an inquiry to be made, by a competent authority, whether it is possible to deprive nitro-glycerine, during transport, of its explosive qualities. To that inquiry he had not yet received a definite answer. If there were any means of making it non-explosive he thought it was absolutely necessary that they should be enforced on all persons who convey it. If there were no such means, he thought its conveyance ought to be absolutely prohibited. There *are* means of depriving this deadly material of its power during transport, and again restoring it when required for use, by admixture with methylated spirit. But far better than this would be the employment of dynamite, a mixture of nitro-glycerine and sand, and which cannot be exploded except by a percussion fuse. There is also the safety gun cotton, as prepared by Messrs. Prentice under Professor Abel's pulping process, and which only burns quietly out when ignited, even in quantity, in an unconfined condition. But when fired in a close chamber, such as a gun barrel or blast hole, its full energy is developed.

Later on in the evening, and in a committee of the whole House, Sir J. Hay obtained leave to bring in a bill to prohibit the importation and regulate the conveyance of nitro-glycerine, and the bill was afterwards introduced and read a first time.

The recent boiler explosions appears to have put nervous members on the *qui vive* as to the steam power employed in the Houses of Parliament, for Mr. H. B. Sheridan gave notice that on Tuesday he would ask the President of the Board of Trade whether he had yet received a full account of the number of persons killed and injured by the terrible explosion at Bingley, which occurred about three weeks ago, and whether it was true that twenty persons were killed and nearly forty persons seriously injured by that explosion; and whether he could give any information as to the loss of life and property and the injury to individuals which had resulted from the boiler explosions which had since occurred, viz., at Wheal Bassett, near Redruth; at Lord Durham's Sherborne House Colliery, at the Abergwawr Colliery, at Calderbank, belonging to the Monkland Iron and Steel Company; and the one on Monday last, at Nuneaton, on property belonging to Mr. Newdegate, M.P. The hon. gentleman also gave notice that he would ask the First Commissioner of Works whether it was true that a large number of boilers were under the Houses of Parliament, and what number of boilers are under the floor of the House of Commons, and what is the size and capacity of such boilers and the pressure per square inch, and whether the boilers under the floor of the House are periodically tested and examined, and when they were last thoroughly inspected and examined, and by whom?

On Tuesday, Mr. Sheridan put the question, so far as it related to the explosions in question. He, however, omitted all notice of the boilers under the Houses of Parliament, having, doubtless, been satisfied in the meantime that he had nothing to apprehend from a blow-up in that quarter, at any rate. Mr. Lefevre's reply to the question which was put was to the effect that neither he nor the Home Office had received any information on the subject; consequently, he was unable either to deny or confirm the statements to be inferred from the questions.

THE INSTITUTION OF CIVIL ENGINEERS.

THE council of the Institution of Civil Engineers have awarded the following premiums:— 1. A Telford medal, and a Telford premium, in books (to consist of a complete set of the publications of the Institution), to M. Jules Gaudard, C.E., Lausanne, for his paper "On the Present State of Knowledge of the Strength and Resistance of Materials." 2. A Telford medal, and a Telford premium, in books, to William Shelford, M. Inst. C.E., for his paper "On the Outfall of the River Humber." *3. A Watt medal, and a Telford premium, in books, to Zerah Colburn, M. Inst. C.E., for his paper "On American Locomotives and Rolling Stock." 4. A Telford medal, and a Telford premium, in books, to Thomas Nesham Kirkham, M. Inst. C.E., for his paper "Experiments on the Standards of Comparison employed for Testing the Illuminating Power of Coal Gas." 5. A Telford medal, and a Telford premium, in books, to John Ellacott, M. Inst. C.E., for his "Description of the Low Water Basin at Birkenhead." 6. A Telford medal, and a Telford premium, in books, to Professor David Thomas Anstead, F.R.S., for his paper "On the Lagoons and Marshes of certain parts of the Shores of the Mediterranean." 7. A Telford premium, in books, to William Henry Wheeler, M. Inst. C.E., for his "Description of the River Witham and its Estuary, and of the various Works carried out in connection therewith, for the Drainage of the Fens and the improvement of the Navigation." 8. A Telford premium, in books, to James Robert Mosse, M. Inst. C.E., for his paper on "On the Mauritius Railway, Midland line." 9. A Telford premium, in books, to Imrie Bell, M. Inst. C.E., for his paper "On Sinking Wells for the Foundations of the Piers of the Jumna Bridge, Delhi Railway." 10. A Telford premium, in books, to John Milroy, Assoc. Inst. C.E., for his "Description of Apparatus for Excavating the Interior of, and for Sinking, Iron Cylinders." 11. A Telford premium, in books, to Samuel Parker Bidder, jun., Assoc. Inst. C.E., for his paper "On Machines employed in Working and Breaking Down Coal, so as to avoid the use of Gunpowder." 12. A Telford premium, in books, to Charles John Chubb, for his paper "On Coal-getting Machinery as a substitute for the use of Gunpowder." 13. The Manby premium, in books, to David Marr Henderson, Assoc. Inst. C.E., for his paper "On Lighthouse Apparatus and Lanterns."

The Council have likewise awarded the following prizes to students of the Institution:—A Miller prize to Edward Bazalgette, Stud. Inst. C.E., for his paper "On the Use of Concrete in Building Operations." 2. A Miller prize to Frederick Harry Mort, Stud. Inst. C.E., for his paper "An Inquiry into the Nature and Causes of some Discrepancies between Theory and Practice." 3. A Miller prize to Tristie James Ellis, Stud. Inst. C.E., for his paper "On the Artistic Design of Bridges." 4. A Miller prize to Thomas Robert Gainsford, Stud. Inst. C.E., for his paper "On the Construction of a Railway Tunnel or Covered Way at Bradford, Yorkshire, among Abandoned Coal and Ironstone Workings." 5. A Miller prize to Charles Henry Grey Jenkinson, Stud. Inst. C.E., for his paper "On Wrought-iron Girder Bridges." 6. A Miller prize to George Henry Roberts, Stud. Inst. C.E., for his paper "On Reservoir Embankments."

CASTING PLOUGH HEADS, &c.

IN casting plough heads in steel by the process at present in use, considerable expense is incurred in preparing suitable moulds of sand or loam, which require to be carefully dried, and then serve only for the production of a single casting. With the view of superseding this method, Messrs. David Greig and John Fernie, of Leeds, have patented an invention, which consists in casting the plough heads in a metal mould, by which means much labour is saved in the production, as one mould will serve for the casting of an indefinite number of heads. The metal moulds or chills are cast from models made in the ordinary way. They may be cast from moulds made in plaster, and the inventors prefer them made in steel. They are fixed with hinges to a frame, so that when the castings are made the parts of the chill swing open and the casting is quickly extracted. At the parts where the fluid steel first touches the chill a recess is made, into which loam is inserted to prevent the chill being cut away by the action of the steel. When possible, the steel is allowed to ascend into the chill from the bottom or sides instead of falling into it. The interior of the chills are coated with washes composed of clay ground, powdered blacklead, or they are smoked in the ordinary way.

The mould is constructed in some cases in such manner that when the metal contracts, portions of the mould, which, if they remained rigid, would pull or tear the casting, are allowed to yield to the contraction, and no strain is thrown on the casting while it is in the soft or plastic state. This is effected by placing in those parts of the mould subject to compression loam or sand, of sufficient thickness to resist the pressure of the fluid steel or metal, but of so open a nature and of such a form as to give way or crumble with a slight compression. The inventors also use a material having a thin face of loam to resist the metal, and a backing of a material which will melt or burn out when the heat from the melted metal penetrates through the thin face. By these means portions of the mould are allowed to contract. Another method proposed is to release those parts of the mould subject to compression by withdrawing wedge pieces immediately the metal is poured into the mould.

In casting toothed and other wheels in steel, metal moulds are also employed, and they are constructed with yielding or movable parts, as just described. In forming the moulds for casting pinions which have their teeth smaller at the root than they are at the pitch line, a number of small pieces of metal, corresponding to the spaces between the teeth are employed, and these are arranged in the interior of the mould; they are of such a form that they will be drawn in when the contraction of the metal takes place.

In casting crank axles in cast steel the moulds are of such an internal form that the proper twist, right or left hand, is given to the ingot, and when the metal has been poured into the mould the inventors force in, by screws or hydraulic power, blocks of metal through the sides of the mould into the throws of the cranks, at those parts where the casting has to be cut out when forming the crank pins. By this means they prevent the formation of unsoundness in the throws, which would otherwise happen from the metal remaining longer hot in those parts in consequence of their larger size. In making double-crank axles the portion of the mould between the webs or throws is allowed to contract by the means already described, so that no strain is thrown on the casting between the webs in consequence of contraction.

* Has previously received a Telford medal.

STEAM BOILER EXPLOSIONS.

OUR readers are aware a bill providing for the periodical inspection of steam boilers has been prepared and brought in Parliament during the present session by Mr. Henry B. Sheridan, Mr. Vickers, and Mr. Brady. The following is a copy of the bill:—

Whereas it is expedient that Her Majesty's subjects should be protected by a proper system of inspection and registration from accidents occasioned by the explosion of steam boilers:

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in the present Parliament assembled, and by the authority of the same, as follows:—

1. From and after the day of one thousand eight hundred and the Lords of the committee of Her Majesty's Privy Council appointed for trade and foreign plantations, hereafter called the Board of Trade, shall have power, and they are hereby required, immediately after the passing of this Act, and from time to time, to issue rules and orders by which a complete and effective system of registering, inspecting, testing, and ascertaining the safety and security of steam boilers in the United Kingdom of Great Britain and Ireland shall be established and carried into effect, and such rules and orders shall have the same legal authority and effect as if they were incorporated in and formed part of this Act: Provided always, that all such rules and orders shall be placed before Parliament within six months after they have been issued by the Board of Trade.

2. A registrar and inspector-general of steam boilers for the United Kingdom of Great Britain and Ireland shall be appointed by the Board of Trade immediately after the passing of the Act, and the duties and powers of such registrar and inspector general shall be defined and governed by the said rules and orders to be issued by the Board of Trade. Such salary as Her Majesty's Treasury shall deem an adequate and proper remuneration for the services to be performed by the said registrar and inspector-general shall also be paid to him under and by virtue of this Act out of such funds as Parliament shall provide for that purpose.

3. The registrar and inspector-general of steam boilers appointed under and by virtue of the last preceding section shall, subject to the said rules and orders of the Board of Trade, have power to appoint deputy registrars and sub-inspectors, with such salaries and allowances as he shall deem necessary and proper, the said salaries and allowances to be paid out of such funds as Parliament shall provide for that purpose; and, to give effect to the authority, powers, and duties to be exercised and performed by such deputy registrars and sub-inspectors, the said registrar and inspector-general, having regard, nevertheless, to the said rules and orders of the Board of Trade, shall limit and confine the authority, powers, and duties so to be exercised by the said deputy registrars and sub-inspectors to the counties, cities, towns, and districts particularly indicated and set forth in written instructions to be issued to them by the said registrar and inspector-general.

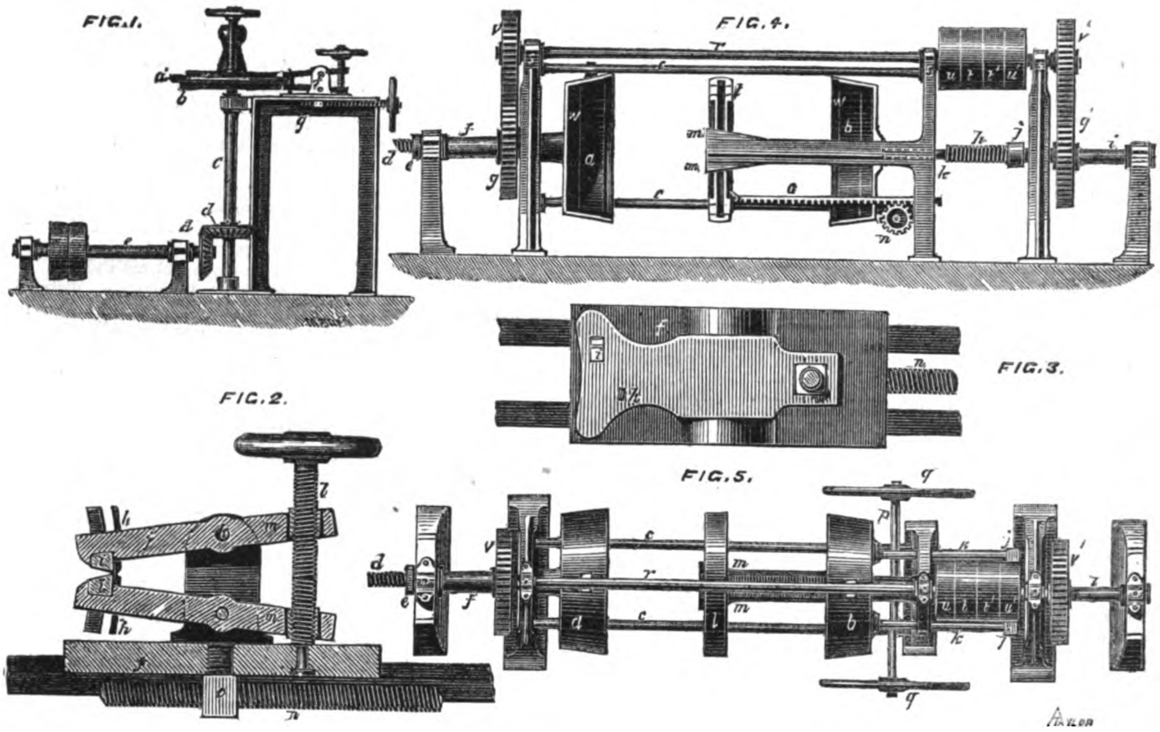
COAL IN PRUSSIA.

SOME facts relating to the consumption of coal, compiled from official sources, are given in the "North German Correspondent." It appears that the consumption of English coals in Berlin and the Prussian inland provinces has for some years past shown a gradual diminution, owing to the increasing use of Silesian and Saxon (Zwickau) coals. Notwithstanding this, the whole importation of English coals into the Zollverein from 1857 to 1867 shows an augmentation of 4,418,300 centners, or 22 per cent., an increase entirely owing to the very large consumption of these coals in the maritime provinces of Prussia, which can procure them cheaper by sea from England than from the interior, or from Saxony by land carriage. In the ports of the North German Confederation English coals are yearly becoming more important as an article of commerce. In 1867 Lübeck imported 22,299 tons; Memel, 35,319; and Neufahrwasser, 16,840; or, together, 74,458 tons of English coals; and there is not a single Baltic port in which their purchase and sale do not give rise to large transactions every year. The "Staats-Anzeiger" collates the quantities of coals raised in England and Prussia respectively during the years 1867 and 1868. In Great Britain, in the former year, 3,195 coalpits, with 333,116 workmen, produced 105,078,000 tons, or 2,133,083,000 zollcentners. In 1868 the production had fallen to 104½ millions of tons, or 2,121 millions zollcentners, while the number of pits had risen to 3,291, and that of the miners to 346,820. In Prussia, during the year 1867, 426 pits, with 102,773 workmen, produced 420,571,116 centners of coals, and in 1868, with 106,348 men, they yielded 454,486,660 centners. While the coal production of Great Britain in the year 1854 was ten times greater than that of Prussia, being 64,661,000 tons, or 1,312,618,300 centners, against 136,225,096 centners, in 1867 it was only five times as great, and in 1868 only 4·6 times. Leaving out of account the recent territorial acquisitions of Prussia, we find the production of coals in the old provinces amounted in 1868 to 4·7 of that of Great Britain. While the amount of coals raised in the latter country from 1854 to 1868 increased by 40 millions of tons (812 millions of centners), or 62 per cent., it rose in the old Prussian provinces to no less than 310,379,729 centners, or 227·8 per cent. The average yield of a coalpit in Great Britain in 1867 was 667,000 centners, and 644,000 centners in 1868; in Prussia it was 987,000 centners in 1867, and 1,067,000 centners in 1868. On the other hand, the average quantity raised by each miner in the two years was 6,398 and 6,116 centners in Great Britain, and 4,092 and 4,273 centners, or 48 per cent. less, in Prussia. The proportion of accidental deaths of miners in 1867 was 1 in 280, and for every 1,792,490 centners of coals produced in Great Britain; in Prussia one man in 352·5, and for every 1,440,157 centners raised. Of the entire accidents in British mines in 1867, 24·3 per cent. were caused by explosions, against 13·31 in Prussian pits; 37·73 per cent., against 36·13 in Prussia, by earth-slips; 17·73 per cent., against 25·26 in Prussia, by other accidents underground; 7·40 per cent., against 3·7 by accidents above ground; and 13·11 per cent., against 22·18, by accidents in the shafts.

FIVE beautiful pearls, found at the newly-discovered fisheries in Western Austrlia, were brought to this country by the last mail.

CASK-MAKING MACHINERY.

BY MR. JOHN REID.



REID'S CASK-MAKING MACHINERY.

IN our last issue we described and illustrated some portions of the cask-making machinery invented by Mr. John Reid, of Glasgow, particulars of which we took from the "Brewers' Journal." We now conclude our notice with a description of his machinery for forming the sides of barrels, and of his trussing machine, which are illustrated in the accompanying engravings. Fig. 1 is a side elevation of the first-named machine; the bars *a*, of which the ends are constructed, are placed on the revolving table *b*, which is fixed to the vertical shaft *c*, actuated by the bevel wheels *d*, from the shaft *e*. The cutters by which the ends are cut to the circular form, and to the required bevel around the edge, are carried in a saddle *f*, mounted on a slide on the table *g*. Fig. 2 is a horizontal section of the saddle, showing the cutters, and fig. 3 is a plan of the same, drawn to an enlarged scale. *h h* are the cutters by which the ends are cut to the circular form, each cutter cutting half through the bars *a*. The edges are cut at the same time to the required bevel by the cutters *i i*. The holders *j j* are centred by the axes *k k*, and are gradually brought together by the right and left-handed screw *l*, working in swivelling nuts *m*. The saddle is slid backwards and forwards by the screw *n*, working in the nut *o*, so as to suit any required diameter of end.

Fig. 4 is a sectional elevation of a trussing machine, upon Mr. Reid's improved principle, fig. 5 being a plan of the apparatus. It consists of two circular frames or cones *a b*, placed one at each end of the machine, and supported on the guide bars *c*. During trussing operations, the cones travel towards and from the centre of the machine, the cone *a* being actuated by the screw *d*, which passes through and works in a nut *e*, at the end of the hollow shaft *f*, on which the spur wheel *g* is keyed. The cone *b* is actuated by the screw *h*, which is formed on the end of the shaft *i*, and works in a crosshead *j*, which is attached to the cone by the rod *k*. Midway between the cones is placed an expanding and contracting disc *l*, which is slid backwards and forwards upon the inclined planes *m* by the pinion *n* gearing into the toothed rack *o*. The pinion *n* is keyed on the cross shaft *p*, which is rotated by the handwheels *q*. A shaft *r* is supported upon the standards *s*, and is fitted with two fast pulleys *t* and *t* ¹, one being operated by an open belt for drawing the machine in one direction, and the other by a cross belt for reversing it. Two loose pulleys *u* and *u* ¹ are provided for stopping the machine. The screws *d h* which actuate the trussing cones *a b* are operated by the pinions *v* and *v* ¹ gearing into the wheels *g* and *g* ¹.

The *modus operandi* of the trussing machine is as follows:—The cones are drawn apart to a distance a little less than the length of the staves to be used, and the disc *l* is expanded by being pushed towards the centre of the machine, until the diameter of the disc is equal to the greatest internal diameter of the barrel. The binding hoops are placed in the recesses *w*, which are formed in the trussing cones. The staves are now built round the expanded disc, and the bottom or one end may be placed in at one end of the staves which rest in the cone *a*. The cones are then moved simultaneously towards the centre by the actuating mechanism, until the ends of the barrel have nearly arrived at the bottom of the cones. The machine is then thrown out of gear until the disc is drawn back and contracted by means of the rack and pinion. The machine is then reversed, and the cones are moved outwards, leaving the hoops which were placed in their recesses on the barrel, which is now removed from the machine. The disc is afterwards pushed forwards and expanded to the proper diameter for building up the next barrel.

THE EAST RIVER BRIDGE, U.S.A.

THE plan of the East River bridge, as proposed by Mr. Roebling, has met with the approval of the Board of U.S. Engineers, appointed to examine it, and of the Government, and has been fully adopted by the Board of Consulting Engineers, consisting of Horatio Allen, William J. McAlpine, J. J. Serrell, Benjamin H. Lathrop, James P. Kirkwood, and J. Dutton Steele, who have made to the directors of the Bridge Company their final report, of which the following is the substance:—The plans, including foundations, towers, and superstructure have been laid before the Board by Mr. Roebling at various times between February 16 and April 26, and from him they have received the fullest information touching all the details. Having completed the examination of the plans and the investigation of the combinations and proportions proposed, the Board deemed it an appropriate part of their duty to examine the structures of the same general character erected by Mr. Roebling across the Monongahela and Allegheny, at Pittsburgh, in 1846 and 1860; across the Niagara Falls in 1850, and across the Ohio, at Cincinnati, in 1860. They have thus had an opportunity of learning the successive steps in bridge building, which, beginning with a span of 822 in 1854, and one of 1,057ft. in 1867, all standing this day—a practical demonstration of the soundness of the principles and proportions on which these structures have been erected, and rendering unnecessary, at least for spans of 1,000ft., any other demonstration, and affording the best source of information as to the practicability of taking another step in a span of 1,600ft. The bridge proposed by Mr. Roebling, a steel wire cable suspension bridge, 1,600ft. between the towers, 135ft. above the water, will be, in the opinion of the board, a durable structure of a strength sufficient to withstand six times the strain to which it can under any circumstances be subjected, that it will bear the action of the greatest storm of which we have any knowledge, and that the method of joining the parts cannot be surpassed for simplicity and security in the result.

STEAM FIRE ENGINE FOR THE GREAT WESTERN RAILWAY.

CONSIDERABLE interest was excited at Swindon on Saturday last, the 10th inst., by the trial of a new steam fire engine, selected by Mr. Armstrong, after a careful investigation, for the protection of the railway works. The engine is one of Shand, Mason, and Co.'s medium size, so well known in London, the provinces, and foreign countries; but the principal novelty was in the application of their new patent inclined water tube boiler. The experiments were conducted under the superintendence of Mr. Armstrong and Mr. Dean, in the presence of a number of gentlemen connected with the Swindon Works, the following being Mr. Dean's attested statement of the time occupied in getting up steam:—Fire lighted at 40sec. after 1 o'clock p.m., cold water being used, with oak shavings and broken wood from the workshops as fuel; 5lb. steam pressure was obtained in 3min. 50sec., 10lb. in 4min. 28sec., 20lb. in 5min. 12sec. (when a jet of steam was admitted into the chimney), 30lb. in 5min. 55sec., 60lb. in 6min. 33sec., and 100lb. in 7min. 5sec. At this pressure, which was easily maintained throughout the trial, the engine was started. Various jets, up to 1⅜in. diameter, were used, the water being projected upwards of 200ft. The steady working of the engine, and the remarkable steaming properties of the boiler, were admired by all present, although at a previous workshop trial 100lb. steam pressure was obtained in 6min. 40sec. The Metropolitan Fire Brigade are now under the necessity of using gas at a very great cost to keep hot water in the boilers of their steam fire engines, in order to reduce the time for raising steam—an expense which would be entirely saved by the use of the new boiler.

THE CLOCK OF BEAUVAIS CATHEDRAL.

FROM the remotest periods man has felt his way towards measuring that impalpable agent, ceaselessly progressing, never resting time. He has measured it by torches of pitch which should burn regularly. He has invented the hour-glass and the clepsydra, where grains of sand or drops of water falling from one vessel into another indicated its passage. He has invented the sun dial. What

has he not imagined, from the time when, having discovered the mariner's compass in 1303, he perceived and applied the principle of gravity as it exists in the pendulum. This was the great advance, the chief step forward which opened the door of discovery to the learned to the mysteries of astronomy. By the exact measurement of time some of the greatest natural problems had been solved. But that man who would ask of horology nothing more than the indication of the time for his repasts and his repose, is profoundly indifferent to its aim and object. However, an inventive genius constructed the clock of the cathedral of Strasbourg which indicates a mass of things unrecorded in the almanacs of the period. This was regarded with the veneration with which a saint was invested, speaking a dead language unknown to the multitude. Since that time, mechanical invention has become so general that the clock of Alsace has ceased to be a mystery to all but the learned, the possession of a time-keeper being now common to most of us.

Something novel was further desired, and this novelty a clock maker of Beauvais has given us. But this is a little history. Do you know the cathedral of Beauvais? The span of its roof leaves a space of full 50 yards. This is unfinished, and for 200 years nothing but an ugly wall saluted the eye as a blemish on this colossal monument. To cover this defect the chief inhabitants (to the number of 10) met and clubbed together to place there a monumental clock. To accomplish this purpose, money and an horologist were required. The clock maker was at hand, a fellow townsman had just finished a splendid work for Besancon. A sum of £1,600 having been collected, the work was begun. Twenty workmen, 10 of whom are clock-makers, have been at work for four years. The accomplishment of this great work leaves far behind all previous attempts in this direction. The result is a work composed of 14 different movements consisting of 90,000 pieces, weighing over 35,000lb. and costing £5,600, or £4,000 more than the sum first collected, but against this excess is to be reckoned a *chef d'œuvre* which future ages may well be debited with. The body of the clock is 36ft. high, it is made of sculptured oak in columns, and measures 16ft. in breadth by nearly nine in depth; the whole is finished in the byzantine style of decoration. The figure of the Supreme Being from the summit of the clock, at every hour, by a solemn gesture, calls attention to the saints who are at their alcoves yielding attention to the sounds which accompany the crowing of a fine cock.

The main dial, there are 50 in all, is occupied by the figure of the Saviour enamelled on copper, the largest work in enamel existing; it cost £130. Above their divine Master the 12 apostles, also in enamel, figure in a circle artistically expressive of devotion. Two hands of steel covered by platinum move over this dial through 24 divisions; it is pierced, as are all the others, and shows the pendulum, weighing nearly 1cwt., which renews its impulse from a steel ball weighing a gramme, or about the 32nd part of an ounce. This impulse is thoroughly the product of mechanical inventiveness, and is, as it were, an allegory exhibiting the submission of brute force to intelligent direction. This movement impels the 14 others, and is wound up weekly, being driven by weights in the usual way. The other dials indicate:—The days of the week. The movements of the planetary bodies. Sun rise. Sun set. The seasons. The signs of the Zodiac. The duration of daylight. The duration of night. The equation of time. The dates. The saints' days. The months. The phases of the moon. The age of the moon. The time at the principal cities of the world. The solstices. The movable feasts. The age of the world. The year of the century. The bissextile years. The longitudes. The number of the century. This portion of the machinery exhibits no indication more than once in 100 years, but nothing more is required than to wind the machine every eighth day. Other dials show further:—The tides. The eclipses for all the world, both total and partial. At the hour when the sun or moon is eclipsed in the heavens, to the minute even, the sun or moon suffers obscuration on the clock. To form a correct appreciation of the enormous work and calculation in this great machine, unequalled anywhere, which has its separate movement from that which shows seconds of time to those which indicate events occurring not oftener than once in 100 years, it must be remembered that three centuries out of four the last year leaps its bissextile. In these years the clock has to leap from February 29, and goes from the 28th to the 1st of March. Here is a movement occurring only in 400 years. What is left but to admire the inventive genius which has combined in one harmonious whole and subjected to a uniform direction 90,000 separate pieces, all uniting to measure and indicate the footsteps of time, showing the positions of the smaller and the greater heavenly bodies in both worlds; even those we see nothing of, which exist in the other hemisphere, and of which this clock faithfully records the rising and setting. The inhabitants of Beauvais possess a wonder of the world, and we are indebted to them for showing it at the Exhibition of Paris, where its modest inventor explained its operations, and who by a remarkable coincidence bears a name strictly in harmony with his devotion to exact science. His name is Verite. —Translated from the "Petit Journal," of Paris, by S. J.

Note:—Mr. Steckelburger, of Strasbourg, jealous for the honour of his native town, protests as follows against the assumption that the Beauvais clock is unequalled:—Mr. Mauremont says that the astronomical clock of Strasbourg has no longer any secrets for anybody. For a very good reason, indeed! He is speaking of that which was constructed in 1574 by Isaac Haberecht. How could this poor machine have any secrets for any one, since it was taken down 30 years ago, and the various parts placed in the religious establishment of Notre Dame, where it may still be seen. But this is not the clock we have to do with; the present clock dates from 1842: it is that constructed by Mr. Schwilgue.

I could not suppress a smile at the catalogue of indications said to be shown by the Beauvais clock, for our cathedral clock shows all these and some besides. It shows all the wonderful things in the almanacs, and all the astronomical calculations possible and perpetual. It contains an ecclesiastical computator with all its indications; the golden number, the epacts, dominical letter, solar cycle, &c.; a perpetual calendar with the movable feasts, a planetarium on the Gopernican system, showing all the mean equinoctial revolutions of every planet visible to the naked eye; the phases of the moon; the eclipses; apparent and and sidereal time; a celestial sphere showing the precession of the equinoxes, the solar and lunar equations for the reduction of the mean motion of the sun and moon to true time and place. What else I hardly know. The Beauvais clock makes a change in every fourth century; a great merit! The precise indication is exhibited here, but ask an astronomer what is meant by the precession of the equinoxes. He will tell you it is a movement in the stars describing a complete revolution round the earth in the space of about 25,000 to 26,000 years. Well, Sir, in the Strasbourg clock is a sphere following exactly this motion, and whose rotation is of that kind as to ensure one revolution in 25,920 years. The thing can be measured and indicated; it is unnecessary to await its accomplishment: it would be too remote. If your correspondent will but pay a visit to Strasbourg, I shall be pleased to conduct him to this famous work of our regretted M. Schwilgue.—"Horological Journal."

MANURE FOR HOP GROUNDS.

THE economical habits of our neighbours of France offer us many useful lessons, especially in those industries in which scientific questions enter largely; and, when properly understood there are few industries indeed which do not come under this head. The question of the proper kind of manure for hop plantations is one that has been largely discussed; and we see by the "Brewers' Journal" that M. Gueymard, of Grenoble, has done good service in showing what kind and what quantity of manure the hop plant itself supplies towards its own reproduction. Having analysed chemically the composition of the stalks, leaves, and cones or flowers, he finds that they contain the following percentages of fertilizing substances:—

	Stalks.	Leaves.	Flowers.
Soluble salts of potash .	1·41	2·02	2·92
Carbonate of lime . .	2·58	8·00	2·53
Magnesia . . .	0·31	1·70	0·60
Phosphoric acid . .	0·80	1·26	1·26
Oxide of iron and alumina	0·38	1·70	0·70

If, then, the leaves as well as the stalks of the bine, cut up in a chaff-cutting machine, as recommended by M. Gueymard, be left on the ground as manure, nothing more requires to be added but the fertilizing principles taken away by the flowers, which average about one ton per hectare (2½ acres), and, consequently, contain about 44lb. of potash and 15lb. of phosphoric acid, as the magnesia, alumina, silica, oxide of iron, and carbonate of lime, are usually more plentiful in the soil than necessary for the nourishment of the plant. To replace the potash and phosphorus, the amount of manure required will be but small, and M. Gueymard estimates it at five to six tons, or about one-third the quantity usually employed; or, in other words, the use of the leaves and stalks of the hop plant causes a saving of two-thirds of the quantity of the manure commonly applied to hop plantations. If this estimate be correct, it is well worthy of consideration and trial.

A CONVICTION under the Sea Birds Act occurred at Bridlington on Saturday last. Mr. Fraser, india-rubber manufacturer, Sheffield, was charged before a bench of East Yorkshire magistrates with having shot twenty-eight seagulls at Flamborough-head. The defendant was fined in the mitigated penalty of 2s. 6d. for each bird, and 9s. costs. The full penalty for each bird is £1.

APPARATUS FOR GRINDING THE CARDS OF CARDING ENGINES.

MR. SPENCER CRIGHTON, of Ashton-on-Mersey, Chester, and Mr. John Taft, of Manchester, have patented an invention which relates to machinery for grinding the cards of carding engines in which a drum covered with grinding material revolves in contact with the surface of the cards, and at the same time traverses to and fro in order to operate upon the entire surface of the cards. The drum has previously to this invention been arranged with its axis parallel or nearly parallel with the line of direction of its traverse, and when the grinding roller has been operating upon a card roller the axis of the grinding roller has been parallel or nearly parallel with the axis of the card roller.

Referring to our engraving, fig. 1 is a front elevation, fig. 2 a plan, and fig. 3 an end sectional elevation of the machine, representing it as when operating upon two card rollers, figs. 4 and 5 are detached views of portions of the mechanism. In figs. 1, 2 and 3, *a a* are the two card rollers, and *b b* b^1 b^1 are four grinding rollers operating on the card rollers. The card rollers are mounted in the bearings *c c*, which are fitted to slide on the hangers *d d*, shown separately at fig. 4. Each of the hangers is fitted to slide on the cross rail *e*, in order that the distance apart of the hangers may be varied to suit different lengths of card rollers, each hanger being fastened by a bolt d^1 passing through a slot in the cross rail *e*. Each of the bearings *c* is connected to the lower end of a screw *f* by an attachment which will admit of the revolution of the screw, and each screw works in a nut f^1, so that the height of either end of each card roller may be separately adjusted by turning the corresponding screw by means of the hand wheel f^2. Each of the nuts f^1 is formed as a skew spur wheel, and is in gear with a second spur wheel *g* which is mounted on one of the two shafts *h h*, each of the shafts connecting together the two screws, which are employed to adjust the height of one of the card rollers, so that when the shaft rotates the screws will revolve in unison and both ends of the roller will be raised or lowered to an equal extent. The two shafts *h h* are geared together, as shown at fig. 4, and are actuated by the handwheel h^1 and the spurwheel h^2, so that by turning the handwheel in the required direction the two card rollers will be raised or lowered simultaneously.

The card rollers *a a* are each caused to rotate by means of the straps *i i* acting on the pulleys i^1 i^1, which are temporarily affixed to the shafts of the rollers, the straps being actuated by the pulleys i^2 i^2, mounted on the main driving shaft *j*. In the example illustrated, four grinding rollers are employed, the rollers *b b* being mounted on the spindle *k*, and the rollers b^1 b^1 on the spindle k^1, the spindles being fitted to revolve in bearings attached to the sliding carriage *l*. The carriage is fitted to slide to and fro along the bed *m*, and is actuated by the screw shaft *n* which revolves in bearings attached to each end of the bed, and works in a nut attached to the carriage. The screw shaft is driven alternately in opposite directions by means of the cross strap *o* and the open strap *p*, which are driven by pulleys on the main driving shaft *j* and put in motion. The pulley o^1 is fitted to slide on one end of the screw shaft, and the pulley p^1, which is fitted to slide on the outside of the bearing in which the other end of the screw shaft revolves, as shown in fig. 5.

The screw shaft is fitted at one end with a clutch o^2, and at the other end with a similar clutch formed on the back of the bevel wheel p^2, the arrangement being such as that when the pulley *o* is slid into gear with the clutch o^2 and the pulley *p* out of gear with the clutch p^2 the carriage will slide along the bed in one direction. On the contrary, when the pulley *o* is moved out of gear and the pulley *p* into gear, the carriage will move in a reverse direction. This movement of the pulleys is effected by the sliding rod *q* which is fitted at each end with a fork which enters a groove formed in the boss of the pulley, shown in fig. 5. A second sliding rod *r*, shown by dotted lines in fig. 1, is fitted with fingers capable of being adjusted to suit the required length of traverse of the carriage. A projecting piece attached to the carriage comes into contact with one of the fingers when the carriage approaches either end of its traverse, and communicates a sliding motion to the rod *r*, and the rod *r* gives motion to the quadrant or tumbling lever *s*, shown in plan in the small detached figure; this lever is mounted on a stud fixed to the under side of the bed, the lever continuing to derive its motion from the carriage

APPARATUS FOR GRINDING THE CARDS OF CARDING ENGINES.

BY MR. SPENCER CRIGHTON.

FIG. 1. FIG. 4. FIG. 5.

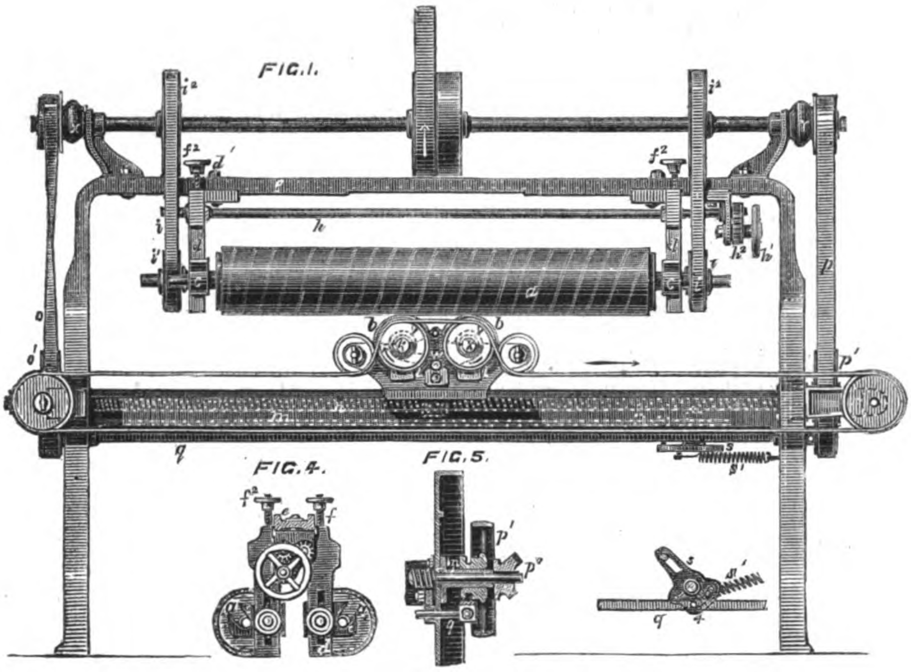


FIG. 3.

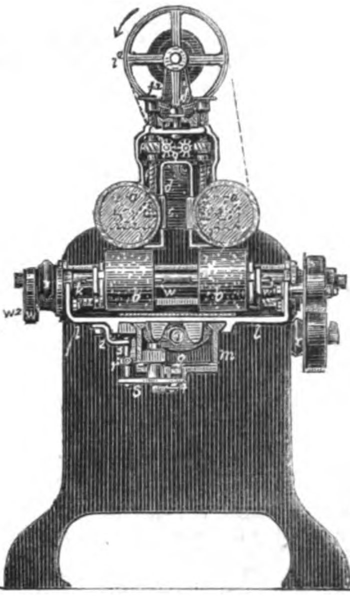


FIG. 2.

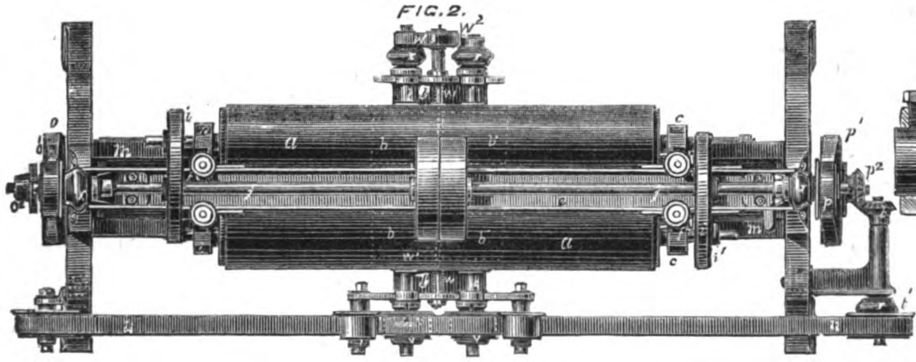
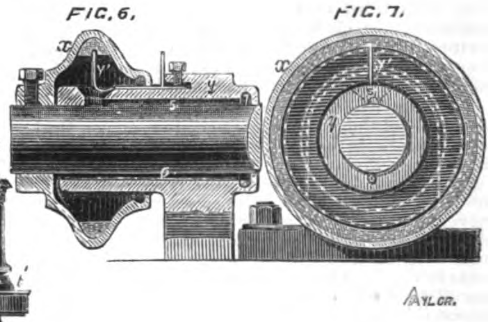


FIG. 6. FIG. 7.



until the point of attachment of the spring s^1 to the lever has to some extent passed the centre of traverse of the lever, when the spring will complete the movement of the lever and one end of the quadrant-shaped slot will strike against a stud fixed to the rod q. The rod will thereby be moved sufficiently to effect the sliding movement of the pu leys o and p.

The bevel wheel p^2 gives motion to the wheel t, and thereby to the pulley t^1 and the driving strap u, the strap being passed partly around the pulleys v v, fixed to the ends of the spindles k k^1, a revolving motion being thus imparted to the grinding rollers. To the sliding carriage is fitted a screw w, in this case formed with a right-hand thread on one end and a left-hand thread on the other end, and on the screw is mounted the double forks w^1 w^1, which enter grooves formed in the bosses of the grinding rollers. On the outer end of the screw is fixed the pulley w^2, which is driven by the end of one of the spindles by the strap w^3, so that when the grinding rollers are revolving in one direction the rollers will be caused to slide on their spindles and to approach each the other, a reverse action taking place when the grinding rollers are caused to revolve in a reverse direction.

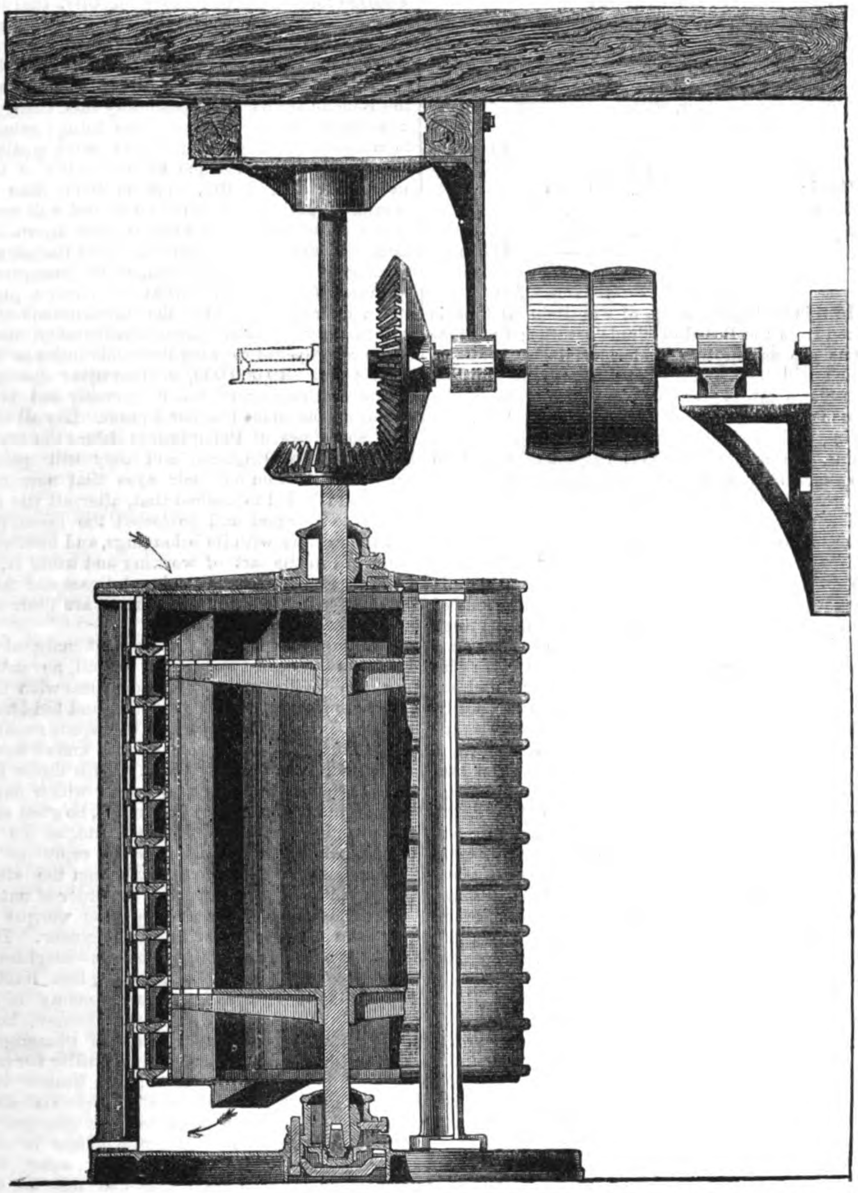
The action of the machine is as follows:—Supposing that either one or two card rollers have been placed in the bearings and adjusted with relation to the grinding rollers, and that the sliding carriage is to the left hand in fig. 1, the driving shaft is set in motion, say, for example, in the direction of the arrow. As the pulley p is in gear with the screw shaft, if the shaft be cut with a right-hand thread the carriage will traverse along the bed of the machine towards the right hand, and at the same time motion will be communicated to the strap u, and the grinding rollers will revolve in the direction of the arrows. As the strap w^3 causes the screw w to revolve, the grinding rollers will slide on their spindles in a direction towards the bearings of the spindles, and as the card rollers also revolve in their bearings, the grinding rollers being covered with emery will grind the points of the card teeth as the carriage traverses. The employment of two grinding rollers to act simultaneously upon one card roller enables the operation to be more quickly performed, at the same time that each grinding roller may be allowed to act more lightly on the card roller than if only one roller was employed.

The carriage continues to slide towards the right hand until the grinding rollers arrive at or near the end of the card roller, when the projecting piece 2 comes into contact with the finger 3 on the rod r, and moves the rod and thereby the lever s until the lever is in a position which will allow the spiral spring to act with sufficient force to continue the motion of the lever without the aid of the carriage. The quadrant-shaped portion of the lever will then strike against the stud 4 and the rod q will be moved to the left hand a sufficient distance to throw the pulley p out of gear and the pulley o into gear, which movement will reverse the direction of motion of the carriage and also of the grinding rollers. The carriage will move towards the left, and as a consequence of the reversal of the motion of the grinding rollers, the rollers will slide on their spindles in a reverse direction, that is towards each other. At suitable intervals, the card rollers are lowered towards the grinding rollers by turning the handwheel h^1, and the operation is continued so long as is advisable, the direction of motion of the carriage and also of the grinding rollers being reversed when the carriage arrives at either end of its traverse.

Lubricators x x made according to Messrs. Crighton and Taft's improvements are employed to lubricate the bearings of the machine, the lubricators being illustrated at figs. 6 and 7, where x is the lubricator and y is the bearing to be lubricated. The lubricator is fixed to the shaft or spindle revolving in the bearing, so that the lubricator will revolve and the oil contained in it will be carried round and will come into contact with the wire y^1, a portion of the oil flowing down the wire and falling into a hole formed in the top of the bearing. The oil thus led from the lubricator flows along the groove 5, lubricating the bearing and shaft in its progress, and falling into the lower groove 6 is returned to the lubricaior, the annular groove 7 preventing to a certain extent an overflow of oil at the opposite end of the bearing. This arrangement is also applicable to other purposes, as, for example, to line shafting and to beater shafts, and especially to shafts running at high speeds. In some cases, pulleys, wheels, pinions, or other revolving parts of machinery may be suitably formed to act as lubricators, as in the case of the pulleys v v, the action of the lubricators being the same as that of the example we have described. We understand that a number of these machines are at work, and they do not fail to give entire satisfaction.

APPARATUS FOR THE TREATMENT OF GRAIN.

BY MR. WILLIAM SECK.



ON THE TREATMENT OF GRAIN.

THOSE of our readers who are practically engaged in producing flour from grain prepared for grinding by the ordinary processes are aware that the greatest difficulty encountered is the separation of the flour from the bran. Assuming the possibility of their complete separation, we have the authority of Liebig for stating that 100lb. of wheat ought to yield from 92lb. to 94lb. of pure flour, and from 6lb. to 8lb. only of bran. According, however, to the present general practice of the trade, with existing machinery, 100lb. of wheat yields, on an average, only from 65lb. to 71lb. of tolerably pure flour (No. 1 quality), while there remains from 8lb. to 15lb. of scrap, or flour of a much darker shade, arising from its being largely intermingled with bran; and 18lb. of bran, ground hulls or integuments. Attempts have been made to correct these decidedly unfavourable results by improving the bolters and boltering implements; nevertheless, but little has been gained by so doing—a want of success which is readily accounted for when the following analysis of the grain is taken into consideration.

By the aid of a microscope, and even by close inspection with the naked eye, the following parts may be easily detected on the grain, viz.:—1. The beard, which consists of a tuft of very small hair tubes, of a dirty white colour. These hair tubes are of much smaller diameter than that of any grain of flour. Under the stones they are reduced to dust, which, owing to the minuteness of its particles, passes along with the flour through the bolters, and therefore cannot be kept separate from it; moreover, owing to the nature of the beard, it follows tha, an additional quantity of other dust and dirt adhering firmly to the hair tubes, will likewise go through the bolters with the flour. 2. The germ, which forms a conical projection on the under part of the grain, and strongly adheres thereto, but, being of a dirty yellow or of a brownish colour, is readily discernible from the rest of the hull. As the germ does not contain any farinaceous matter, such as the kernel, but is of a horny substance and therefore very hard, it is impossible to strip it off under the stones, as is done with the bran, because, like the beard, it grinds into very small particles and passes through the bolters with the flour, to which it imparts a considerably darker shade. 3. The husk, which appears rough and wrinkled, is partly disengaged from the other skins, loosely envelopes the kernel, soon becomes very dry and hard, and, under the stones, breaks up into small prismatic ingredients, which, by passing easily through the bolters, not only give a dismal dark shade to the flour, but appear as coloured spots upon it.

The combined weight of the beard, germ, and outer skin, is equal to about from 1 to $1\frac{1}{2}$ per cent. of the entire weight of the grain. Although it might appear that so small a quantity as from 1 to $1\frac{1}{2}$ per cent. of such matters could not materially deteriorate the quality of the flour, it is nevertheless a fact that it does so, inasmuch as it reduces the yield of No. 1 flour from the grain to the extent of 10 per cent.; a fact which can be readily demonstrated by mixing 1lb. of dust with 10lb. of flour, which will thereby become converted into a dark spotted mass, representing the lowest quality of flour. As the above-mentioned ingredients, for the reasons given, cannot possibly be separated from the flour, it becomes evident that they must be removed from the grain before its subjection to the grinding process.

The chief mistake hitherto committed, in the cleaning of grain, has been its submission to wire brushes, sharp surfaces of stone, corrugated sheet iron, &c., the latter being the most generally used, and revolving cylinders or covers commonly called "robbers" being employed. So long as the surfaces remain sharp, whenever the grain comes in contact therewith, it is injured by having its hull cut open. A close inspection of wheat treated in the manner referred to will amply bear out this statement. Such injuries to the grain occasion the premature breaking up of the bran in the process of grinding, and cause it to be largely ground up into flour. But, as the hulls of the grains contain a considerable quantity of silicate, the sharpened surfaces become rapidly blunt by the constant rubbing, until at last little or no effect is produced upon the grain by its passage through the machine. Hence it follows that machines based upon this mode of operation have the effect of damaging the grain, until they ultimately become utterly useless, though nevertheless, at the same time, absorbing considerable motive power. In order to partially remedy these serious defects, it is found requisite to employ two or more apparatuses of the expensive construction in question, one at least of which is usually kept sharp; but although they are kept in repair at considerable cost, and involve much trouble, the results of their working are anything but satisfactory.

Moreover, they necessitate an excessive amount of supervision, so that, altogether, when the quality of the flour produced is taken into consideration, loss of money results from their employment. So defective is this system, that in large mills recently erected in Hungary, the old system known as the "spitzgang" appears to have been resorted to, only, however, to be again relinquished, because it, too, very imperfectly removed the hulls, while it was at the same time equally damaging in its effects upon the grain. It is true that some machines having cylinders without corrugated surfaces containing fixed or movable wings have been in use, but they have been considered equally ineffective, inasmuch as the grain by its own weight passes too rapidly through the apparatus. Only the winnowing effected during the process is worthy of notice, because it certainly does at least remove such small particles of dirt and dust as do not adhere firmly to the grains.

Now, Mr. William Seck, a Prussian inventor, has devoted himself to the subject for a number of years, during which time he has spent a considerable amount of money in constructing and perfecting machinery for hulling and cleaning grain. His experience is that no thoroughly satisfactory result can be attained by direct operation of the machinery against the beard, germ, and wrinkled hull of the grain, but that the desired end can be completely effected by working the grains among one another by means of centrifugal force. The husks of grain contain a considerable quantity of silicate, a substance so hard that even the hardest French millstones will not resist it for any length of time. For this reason, no corrugated iron or steel, or other sharp surface, would be sufficiently lasting to scour the grain for any considerable period. It is therefore submitted by Mr. Seck that grain should be treated against grain on the same principle that diamonds are polished by diamonds. By repeated trials, it has been conclusively proved that, in order to effect a thorough polishing and raising of all prominent parts of the grain, it should be subjected to a velocity of 3,000ft. per minute, in a centrifugal apparatus, and that its treatment therein should be continued for a period varying from three to four minutes, according to the nature of the grain operated upon. Upon this principle, Mr. Seck has based the system of which the following is a brief description, the apparatus being illustrated in part section in the accompanying engraving. We may here state that we recently examined one of these machines at the offices of Mr. Seebohm-Ultzen, 21, Mark-lane, London.

The machine consists of a vertical casing, having a number of rings or circular shelves around its interior, and containing a rotating drum provided with vanes which take into the spaces between the rings or shelves. Part of the outer casing is constructed of sheet iron having perforations through which the currents of air escape into the dust or bran chamber, carrying with them

all dust, dirt, bran, &c. By the rotation of the drum, the grains are carried round upon the shelves at a velocity of 3,000ft. per minute, thus rubbing against each other most effectually. The outlets from one shelf to another are so arranged as to keep the grain under treatment during the required period of from three to four minutes. The velocity above mentioned has been determined by ample tests, and adjusted to completely remove all injurious parts, without in any way damaging or heating the grain. As regards wear and tear, it may be observed that by the working of the grains against one another, as described, combined with the peculiarity of the apparatus, all undue stress upon the various parts of the machine is entirely avoided. In proof of this fact, we are informed that a number of these machines have been constantly at work for about three years past, without requiring any repair or showing any signs of wear, and that they continue as efficient in their operation as they were at first starting.

From our description it will be seen that not only does Mr. Seck's apparatus treat the grain in the only appropriate manner, but that the grain is simultaneously subjected to perfect ventilation such as is not attained in any other machine. The ventilation being simultaneous prevents the adhesion to the grain of any injurious particles which should properly be separated from it. Besides having their beards, germs and wrinkled husks removed, the grains likewise receive a certain polish, so that, on leaving the apparatus, they are pleasant to the touch and ready to go at once under the millstone. The Royal Prussian Government has exclusively adopted this system, and have set up a number of these machines in their mills attached to the Royal Marine and Military Departments at Dantzic, Coblentz, &c.

In a well fitted Austrian mill, the grain treated by Mr. Seck's apparatus yielded 47 per cent. of No. 0 and No. 1 flour, as against 32 per cent. obtained from grain treated in well arranged apparatus according to the old system, in which both robber and spitzgang were employed, while the inferior qualities of flour resulting from the grain passed through Mr. Seck's machine were much better than those from the grain treated by the other process. The official trials ordered by the Austrian Government, and superintended by a staff of officers delegated by the War Department, with a number of other gentlemen in office, gave equally good results. Under the system employed at the military steam flour mills in Austria, the yield of 100lb. of rye of the standard quality was as follows, viz.:—85lb. of flour, 12lb. of bran, and 3lb. of dust, including loss. By Mr. Seck's process, the following results were obtained from 100lb. of somewhat inferior rye, which happened to be at hand in the mill, the rye, in this instance, being of the quality produced in Pilsen, where the trials took place, viz.:—

1st Trial.

89·59lb. of flour
0·91 „ „ black flour
3·88 „ „ bran
2·28 „ „ ligneous husk (when cleaning)
0·09 „ „ dust including loss (when cleaning)
0·32 „ „ dust including loss (when grinding)
The flour being likewise far superior in quality to that yielded by the other process.

2nd Trial.

A second trial, in which no scrap or black flour was produced, gave:—
92·51lb. of flour
2·84 „ „ bran (when grinding)
2·48 „ „ bran (when cleaning)
0·09 „ „ dust including loss (when cleaning)
2·27 „ „ dust including loss (when grinding)

We may add, in conclusion, that there are now some 300 of Seck's machines at work on the Continent, and, as far as experience goes, they give every satisfaction. At the annual meeting of the Union of Millers, held at Leipsig last month, one of Mr. Seck's machines was exhibited, and, we are informed, obtained the only first-class prize medal, a resolution being passed by the Union recommending the apparatus for general adoption.

THE PAYING AND NON-PAYING WEIGHTS PULLED BY THE LOCOMOTIVE ENGINE IN 1867.

By Mr. B. Haughton, C.E.

(Concluded from page 28.)

SOME persons may take exception to the rating of the assumed items, but, even should they be found strained or faulty, which I have taken all pains to prevent, the amount of their error, however largely it may be estimated, cannot materially affect the issues.

Weight of the average goods train was, in 1867—

Non-paying load, viz.:—

Engine and tender . .	50 tons	
2 breaks	8 „	
6 goods trucks at 3½ tons each, to carry 3 tons .	21 „	
6 mineral trucks at 3½ tons each, to carry 7 tons each	21 „	
		100 tons
Of the above, to be sent back as empties, 2 goods trucks, 6 mineral trucks	28 tons	
¼ engine and tender, with empties	12 „	
		40 „
Paying load.		
Goods	19 tons	
Minerals	41 „	
6½ head live stock . .	1 „	
		61 tons
Total . . .		201 „

In this table, the detail of the item 61 tons is taken from the Board of Trade returns; the other items are assumptive (under certain restrictions, which will be apparent), still not to be omitted. These two tables give the average weights of the passenger and goods trains of the year; by multiplying their several sums by the total numbers of trains, passengers and goods respectively, run in the year as given in the returns, I have arrived at the great totals given before.

The second point to which I have asked your attention is that of the immense excess of the non-paying weight of the trains over and above the paying weight. This is a subject which is frequently treated in the scientific publications of the day, and which has been discussed at meetings of this Society, but I am not aware that it has been hitherto considered in connection with the Board of Trade returns. In the annual address which I had the honour to give to this Society in October, 1868, I alluded to the subject of non-paying weight. I then gave an estimate of what I believed to be the proportions in which these two divisions of the total weight of the train are to be found. The non-paying weight, large as it was, I now find was understated, as shown by the astounding results extracted from the returns. This was in part owing to the fact that the figures were drawn from a much smaller railway circle than that from which the returns immediately before us have been computed.

The proportions of the paying weights of trains run in 1867 were, viz.:—

Passenger Trains.

Paying weight, 4·89 per cent. of the total weight of the train.

Goods Trains.

Paying weight, 30·34 per cent. of the total weight of the train.

Total Passenger and Goods Trains.

Paying weight, 16·67 per cent. of the weight of the whole train.

Or, in simpler phraseology, it takes 19 tons of train equipment to carry 1 ton of passengers, 2¾ tons of the same to carry 1 ton of goods, and, in gross, 5 tons of equipment to carry 1 ton of paying load.

That the public are not acquainted with these facts is, I believe, the secret of their discontent with the management of our railways. They place themselves willingly under the direction of theorists, who are not competent to realize the situation. Relieve them from this state of suspense in which they are placed, make them familiar with the reason why they cannot hope for a reduction of fares, and they will rest content, and railway property cannot fail to be the gainer thereby. Show them that the experience of the Post Office cannot be taken as a guide for the management of railways, because a letter weighs practically nothing, as I have endeavoured to show in the address beforementioned, and that its numbers may be increased almost indefinitely without extra cost of carriage, whereas a passenger will weigh 2 tons, including his share of train equipment; and, moreover, that each passenger carried in addition to the usual numbers will bring an additional weight of 2 tons with him. Show them that the fares charged by excursion trains cannot be taken as a guide, because the conditions under which they are run are not those required in the conduct of the common traffic trains of the country. Show them that the extremely low fares charged on the Belgian railways cannot be taken as a guide, because, firstly, what are commonly called the Belgian railways, and notably so in the second report of the Railway Commission of 1868, are not the Belgian railways, but only a fraction of them, that is to say, 535 miles out of 1,819; secondly, that they were constructed by the Government, before private railway enterprise had commenced in Belgium, who naturally selected the most promising lines of country, and are, in fact, possessed of the cream of the traffic of the land; thirdly, that these lines have cost £18,000 a mile as against £36,000 for the English lines; fourthly, that these lines have been charged with no parliamentary expenses; fifthly, that land is of far greater value in England than in Belgium; sixthly, that labour is dearer in England; seventhly, that the speed of the Belgian trains is considerably less than that usual in England. That all these things combine to make the working of railways more costly at home, and so to produce higher tariffs of fares and rates; and, finally, that no later than this month, M. Malou, Belgian senator, and well versed in the railways of that country, has shown in a pamphlet which he has published, that the glowing promise of a new railway era, to be inaugurated by these gifted Belgian legislators, is only a juggle and a delusion, and that the Government must immediately raise their fares considerably, unless they are prepared to work their 535 miles of line, having cost £10,000,000, with an utter disregard of the ordinary principles of economy and trade, and at an enormous loss per annum. Lay all these facts and views of the question before the travelling public of England, and they will quickly wipe the film from off their eyes that now rests there, and be led to confess that, after all, the men who have invented and perfected the locomotive and the railway with its belongings, and instructed the world in the art of working and using it, are as likely to know how to tend and direct and manipulate it with skill and sagacity, as are their continental and other pupils.

The English engineer knows that natural and economic laws must eventually prevail, no matter how the public may wish to dispense with their action; he knows the ways, paths, and tendencies of these laws; he knows how to respect them, as respected they will be; while he also knows how to bend them to his educated will. With these laws as his guides, and with the forces which nature permits him to wield as implements, he goes on in a safe and sure road of progress, and, as he advances, hardly turns his head to reply to the dreamers and triflers, who preach from the stump and the journal the reversal of the order of nature.

This immense dead or non-paying weight has ever been a difficulty with the engineer. Dead weight has no doubt increased of late—engines are made heavier, hence more adhesion, less liability to become derailed and greater economy of fuel in working; carriages are made longer, hence there is more space for the legs of passengers; they are made higher, hence more facility for moving when in an erect position; the timber is of larger scantling, hence more steadiness and durability—all these changes have been changes for the better, the traveller in consequence is more convenienced as well as physically safer than before—the latter a boon that can not be over estimated; he is actually 1,000 per cent. safer at present sitting in a railway carriage in motion, then when walking in the London streets. The Briton of the age, in short, travels fast and securely; faster, indeed, than the representative individual of any other nation; he is in the condition of the man who lives fast, and builds a large and comfortable mansion for his gratification; its dimensions are greater than are absolutely necessary for his wants, yet he can afford the cost and he defrays it. The Briton must do likewise if he wishes to travel fast.

Reduction of non-paying weight is practicable, but it implies a reduction both of the rate of speed and of convenience, and it is not likely that it can be attempted in the face of the long enjoyment of these luxuries which the public have possessed. The receipts per mile from the 73¼ persons who travelled per train' run in 1867, were, viz.—

	Persons.		s. d.	Corrected income per mile.
1st class . .	8¼	at 2d. per mile	1 4½	1 2¾
2nd class . .	20	at 1½d. „	2 6	2 3
3rd class .	45	at 1d. „	3 9	3 8
	73¼		7 7½	7 1¾

The column headed "Corrected" shows the correct figures, having made the proper deductions because of return tickets, which may be taken at 60 per cent. of the whole number of tickets issued for 1st and 2nd classes. This 7*s.* 1¾*d.* per mile must not be confused with the 4*s.* 9*d.* per train mile of the returns; the first is the income per mile run by the 73¼ passengers, the average mileage run by each passenger being 12¾ miles, while the average mileage per train was 19 miles.

The following details may be useful, viz.:—73¼

passengers carried in each of the 3,924,624 passengers trains run. Paying and non-paying weights of each train 143 tons, being a total weight per passenger of 2 tons. Total weight of train per 1 ton of passengers equal to 20 tons 8cwt. 60 tons goods and minerals, and 6½ head of live stock carried in each of the 2,403,866 goods trains run, paying and non-paying weights of each train 201 tons, being a total weight per 1 ton of freight of 3¼ tons.

Each passenger train, weighing a total of 143 tons, was pulled over a distance of 19·08 miles, bringing a revenue of £4 11*s.* 4¾*d.*, equal to

	d.
Per mile ton of paying weight . . .	8·2
Per mile ton of total weight of train . .	0·40

Each good train, weighing a total of 201 tons, was pulled over a distance of 30·64 miles, bringing a revenue of £8 19*s.* 2¾*d.*, equal to

	d.
Per mile ton of paying weight . . .	1·14
Per mile ton of total weight of train . .	0·34
Passenger revenue per head per train mile .	0·78
Passengers revenue per head per mile actually run by each passenger . . .	1·17

These figures lead to the vexed question, viz., the relative paying properties of passengers and goods, which is shown in the items as above, viz.:—

	d.
Passenger revenue per mile ton of total weight of train	0·40
Goods revenue per mile ton of total weight of train	0·34

These figures are not strictly accurate, while sufficiently so for our purpose, because we know from the passenger revenue per head per train mile of 0·78*d.*, that each passenger cannot have travelled the whole 19·08 miles run by the passenger train. I find that the actual distance run by each passenger was about 12¾ miles or ⅜ more than the distance run 1855, as given by Mr. Robert Stephenson in his address to the Institute in 1856, before alluded to. The precise distance run by each ton of goods pulled is not so easily found. However, all things considered, the deductions for these drawbacks of passenger and goods mileage from the 19 miles and 30¾ miles run will not cause any material error in the representative fractions 0·40*d.* and 0·34*d.*, the incomes per hor. mile ton, respectively, as the deductions would only apply to the paying weight sections of the train, which in each case is small as compared with the total weights.

These fractional figures would place the advantage on the side of passenger traffic to the extent of 0·06*d.* per hor. mile ton, but against such is to be placed the serious debit of 90 per cent. more speed, also 90 per cent. more of capital invested in vehicles, valuing carriages at £200, and trucks at £60 each, the capital invested in the latter being, viz.:—

Carriage capital, per ton of freight pulled per annum	3s. 9d.
Truck capital, per ton of freight pulled per annum	2s. 0d.

While to its credit is to be placed, say, 50 per cent. less concussion, and the carrying of 75 per cent. more freight per vehicle, &c., &c., viz.:—

27,354 carriages carried 27,472,368 tons, or 1,004 tons per vehicle.

247,048 trucks carried 146,635,826 tons, or 593 tons per vehicle.

A Debtor and Creditor account would stand thus—

PASSENGER TRAFFIC,
AS AGAINST
GOODS TRAFFIC.

Dr.	*Cr.*
90 per cent. more speed.	17 per cent. more revenue per mile ton of total weight pulled.
90 per cent. more vehicle capital invested per 1 ton of paying load pulled.	50 per cent. less concussion, viz., load carried 12cwt. per foot of wheel base, as against 20cwt. to 40cwt.
	75 per cent. more paying load carried per vehicle per annum.
	12 per cent. greater facility in reception and delivery of paying load.

I shall not now strike the balance; the advantage, however, at first sight is on the side of goods traffi·. If the two sides should be found on a line, it will be a remarkable proof of the sagacity of railway managers, in that they succeed in making the two great divisions of traffic revenue contribute equally to the general account.

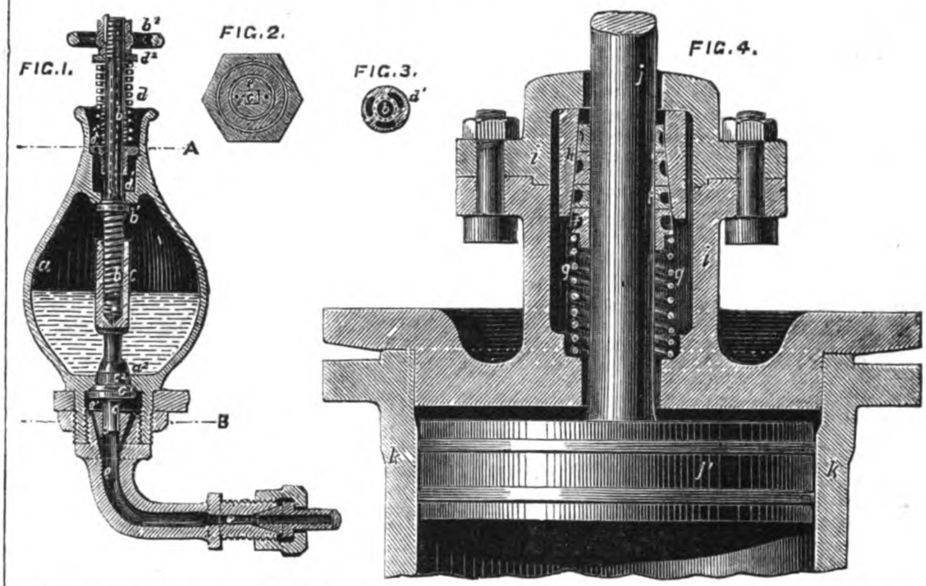
I must not forget to acknowledge my obligations to Mr. Frederick T. Haggard, of Burnham House, Kent, for the assistance which I have received from him while investigating this question, as well as for the hints which I have taken from his valuable pamphlet entitled "A Mile of Railway," published last February. He will, I trust, permit me to take this opportunity of thanking him for his kindness in giving me that information whenever sought, which his grasp of the subject and general practical knowledge of statistics and finance enables him to command. The moral which I have endeavoured to make this paper convey is this: that so long as the railways of the United Kingdom shall carry passengers and their train equipage at 0·40*d.*, or two-fifths of a penny, per ton per mile, at an average speed, while running, of thirty-four miles per hour, and goods and minerals, with their accompanying dead weights, at 0·34*d.*, or one-third of a penny, per ton per mile, at a speed of eighteen miles per hour, the public cannot complain.

If they will take a common sense view of the question, and compare these rates and speeds with those of such other modes of traction as they are familiar with, and further compare them with those of other countries, giving their own country credit for the many and great conveniences and accommodations which the system confers upon them, as well as taking due cognizance of the quality and price of the material out of which the fabric is made, and upon which it is built up, I feel assured their verdict will agree with that before quoted—that in the matter of railways they are "the best served community in the world." These returns disclose the strange facts that the average British passenger weighs 2 tons with train accessories, and that the ton of goods, &c., weighs 3¼ tons; by no known processes can these enormous multiplication of original net weights be reduced, consistent with affording that amount of personal security, and comfort, and accommodation now enjoyed; let them in their future deliberations on this subject relinquish the idea which has so long clung to them, and which has been so ingeniously and persistently placed before them, that a railway passenger is a featherweight—a letter or a newspaper, as it were—and that he may be treated accordingly, let them try to realize the facts as stated, as to the actual total of paying and non-paying weights pulled, and the enormous energy developed in order to produce the effect expressed in the figures as before given, viz., 25,512,646,408 hor. mile tons.

These, combined with the figures representing the wear and tear of material, and the labour expended in the maintenance of the system, will, perhaps, convince them of what an exacting, devouring, and insatiable monster it is that they have called upon to minister to their lately-born wants, and will go far to reconcile them to the existing tariffs of fares and rates, which, no doubt, competition and the wish to act in a just and liberal spirit to all parties concerned on the part of railway executives, has already reduced to the lowest admissible rate. I believe that these are amongst the "things not generally known," and that when generally known they must tend to promote and strengthen that cordial understanding which ought to exist between the ra lway proprietor and the traveller by railway, and so without fail to increase the confidence of the investing public in this great property, and as a necessary sequence to enhance its money value.

LUBRICATING APPARATUS AND PACKING.

BY MR. F. HOLT.



LUBRICATING AND PACKING STEAM ENGINES.

THE object of the invention we are about to describe is to reduce the friction in the working surfaces of steam engines by means of an improved lubricating apparatus, and to prevent the escape of steam in the stuffing boxes by means of an improved metallic packing. It has been patented by Mr. F. Holt, of Gorton Foundry, Manchester, and is illustrated in the annexed engraving, in which fig. 1 is a vertical section, and figs. 2 and 3 transverse sections of the lubricator. This apparatus consists of a vessel *a* provided above and below with a valve seating, marked respectively a^1 and a^2. The spindle *b* of the upper valve b^1 is screwed into the spindle *c* of the lower valve c^1, and the valves b^1 and c^1 are held up against their seatings a^1 and a^2 by the spring *d*, which abuts against the fixed washer d^1, shown detached in fig. 3, and the loose washer d^2 placed below the boss of the handwheel b^2 fixed to the spindle *b*. The upper valve is opened to pour the lubricant into the vessel by screwing the upper into the lower spindle, and it is closed by turning the spindle in the contrary direction. When the cylinder requires to be lubricated, the lower valve c^1 is opened by turning the upper spindle *b* to allow a portion of the lubricant to flow out of the vessel *a* through the elbow pipe *e*, the upper portion of which serves as a guide for the square lower part of the spindle *c*, as shown in fig. 2, which is made with diagonal perforations e^1, to convey the lubricant into the pipe *e*. The quantity of lubricant allowed to escape is governed by the diameter of the shoulder e^2 on the spindle *c* passing through the opening above the seating b^2.

This apparatus is particularly beneficial when applied to the cylinders of locomotive engines, as the lubricant is only required when the steam is turned off, and when the engine is running down an incline or is in motion by its own inertia. In condensing engines the vacuum formed in the pipe *e* causes the valve c^1 to be opened at every stroke of the engine to the extent of the back lash in the screw on the spindle *b*, screwed into the socket of tho spindle *c*, thus rendering the lubricator self-acting in all cases where a partial vacuum is formed under the valve c^1. Some of these lubricators are now working on the North British, the Great Southern and Western of Ireland, and other railways, where they give every satisfaction. They are

manufactured by Messrs. Storey and Sons, Knott Mill Works, Manchester.

Fig. 4 is a section of Mr. Holt's metallic packings, which are adapted for the stuffing boxes of locomotives and other steam engines. The packing consists of two or more packing rings *f*, which are cut through in one part. These rings are slightly conical at their circumference, and are pressed by the spring *g* into the conical bush *h* loose in the stuffing box *i*. The end of the bush *h* being faced to the end of the stuffing box prevents the escape of steam, and allows the packing to adapt itself to any slight irregularity in the position of the piston rod *j* of the piston *j* [1] working in the cylinder *k*.

CHEMISTRY OF COMBUSTION.*

No. I.

By MR. W. M. HENDERSON.

THE following notes, relating to the subject of steam boilers, are offered to those interested in the matter of steam boiler inspection. The information conveyed has been condensed mainly from the works of William Fairbairn, Robert Armstrong, and Charles Wye Williams, interspersed with the results of twenty years' practical experience of the writer.

CHEMISTRY OF COMBUSTION.

Ordinary combustion is the combination of oxygen with the combustible element of fuel. In coke and charcoal, carbon is the sole combustible element, while in coal there is hydrogen also. In 100lb. of good coal there are about 84lb. of carbon and 6lb. of hydrogen; the residue is composed of matter that does not assist combustion, but sometimes retards it by forming clinkers, and otherwise obstructing the process. The hydrogen furnishes weight for weight, about four times as much heat as the carbon, or 22 per cent. of the whole. The products of combustion are:—

Steam	H 2, O 1	in weight as 1 to 8.	invisible and incombustible.
Carbonic acid	C 1, O 2	" " 6 to 16	" " "
Carbonic oxide	C 1, O 1		" " "
Smoke			

The first part of the process of burning coal consists in distilling, or expelling by heat, the hydrogen, in the gaseous form, combined with the carbon in one or two proportions, forming carburetted hydrogen, or coal gas, H 2 C 1 in weight, as 1 to 3, and bi-carburetted hydrogen or olefiant gas, H 2 C 2 in weight, as 1 to 6, the latter forming 10 per cent. of the whole. Taking this estimate, we find that 9-10ths of the 6lb. of hydrogen combines with three times its weight of carbon, taking up 16·2lb. of the latter, and 1-10th combines with six times its weight, taking 3·6lb., together taking 19·8lb. from the 84lb. of carbon in the 100lb. of coal, making 25·8lb. of carburetted gases, to be burned above the coke, leaving 64·2lb. of carbon to be burned in the form of coke.

Now, to burn 1lb. of hydrogen requires 8lb. of oxygen, and the product is 9lb. of aqueous vapour; and to burn 1lb. of carbon requires 2 and 2-3rd lb. of oxygen, the product being 3 and 2-3rd lb. of carbonic acid (the resultant of perfect combustion). Hence, to burn the 6lb. of hydrogen requires 48lb. of oxgen, and to burn the 19·8lb. of carbon, combined with it, requires 52·8lb.; altogether 100·8lb. of oxygen to burn the gaseous portion of 100lb. of coal. To burn the 64·2lb. of carbon that remains upon the grate, after the expulsion of the volatile gases, would require 172·2lb. of oxygen, the sum of both being 272lb. of oxygen to consume 100lb. of coal.

Atmospheric air consists of volumes N 4 O 1 in weight, as 28 to 8, the oxygen being but 1-5th of its bulk, and the quantity required being as 2 to 1 of the carbon, in order to produce perfect combustion; the quantity of air employed will, therefore, be ten times the volume of the gas to be consumed. From this it will be seen that 1,224lb. or 16,320 cubic feet of air must be admitted to effect the combustion of 100lb. of coal, allowing that 60 cubic feet of atmospheric air are required to produce each pound of oxygen. The quantity chemically required for 1lb. of coal is, therefore, about 164 cubic feet, of which 60·8 enters into combustion with the volatile gases, and 103·2 with the solid portion of the coal. At the general temperature of the furnace, 1,000deg., these products of combustion expand about three times the original bulk of the air, *i.e.*, 164 $\times$ 3 = 492 cubic feet of air and gas to be passed with a velocity of 36ft. per second.

The formation of carbonic oxide is known to be greater in a thick fire with a poor draft than in a thin fire with a strong draft; in the former case there may be perfect combustion, producing carbonic acid in the lower part, and the acid so produced may take up another equivalent of carbon in the upper part of the fire, and thus waste half of the carbon, which passes off in the form of carbonic oxide. The remedy for this is a judicious introduction of air above the fire. But to effect the combustion of either gas or solid carbon, it is necessary that the oxygen which is to combine with it should be brought within the sphere of its attraction; the two must be brought into intimate contact and touch, or nearly touch, while the temperature is favourable. The gas from a burner or candle will not attract oxygen at ¼in. distance; practically, they must be intimately mixed before they can burn.

If these conditions be not fulfilled, the combustion will be incomplete; the hydrogen, possessing the strongest affinity for oxygen, will first combine and leave the carbon free, in the form of black powder, which will mix with the vapour resulting from the combustion of the hydrogen and with the nitrogen gas, and constitute what is called smoke. Now, if this smoke, containing, as it often does, valuable quantities of uncombined carbon, comes in contact with cold surfaces, it loses heat, falls to the temperature of steam, and its combustion is then practically impossible. At the moment the hydrogen and oxygen combine to form water they are at a white heat; if, at this moment, there be present a sufficient excess of oxygen the carbon will be consumed, but if, at this moment, the carbon is not also combined, smoke ensues. The problem is to burn the gas in the act of distillation at one operation.

In a properly constructed steam boiler an average of 10lb. of coal will be burned per square foot of grate per hour with natural draught, and as 1lb. of good coal will evaporate about 8lb. of water, 80lb. or about 10 gallons of water will be evaporated for each square foot of grate surface per hour. When blast is employed these quantities may be doubled. The furnace room should be from 1·5 to 2·5 cubic feet per square foot of grate, according to the consumption of coal. The boiler room should be about 1 cubic foot for each square foot of heating surface. The area of heating surface should not be less than 1 square foot per pound of coal consumed per hour, or, where it can be obtained, as 18 to 1 of the grate surface. Area over bridge, through flues and chimney, 2 square inches per pound of coal consumed; or, taking 12lb. of coal as being the maximum that can be burnt upon a square foot of grate, a calorimeter of 24 square inches per square foot of grate surface is recommended for natural draught. Ash pit entrance for air, one-half area of grate. Area of orifices for admission of air above grate should be about 4 square inches for each square foot of grate, more or less, according to the gas-generative qualities of the coal and extent of combustion. In regard to the disposition of the heating surface, it should be as concentrated as possible, as experiments have shown that the first foot of the length of tubes in horizontal boilers, next the furnace, was equal in evaporative value to the furnace itself; that the next 4ft. were not equal to the first foot, and that the fifth foot possessed very feeble generative properties. It is, therefore, considered there is no gain in having tubes in such boilers over 6ft. in length, and that the effective length of flues in horizontal boilers is arrived at within very moderate limits, probably not exceeding the maximum of 20ft. The reason of this is quite obvious, as a boiler may be of such length that the generative value of the heated gases may be entirely expended before they have reached the extreme end, in which event, it is plain, a positive loss is entailed; for the water which has been heated at the furnace end, and the steam which has been raise there, must be deprived of a portion of that heat again, in order to raise equally the temperature of the water at the cold end.

For many years, within the experience of the writer, it was the practice to construct steam boilers from 40ft. to 60ft. in length, with a view to use up the whole of the heat resulting from combustion of the fuel. Some of these very boilers, after being cut in two—the one-half only retained—gave such improved results as to have at last completely exploded that plausible theory. Quite an important feature in the generation of steam is to be found in the manner of conducting and applying the heated gases to a steam boiler. They should be led at once through the body of the water, *i.e.*, through flues or tubes, and if a return can be made, with a view to economy, to make such a return under the shell, and if practicable, with a still further view to economy, over the shell of the boiler. No doubt much of the merit pertaining to the Cornish type is due to this manner of construction. Of the double-flue description, the Butterley, or Fish-mouth, or, as it is better known in this country by the more modern name of the Corliss boiler, is far preferable to the common flue boiler, where the heat passes backwards, first under the boilers and lastly through the flues, passing the most effective heating surfaces at the time it has no real generative value. Another matter of eminent importance to this subject, and one which has not received that degree of attention its worth demands, is that of supplying to the uninflamed gases of the furnace the necessary amount of oxygen to insure perfect combustion, which otherwise would escape unconsumed into the atmosphere. This is the only method of obtaining from the fuel the maximum of heat it is capable of yielding. By experiment it has been shown that the saving effected in coal, by a judicious attention to this particular, has been from 12½ to 33 per cent., accompanied with a perfect freedom from smoke, as all smoke consists of a portion of the carbon of the fuel passing off unconsumed.

It is believed this discovery, like many others of great merit, was the result of mere accident, not being brought about from any hope of economy, but the desire to suppress the intolerable nuisance of smoke, emitted from the furnaces in the manufacturing districts of England from the combustion of bituminous coal. In the combustion of anthracites, as largely employed in this country, no great objection has been found to the comparatively colourless smoke emitted, and so it has been allowed to pass unheeded; but as anthracites contain more carbon than bituminous coals (as high as 90 per cent.), even more air is required for their combustion than the latter description; and unless this air is supplied, large quantities of carbonic oxide will be constantly discharged into the atmosphere, carrying off a large percentage of the carbon of the fuel, without contributing in a proper manner to the generation of steam. As regards the form of the furnace many curious ideas exist. It has been contended that the crown sheet should be low enough so that the flame may impinge with force upon it. The value of position of the heating surfaces has been settled for us by some authority long ago, and has been religiously copied in all our works of modern compilers, who inform us that only horizontal surfaces should be considered and calculated as direct heating surface; that vertical sheets must only be taken at half value, and that the upper half of the circumference of flues alone are effective. Now, caloric being a body which radiates in all directions, the transmission of heat through the different parts of a steam boiler cannot vary to such an extent as the above calculations lead us to believe. It is true the heated gases have a tendency to rise to the highest points, but where the calorimeter is properly calculated to carry away the net products of combustion, it cannot ascend in this manner, and must tend to diffuse itself over every avenue in order to effect an exit. A large firebox or capacious furnace is necessary to produce a thorough admixture of the gases of combustion, which undoubtedly should take place in that part where the necessary heat is present to insure this result. The concentrated action of the heated currents upon the firebox must be more injurious with a low crown sheet than a high one; in either case it would be bad enough were it not for the great difference which exists between the temperature of the box and the water within the boiler, which seldom or never exceeds 400deg., whereas that of the furnace may probably reach as high as from 1,500deg. to 2,000deg.

The absorbent material should be as thin as possible, therefore of the highest standard of quality, in order to save time in the transmission of heat, and to effect a rapid evaporation of the water contained within the boiler. As regards the effective evaporating results, or transmission of heat through metals, this depends upon the three following properties:—First, the resistance of the surface next the fire to absorption of the heat; second, the resistance of the internal particles of the metal to the conduction of heat; and, third, the resistance of the surface next the water in giving off the heat. The relative evaporating power of wrought iron, brass, and copper are respectively, 100, 125, and 156.

* "Journal of the Franklin Institute."

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

JULY 8.

(Before Sir W. M. JAMES.)

HEWITT *v.* COOPER.

THIS was a motion, on the part of the plaintiff, for an injunction restraining the defendant from infringing a patent, granted to the plaintiff in 1860, for sockets for whip handles, the main feature of the invention being that the plaintiff inserts in the socket a steel spring covered with leather which clips or catches the whip handle. The defendant had sworn that the sockets made by him differed from the plaintiff's invention in that they were lined with leather and gutta-percha, and had no spring. But, during the hearing of the motion, one of the defendant's sockets was cut open, and, it appearing that there was whalebone inside the leather, the Vice-Chancellor thought the affidavit seemed so much like a deliberate attempt to deceive the Court, that he granted the injunction as prayed, giving leave to defendant to move to dissolve it if he satisfied the Court that the silence of the affidavit as to the whalebone was not fraudulent or material.

On the part of the defendant, any fraudulent intent was disclaimed, and the form of the affidavit was explained as arising from the fact that the whalebone did not act as a spring, and was, therefore, considered a matter of no importance.

Mr. Fellows appeared for the plaintiff; Mr. Kay, Q.C., and Mr. Waller, for the defendant.

JULY 12.

THE GROVER AND BAKER COMPANY *v.* WILSON.

THIS cause came on to be heard before a special jury, but only nine gentlemen were present, and the trial stands postponed till next term.

It involves questions whether the defendant, of the firm of Newton, Wilson, and Co., has not infringed some of the plaintiff's patents for the manufacture of sewing machines.

Mr. Amphlett, Q.C., Mr. Grove, Q.C., and Mr. Lawson appeared for the plaintiffs; Mr. Eddis, Q.C., Mr. Williams, and Mr. Aston for the defendants.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—H. B.—P. N.—J. A. B. and Co.—E. E.—R. and S.—W. A. W.—J. C. E.—J. F.—W. M., jun.—R. S. J.—T. B.—W. F.—C. N.—W. L. W.—B. H.—R. T. T.—H. C.—M. J.—W. R. N.—F. W. B.—R. A. S.—G. W. H.—J. A.—J. S. C.—B. I.—G. C. T.—W. S.—G. E. P.—E. D.—J. F. and Co.—H. G.—R. S. M.—H. R.—C. and Co.—S. U.—G. P.—R. H. J.—M. T. and Co.—H. and F.—J. L. C.—F. B.—A. M.—G. F.

Naval, Military, and Gunnery Items.

A TELEGRAM from Shanghae communicates the sailings of the first tea ships this season for England, namely, the "Titania" and "Huntley Castle" sailing ships, and the "Agamemnon" and "Erl King" steamers. Their cargoes in the aggregate amount to 6,000,000lb. of tea.

ONE of the largest iron ships of war ever yet built has been laid down at Pembroke Dock, and she is to have the name of "Thunderer." A number of heavy armour-plates have arrived to be used in her construction, and when completed it is expected she will be the finest vessel of her class in the British navy.

A GREAT improvement has been effected in breech-loading cartridges, by the Colt Firearms Company, by which the cartridge case can be re-loaded and capped after firing, thus utilizing the same case a number of times. We are obliged to defer the details of this important invention until next week.

THE Emperor of the French has awarded a gold medal of the second class and a diploma to Mr. Peter de la Mare, and a silver medal of the first class and a diploma each to Mr. John de la Mare and Mr. Phillippe le Riche, of St. Heliers, Jersey, in acknowledgment of their services, in January last, to the survivor of the crew of the French lugger, "Villafranca," of Dinan.

THE American yacht "Dauntless," Vice Commodore James G. Bennett, jun., arrived at Queenstown on Sunday, at 2.30 p.m., making the run, from New York to Queenstown, in 12 days 17 hours 6min. 12sec., and beating the time of the "Henrietta" in her famous ocean race with the "Fleetwing" and "Vesta." The "Dauntless" experienced heavy weather the entire voyage.

THE South Holland Institution have awarded a gold medal and a testimonial to Mr. James Herbert, of the barque "T. and R. Walsh," of Queenstown, in acknowledgment of his services to the crew of the Dutch brigantine "Energie," on March 13, 1869. They have also awarded a large silver medal and a testimonial to Mr. John Crawford, of the ship "India," of Glasgow, in acknowledgment of his services to the crew of the "Hollands Trouw," on the July 20, 1868.

THE Emperor of the French has awarded a gold medal of the first class and a diploma to Captain Holker, of the ship "J. R. Hea," of Windsor, Nova Scotia, in acknowledgment of his humane services to the crew, thirty-two in number, of the French ship "Naulonnier," of St. Servan. The Emperor has also awarded a silver medal of the second class and a diploma to Mr. John Woodcock, of the steamer "Tajore," for having rescued a child, who had fallen into the harbour at Marseilles, on August 30, 1868.

THE council of the Institution of Naval Architects, the importance of which is now so far recognized by the Government as to command an annual grant from the public funds, are desirous of receiving special information on the following heads in time for their next annual meeting:—1. Composite shipbuilding. 2. Economy of fuel. 3. The application of steel in lieu of iron to shipbuilding. 4. Iron and steel masts and yards. Practical men in possession of new facts or interesting results relating to any of the foregoing subjects are invited to embody them in papers to be read before the institution, or to forward any results which may have come to their knowledge, to the secretary, at 9, Adelphi-terrace.

WE understand that Mr. Baxter is to be removed from the Admiralty and appointed Secretary for Scotland. Our informant, says the "United Service Gazette," adds, "They don't get on at all well at Whitehall." Just so. It does seem rather significant that from this reforming Admiralty the very first to go is "the greatest Roman of them all"—he to whom was given the task of hunting out and rooting out the very grossest abuses—abuses of such a nature that it is distasteful even to speak of them. From all report, Mr. Baxter was doing his work well. Can it be possible that he was doing it too well, and was got rid of less worse might come of it?

THE last ship built in Woolwich Dockyard was to have been launched, on Monday last, at half-past three. At the appointed time, the ship was duly named the "Thalia" by Mrs. Childers. But she would not stir; neither by persuasion nor by force could the faintest glimmer of hope of her starting be obtained. She was, however, got off at four o'clock on Wednesday morning. The "Thalia" is wood-built, and a sister ship to the "Juno"; she has been designed by the Chief Constructor as a vessel of war and supernumerary troopship. Her dimensions are—length, 200ft. 1in. between perpendiculars; length of keel for tonnage, 171·5⅛; extreme breadth, 40ft. 4in.; breadth for tonnage, 40ft.; breadth moulded, 39ft. 4in.; depth in hold, 21ft. 8in.; burden in tons, 1,459 12-94; horse-power, 400; her armament, 6 guns.

THE Lords of the Admiralty have issued regulations for the issue of prizes and rewards for good shooting to the Royal Marines. The prizes at each division will be three, viz.:—First prize, to the best shot of the division; second prize, to the ten best marksmen of the division; third prize, to the marksmen of the division. The first prize will be £5 and a badge of cross muskets and a crown worked in gold. The second prize will be £3 and a badge of cross muskets worked in gold. The third prize will be £1 10s. and a badge of cross muskets worked in worsted. Whenever the best shot of any division shall have gained a number of points not less than those obtained by the best shot in the army he will be awarded a special prize of £20, a bronze medal inscribed with the year in which won, and the winner's name, company, and division, to be worn on the right breast, and a badge of cross muskets and crown worked in gold. The medal may be worn during the whole period of service. All serjeants having earned the title of marksmen will wear a badge worked in gold.

FROM the Clyde we learn that Messrs. J. and J. Thomson have contracted to supply the engines of four steamers which are being built by Messrs. W. Hamilton and Co., of Port Glasgow, for the Ottoman Government. Messrs. Scott and Co., of Greenock, have launched an iron paddle, named the "Felis Argentine," intended for passenger traffic on the River Plate. The "Felis Argentine" will be engined by the Greenock Foundry Company. The "Oberon," an auxiliary screw, has just left the Clyde for London, where she is loading a cargo for Shanghai. The "Oberon" was built by Messrs. A. and J. Inglis for Messrs. Shaw, Maxton, and Co., of London, and she is expected to make the run out to Shanghai in 75 days. The "Oberon" is 241ft. in length by 36ft. beam, by 21ft. depth. Her burden is 1,235 tons. She is fitted with expansive engines, and can dispense with her propeller when not required, the screw space being enclosed with water-tight shutters, by which means the ship presents one unbroken water line, the propelling space causing no resistance whatever when the vessel is under sail.

Miscellanea.

AT Krenholm, near Narva, in Russia, a number of persons having collected on a bridge, the parapet gave way. Sixty-five were precipitated into the river, and twenty-one were drowned.

WE understand that the Prince of Wales has consented to unveil the statue of Mr. George Peabody, on the site near the Royal Exchange, during the present month. The statue, which is in bronze, is the work of Mr. Story, the American sculptor.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending July 10, was 3,753. Total number since the opening of the Museum, free daily (May 12, 1858), 1,601,535.

A SECOND ascent of Mont Blanc, for the present year, has just been accomplished under favourable conditions by two Englishmen, Messrs. Erdes and Tideman. The number of foreigners who arrived at Chamounix between June 24 and June 30 was 412, making a total for the present season of 1,898.

WE understand that the Commissioners for the Exhibition of 1851 at their last meeting decided to hold a series of annual international exhibitions of select works of fine and industrial art and scientific inventions at Kensington. The first exhibition is fixed for 1871, and as respects industrial works will consist of only three classes.

THE number of visitors to the South Kensington Museum during the week ending July 10, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 13,741; Meyrick and other galleries, 2,928; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,764; Meyrick and other galleries, 220; total, 19,653. Average of corresponding week in former years, 14,139. Total from opening of Museum, 8,669,729.

ABOUT five o'clock on the afternoon of Wednesday week a smart shock of earthquake was felt in the village of Comrie and neighbourhood. The tremor of the earth was scarcely perceptible, and, as usual, the shock apparently came from the south-west and proceeded to the north-east. Several slight shocks during the night have been felt since, and on all occasions the shocks were accompanied with a noise resembling a railway train or distant thunder. It is a remarkable fact that for a series of years shocks of earthquake have been felt in the month of July, but the strange phenomenon occurs frequently at other seasons.

ON Monday last a meeting of the Yorkshire subscribers to provide a fund to purchase an annuity for Mr. George Hudson, was held at York, the Lord Mayor in the chair. It was stated that the amount of the Yorkshire subscriptions was £1,350. The whole sum realized was £4,400. An annuity for Mr. Hudson could be purchased in the North British office, at the rate of £12 16s. per cent., and £4,000 invested upon these terms would produce £512 per annum. It was accordingly agreed that the subscription be invested in the purchase of an annuity for Mr. Hudson's life, and be so settled that there be no power of anticipation or of assigning the same, or of the amount becoming liable for the demands of other persons.

THE prizes that were offered by Mr. Barkas, of Newcastle, to pit lads, in Durham and Northumberland, to induce them to search for fossil remains, are said to have been attended by the most unexpected results. Not only have the lads picked up from the refuse shale heaps large numbers of fish remains, and some remains of large reptiles, but, what is really extraordinary, and will astonish palæontologists, one of the lads has found the lower jaw of a true mammal. The effect of this discovery will be to reduce the comparative ages of all hitherto known mammalia, and carry back the mammalian life of the world for millions of years.

The "Advertiser and Times," Oswego, N.Y., says, "We saw a novel experiment involving the explosive power of gas. In the new tank excavation, now in a forward state, at the gas works in this city, an old well had been pumped out and then filled up, after leaving an aperture beneath. Into this space a limited quantity of gas was introduced from the gas pipe, sufficient to form an explosive compound with the air in the covered well. A match trigger touched off the mine, when a general upheaving of the surrounding earth took place, loosening up the soil and making easier digging."

THE Royal Horticultural Society's grand show of fruit and flowers, to take place next week at Old Trafford, Manchester, promises to be one of the most magnificent displays ever held. The Queen, as well as the Prince of Wales, will both contribute specimen plants, &c., and there are nearly one thousand entries. The exhibition opens on Monday at three o'clock p.m. On Tuesday, the Duke of Buccleugh, K.G., president of the society, will take the chair at the general meeting. On Wednesday, the Prince of Teck (one of the vice-presidents) will distribute the prize awards, and the grounds will be visited by the Prince and Princess of Wales.

REPORTS from the Sutherland coalfields state that the diggings on Kildonan Burn were deserted last week by a number of the diggers, who, on the expiry of their monthly licence, packed everything up and left for their respective homes. A good many of the men had to leave for the purpose of preparing for the coming herring fishing, but many of the old colonial hands left in consequence of the small yield of gold at the above-mentioned burn and the refusal to extend the ground so as to give them a chance on new claims. At Suisgill, however, many of the diggers continued to make pretty fair earnings, and as soon as their licences ran out a good many went forward and applied for renewals. Small nuggets continue to be found. One was got at Suisgill last week that would weigh 1 1-3oz.

ON Monday week a further discovery, connected with the fine pavement recently found near the Poultry, was made while digging to the south or south-east. A floor of a small ante-chamber of common red tesseræ was exhumed, and a passage way running along the outside of the building, having a concrete floor. Mr. J. E. Price, the indefatigable director of the London and Middlesex Archæological Society, has been carefully watching the excavations for some weeks past for traces of the old Roman Watling-street. Within the last few days this road has been discovered about 10ft. or 11ft. from the present level, the road being about 14ft. wide, formed of a rough gravel laid upon old pottery and other *debris*.

DR. GOUJON has subjected the marrow of bone to a series of experiments, which have yielded startling results. Thus, having extracted some of that matter from the femoral bone of a rabbit, he introduced it under the skin of the same animal, and also into an incision mode in a muscle. After some time he found bony productions adhering to the tissues where the inoculation had been performed. Small cylinders of marrow extracted from the cubitus and radius of fowls were inserted into the pectoral muscles of other gallinaceous species, and in this case also the formation of bone was observed. Hence it follows that the medullary substance contributes towards the regeneration of osseous matter in the same way as the periosteum, and may be engrafted with the same ease as the latter.

THE French iron trade continues active. In the Haute Marne a great demand has been experienced for coke-made iron, and considerable orders have been received for sheets and iron wire. It is proposed to establish a rolling mill on an extensive scale at Marnaval. The production of the Moselle works is rapidly run off, and there are scarcely any stocks. The foundries in the Ardennes are well employed. The orders on hand in Belgium for rails, rolled iron, and plates assure the works continued employment for the remainder of the year. The Belgian construction workshops are still, however, not altogether so active as their proprietors could desire; they have a fair number of orders on hand on home account, but find it extremely difficult to obtain foreign orders, in consequence of the almost prohibitory import duties with which they have to contend.

THE Antiquarian Society of Scotland have just received a donation to their museum of two interesting articles, which cannot fail to be attractive, especially to juvenile visitors and all who have read Defoe's story of "Robinson Crusoe." The relics consist of the sea chest and a carved cocoanut cup, which were the property of Alexander Selkirk, the prototype of Robinson Crusoe. These were with him in his solitary residence on Juan Fernandez, and were brought home with him when taken off the island by Captain Woodes Rogers. They were used by Selkirk while he lived in Largo after his return to his native place. The chest contained his clothes, &c., and when he went off from Largo was left with his descendants, with whom it and the cup remained till the death of one of them a few years ago, when they were sold to a gentleman in London. They were recently placed in the hands of Mr. Chapman, of Hanover-street, for disposal, and have been purchased by Sir David Baxter, who, with his usual generosity, has presented them to the Society of Antiquaries of Scotland.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3906
BUILDINGS AND BUILDING MATERIALS—3873, 3887, 3921
CHEMISTRY AND PHOTOGRAPHY—3914
CULTIVATION OF THE SOIL, including agricultural implements and machines.—3882, 3912
ELECTRICAL APPARATUS.—3878
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3905, 3915
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—3872, 3874, 3875, 3881, 3885, 3889, 3890, 3898, 3901, 3903, 3904, 3918, 3920
GENERAL MACHINERY—3877, 3891, 3894, 3895, 3896, 3897, 3910, 3913
LIGHTING, HEATING, AND VENTILATING—3909, 3917
METALS, including apparatus for their manufacture—3871, 3879, 2893, 3911
MISCELLANEOUS—3870, 3876, 3880, 3884, 3888, 3892, 3900, 3919, 3922
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3886, 3899, 3901
SHIPS AND BOATS, including their fittings—3902, 3916
STEAM ENGINES—3896, 3897
WARFARE—3907

3870 P. SPENCE, Manchester. *Alum.* Dated December 19, 1868.

This relates, first, to the manufacture of alum from shale, the object being to obtain with comparative speed a clear solution of sulphate of alumina which is converted into alum in the usual manner. Second, in operating upon raw or uncalcined shale or indurated clays in a granulated form, for the extraction of iron, and obtaining therefrom sulphate and other compounds of alumina. In carrying out the first part of the invention, the calcined shale now used in the manufacture of alum, according to the mode specified under a patent, dated November 27, 1845 (No. 10970), is taken, but before digesting the shale in sulphuric acid it is ground or otherwise brought into a divided state, so that it will pass through a sieve of eight to twelve meshes per lineal inch, taking care, as far as possible, to avoid the production of dust. This granulated shale is now placed in a lead-lined vessel heated by coils of pipe containing steam of from 25lb. to 40lb. pressure, and add sulphuric acid diluted to about 1·375 specific gravity, and maintain the heat at from 225deg. to 235deg. Fah. In carrying out the improvement in the manufacture of aluminous salts, the shales or indurated clays from the coal measures, or from other sources, is taken, and in selecting these it is preferred to obtain those which contain a large proportion, say from 25 to 35 per cent. of alumina, and which at the same time contain only a small proportion of iron. These shales or indurated clays are taken in their dry and hard condition, not allowing them to be weathered by the atmosphere, and they are brought into granulations that will pass through a sieve of eight to twelve meshes to the lineal inch, and if much fine dust is produced during the grinding, the granulated material is passed over a fine sieve to remove the dust. The granulated substance is now taken and placed in a wooden tank containing, say, from 10 to 20 tons, and cover it with water containing 7½ per cent. of the weight of the granulated material of hydrochloric acid of commerce. After the whole has stood for two days, the solution is run off, and the material washed with water until it is cleansed from the solution, and after draining it is calcined for two or three hours at a low heat of barely visible redness in the dark, and this substance will now be found ready for the extraction of alumina.—Patent completed.

3871 J. JONES, Wolverhampton. *Coating metals.* Dated December 19, 1868.

The inventor constructs a flue of suitable size, made, by preference, of iron, and uses in combination therewith an exhaust fan, worked by steam or other suitable power. In order to obtain a strong draught or current of air upon the top edges of and surrounding the bath, he forms a hollow flat flue of suitable form in section. This hollow flat flue is connected to the main downward draught flue, and is open upon its inner side. Into this hollow flat flue the vapour from the metallic bath is first collected or drawn, by means of the circulation of fresh air, and from thence passes into and is taken down the main flue, being conveyed either to a suitable condenser for the purpose of collecting the metals contained in the vapour, or to an ordinary stack. For some purposes he proposes to employ additional collecting flues above the flat flue already specified, and arranged in suitable positions; and he also purposes to use double-acting fans, or more than one fan, in creating or assisting the desired draught.—Patent completed.

3872 W. S. THOMPSON, Cheapside. *Skirts.* Dated December 19, 1868.

The hoops of the skirt are severally composed of two narrow steel ribbons or flat wires, laid parallel to each other, and at a suitable distance apart (equal, say, to the width of the two ribbons). These are connected together by a lap of cloth, secured and stiffened by paste or other adhesive substance. The hoops, before their ends are joined, are passed through loops in the ordinary suspending tapes, and they are made fast thereto by passing eyelets through the tapes and through the central or cloth portion of the hoops.—Patent abandoned.

3873 J. DICKSON, Leith. *Windows.* Dated December 19, 1868.

The batten rods by which the lower sash is kept in place are provided with a socket. At the upper end of each, and at suitable distances apart, on the inner side, studs with heads are fixed, which pass into corresponding retaining plates fixed to the window frame, so that in putting in the batten rods it is necessary only to slip the upper ends into the sockets and the studs into the retaining plates, after which the batten rods are forced downwards until the mitre on the lower end rests close to the corresponding bottom part of the frame. When so lowered, the batten rods are firmly retained in position, and keep the sash in its place. To remove the batten rods, they are raised sufficiently to enable the retaining heads of the studs to clear the slots in the retaining plates; they are then lifted out, leaving the lower sash free to be lifted out also. The sash lines or chains are connected to the sash by being passed through a metallic or wooden nut, which is of a dovetailed form, and passes into a dovetailed recess in the side of the sash, and thus is easily removed when requisite to detach the sash. The parting beads are fitted into grooves in the frame, by which they are retained in place, and removed when it is required to take out the upper sash, which is connected to or detached from the sash lines by means similar to what is hereinbefore set forth with regard to the lower sash.—Patent completed.

3874 G. H. ASKER, Norwich. *Umbrellas, &c.* Dated December 19, 1868.

In order to confine the outer ends of the ribs to stick when the umbrella, parasol, or sunshade is closed, the inventor employs a cap of ivory or other material surrounding the stick, and fixed in or forming a continuation of the runner, which he calls a "tip cap." The exterior of the cap is inclined, so that the pressure of the ribs against it in closing may cause the cap with the runner on which it is fixed or formed to recede to allow the ribs to enter. To allow the runner thus to move, it is necessary that the runner should be able to slide a distance through the notchpiece upon it, in place of having the notchpiece fixed to the runner, as heretofore.—Patent completed.

3875 T. WARWICK and A. BOYLE, Birmingham. *Umbrellas, &c.* Dated December 19, 1868.

A vertical rack capable of an intermittent descending motion carries the pieces of trough-shaped wires from which the stretchers are to be made. A feeder pushes the pieces of wire one at a time from the rack on to notches on the bed of the machine; or the wires may be fed to the feeder by hand. A carrier worked from the principal shaft of the machine rising takes up the wire, and then advances horizontally until the ends of the wire are brought over the lower dies of two pairs of dies, which operate on the two ends of the wire. The carrier then descending leaves the wire resting by its two ends on the said lower dies. The stretcher wire, before it is put into the rack, has a small strengthening or filling-up piece of cylindrical wire, placed by hand in each end. By the descent of the upper dies upon the lower dies the ends of the stretcher wire are flattened and partially shaped, the filling-up piece giving the necessary strength to the flattened end. On the ascent of the upper or movable dies the carrier again lifts the stretcher wire from the lower dies, on which its ends rest, and carrying it forward places its end on the lower dies of a second set of dies, consisting of two pairs. The invention consists, second, in a machine for testing the stretchers and ribs for umbrellas and parasols, constructed in the following manner:—Two pairs of rollers are mounted on horizontal axes, the upper pair not being immediately over the lower pair, one of the upper rolls being situated midway over the two lower rolls, the other roll of the upper pair being on the same level as the first. By passing the stretchers or ribs between the rolls they are made to take temporarily an undulating or wave-like figure, and, if they are too hard are broken, and if too soft take a permanent set, and in either case are unfit for use. Those that pass through the machine without injury are proper to be made up into umbrellas or parasols.—Patent completed.

3876 W. R. LAKE, Southampton-buildings, Chancery-lane. *Cutting rocks, &c.* (A communication). Dated December 21, 1868.

This relates to a previous patent, dated April 8, 1868 (No. 1183). It consists in the novel construction of the frame of the machine described in the specification of that patent, whereby it is rendered more convenient for supporting and adjusting the drilling mechanism, and in the peculiar means employed in connection with the feeding and rotating devices, also described in the former specification, to prevent the injurious effects upon the machine of the vibration and concussion occasioned by the rapid action of the drill.—Patent completed.

3877 T. R. SHAW, Lancaster. *Lubricators.* Dated December 21, 1868.

This consists of a method of supplying the "steps" or bearings in which the said shafts or journals revolve with lubricating material. On the bottom step or lower portion of each bearing the inventor forms a recess, or he forms the bottom step in two portions, with a space between, or he forms two or more of the recesses, or he forms the bottom step in three or more portions, if found suitable in the case of long bearings. The recess or space on each of the aforesaid recesses or spaces is made of a semi-annular form, or of a form approaching thereto, and is provided with a suitable mouth or orifice through which oil or other lubricant may be poured into the recess, and through which the material can be inserted or withdrawn, the mouth or orifice being, by preference, provided with a lid or cover. On the recess he places a piece of sponge of a suitable form to fill or nearly fill the recess.—Patent abandoned.

3878 W. F. STANLEY, Great Turnstile. *Electrical machines.* Dated December 21, 1868.

This consists, first, in making the framework of an electrical machine to consist of two slips of wood united at the one pair of ends to form a handle, and at the other to form a clamp, thereby obviating the necessity of the stand universally made to every description of rotating electrifying machine. Second, the exciting rubbers are simply attached to the frame instead of having separate carriages and adjustments. Third, the axle is made of wood instead of metal, as in plate glass machines. Fourth, the disc is made of sheet glass instead of being made of plate glass; and, fifth, the collector is formed of a piece of woven wire gauze instead of a comb of metal points.—Patent completed.

3879 R. WILSON, Manchester. *Cutting metals, &c.* Dated December 21, 1868.

The inventor uses two nuts, one of which is constructed so that it can be turned round in its socket when required, and thus made to take up the slack caused by the wearing of the nut or screw. He introduces two or more rests or supports which are connected with each other, and which are made to travel below the screw, and so support it when the nuts are near to either end of the screw. He makes the worm double or in two lengths, having room between the parts for screwing or tightening up when either or both the worm threads or rack teeth or cogs are worn.—Patent completed.

3880 J. E. MASSEY, Chadwell-street, *Sounding machines.* Dated December 21, 1868.

The inventor employs a solid brass frame about 13in. long by 7½in. broad, formed in the shape of an oblong shield, this shape being preferred in order to facilitate its passage through the water. Through the thickness of the frame a hole is formed in the upper part, in which is secured the rope for descent and ascent, and in the lower part another hole through which is secured the rope for attaching the sinking weight. In the upper part of the frame is formed a hollow chamber constructed to receive the registering wheels and other parts of the recording apparatus. The hollow chamber is contrived so as to protect its contents from all pressure of the water, and from being fouled. In this chamber is placed an endless screw and two or more wheels, the first of which gears into the endless screw. The chambers and its contents are covered in by a plate of thick brass, on the other surface of which is a small raised box for the purpose of containing the dial and indices which are protected by a sliding cover formed in the edge of the raised box.—Patent abandoned.

3881 H. G. THOMPSON, New York. *Carpets.* Dated December 21, 1868.

The inventor forms an under or additional shed with such threads, and inserts a wire having a knife or cutter at one end, as well understood in the manufacture of cut pile fabrics, in such shed to be beaten up, a wire being introduced into each successive shed formed by the ornamental or figure warps as they are successively thrown out of the fabric. The wires thus introduced travel a

suitable distance with the fabric, and are then withdrawn successively, at the same time severing from the fabric those threads which formed the shed into which they were introduced, the ends of the threads thrown out of the fabric remaining, and being, to some extent, held between the back of the fabric and those wires which have not been withdrawn. The ends of those threads which are not being woven into the fabric the inventor holds by means of clamping or holding surfaces, so as to press upon and securely hold the ends of such threads at a short distance from the point at which the weft is being beaten up, the pressure of such clamping or holding surface or surfaces being relieved when the fabric is being taken up, so that the ends of those threads which are not being woven into the fabric may not be drawn forward with it.—Patent completed.

3882 W. LEWIS, Shrewsbury. *Ploughs.* Dated December 21, 1868.

This relates, first, to the method of forming or constructing the plough beam, by having the side of the beam to which the land side or frame and coulters are attached made with an angular or semicircular face, for the purpose of giving additional strength to the beam, and also for the purpose of adjusting the coulter and skim coulter to any required angle. Second, to the method of attaching the plough wheels to the beam. Instead of the usual method, the inventor has on the neck of the beam, solidly forged with the beam, a box or oblong slot; on the bottom edges of the box or slot projecting under the beam he has recesses in which the plough wheel shafts are fitted, having a bearing on each edge of the box or slot; to each plough wheel shaft he has a loop or socket bolt, through which the plough wheel shaft passes in the inside of the box or slot. On the top of the box or slot he has a plate or washer of the same form as the box or slot on the outer surface, with holes for the loop or socket bolts to pass through. Thus, by screwing down the bolt nuts on the washer or plate, the plough wheel shafts are securely fixed in a simple and effective way, and the plough wheels may be adjusted to any gauge with ease and certainty.—Patent abandoned.

3883 J. BAGGS, High Holborn. *Iron.* Dated December 21, 1868.

This consists in drawing the waste gases from the tunnel head or upper part of an iron furnace, and after passing the same through or over or in contact with ignited coke or charcoal or carbon in any form, in blowing the mixed or revivified gases into the furnace again, to be again burnt by meeting the ordinary air blast at the temperature of ignition, and so on, time after time *ad infinitum.* —Patent abandoned.

3884 J. S. WALKER, Lancaster. *Cutting coal, &c.* Dated December 21, 1868.

This consists principally in the use or employment for such purpose of a peculiar form of disc cutter, mounted horizontally on a short vertical shaft, and driven by bevel gearing actuated by a compressed air engine. The whole is mounted on a carriage supported on wheels, running on a tramway, and propelled slowly along the face of the coal or mineral by means of worms and worm wheels also actuated by the same or an auxiliary compressed air engine, or in any other suitable manner. The cutter consists principally of a disc or wheel provided with a vertical rim or flange all round its circumference. Inside the rim or flange is cast a circle of bevel teeth projecting upwards from the face of the disc or wheel, but not so high as the edge of the rim or flange above named. The outer edge or periphery of the rim or flange is provided at intervals with snugs or projections between which the teeth or cutters are fixed by means of keys. The teeth are mounted in groups of four or five, following each other, the first being formed with a simple point in the centre, the second two points, and so on, arranged in such manner that each successive cutter acts upon a different part of the groove or channel, and the whole group leaves no part uncut. The face of the cutter is wider than the thickness of the disc or wheel with its rim or flange, so as to afford plenty of room for clearance, and prevent the liability of the cutting disc or wheel becoming jammed or wedged fast in the groove or channel. A semicircular shield of plate iron with a strong rim or flange may be placed so as to project from the side of the frame over the disc or wheel fitting inside the rim, so as to prevent the cuttings of coal or mineral from falling into and choking the teeth of the bevel wheel.—Patent completed.

3885 L. A. W. LUND and E. ASCMAN, London. *Buttons, &c.* Dated December 21, 1868.

The inventors first form the exterior surface of the article of gold, silver, aluminium, or other precious metal, by stamping, pressing, "spinning," or in any other ordinary manner, leaving the edge turned up a suitable distance, and where the articles are either circular or oval, rollers may also be used cut or shaped to the exterior surface of the article. They then deposit the article in a die, which fits the exterior surface, and press into the interior thereof horn, ivory, tortoiseshell, vulcanite, gutta-percha, wood, or other suitable material or compound, in a warm or plastic state, so as to fill up the interior quite solidly, leaving sufficient space when required for a covering or back plate of gold or other metal or alloy, or of ivory, mother of pearl, or other suitable material. They then insert the covering or back plate, and bend or press over it, the rim or edge of the exterior surface, by pressing, burnishing, "spinning," or in any other manner, so as to combine the whole, and form, as it were, one solid piece, thus producing a stronger and cheaper article than those hitherto made. Or they can attach pins, screws, hooks, clasps, or other fastenings, either by soldering or otherwise, and either to the front or back covering plate or to both, and then press them together, while the filling material is in a warm or plastic state, thus forming one solid piece of the whole.—Patent completed.

3886 E. A. COWPER, Westminster. *Velocipedes.* Dated December 21, 1868.

One of the improvements consists in varying the throw of the cranks, by mounting the crank pins on sliding pieces, carried by arms projecting from the axle, and caused to slide when required by means of screws acting lengthways of the slides, which latter are held securely in position by a set screw or a catch. Another improvement consists in jointing the frame or back at or near the middle of its length, and connecting the two parts either by a hinge so arranged that the two parts, each with its respective wheel, will fold up side by side, and thus occupy a comparatively small space, or the two parts may be made to separate from each other for this purpose, and be connected when required by any suitable known form or fastening.—Patent abandoned.

3887 R. WHITAKER, Wolverhampton. *Locks, &c.* Dated December 21, 1868.

The inventor makes the bolt of a segmental form, and free to move on an axis or round its outer edge, in a box, case, or rim, or by a groove and fillet. The bolt proper is provided with projections or arms and sometimes with slots or grooves, which, through the action of key bits, whether the ordinary bits, or jointed bits, or any description of bit at present in use, shoots or throws the bolt. Sometimes a ward or wards is or are formed on the radial arm of the bolt, for the bit to throw the bolt, and in some cases the bit of the key acts on one or more pins on the arm, while the pipe of the key fits over another pin. The fastenings may be modified, so as to be fixed externally or internally, and be used for various purposes. The lever or levers may be guarded by wards and detectors or by any other means now in use.—Patent completed.

3889 J. WILKINSON, Leeds. *Saddle cloths, &c.* Dated December 21, 1868.

This consists in fitting upon opposite sides of an open woven fabric, by preference that known as scum cloth, and then subjecting a length of this material to the process for which letters patent were granted, dated November 13, 1855 (No. 2553), in order to mould the same to repeats of the shape required for converting the material into saddle cloths and nummahs, instead of operating upon pieces of the compound fabric cut to a suitable size to form one given article. The inventor strains a length of the fabric, while saturated with moisture, over a shape equal in length to that of the fabric to be treated, and presenting in profile several repeats of the counterpart of the figure which it is desired to impart to the fabric. The edges of the fabric he holds down with tenter hooks, carried by adjustable bars, and having thus secured the wet fabric, he leaves it to dry. The effect of thus drying the fabric at tension will be to give a permanent set thereto, and when dry the length may be cut up into pieces to form any given number of saddle cloths or nummahs. The edges have then to be trimmed to complete the shaping of the article, after which he finishes them by a line of stitches run in near the edge of any suitable sewing machine and by applying a binding round the edge.—Patent completed.

3890 T. B. HUBBELL, Euston-square. *Bandage.* Dated December 21, 1868.

This consists of an elastic waistband, from which depends a sack for containing some absorbent material. The sack is formed of india-rubber, and a sponge or cotton waste is placed therein. It is connected to the waistband by pendent strips of india-rubber attached by cement to the front and rear ends of the sack.—Patent abandoned.

3891 J. H. JOHNSON, Lincoln's Inn-fields. *Sharpening saws.* (A communication). Dated December 21, 1868.

It is proposed to adapt temporarily by means of bolts or other convenient fastenings, a small frame to a convenient part of the saw frame, such small frame containing the sharpening and finishing or polishing appliance and means for working the same. The saw to be operated is steadied between guides, and the teeth are then successively sharpened by bringing to bear upon them a file made in the form of an endless screw or helix, which is formed on a steel cylinder or boss mounted on the lower end of a revolving spindle, worked by a winch handle and pair of bevel wheels. On rotating the helicoidal file whilst in contact with the saw tooth, its cutting edge will be sharpened, whilst at the same time the tooth last operated upon is being finished or polished by the action of a rotatory polisher, situate beneath this file, and carried by the same spindle.—Patent abandoned.

3892 H. W. HAMMOND, Manchester. *Spring pawl washer.* (A communication). Dated December 31, 1868.

This relates to washers to be used with bolts and nuts, and consists in cutting through a washer of the ordinary shape, so as to prevent taper edges and allow of its being forced from the form of a plane to that of a helix, by which means, when it is placed in front of a nut and screwed so tight as to again assume the form of a plane, the cut edges will act with such force against the nut and the other parts to which it is screwed as to prevent the nut from turning round when violently shaken by railway trains or other means.—Patent completed.

3893 W. E. GEDGE, Wellington-street. *Resinous bitumen.* (A communication). Dated December 21, 1868.

The bitumen, the subject of this invention, is composed of white or liquid resin, otherwise called gallipot, of lampblack, and of sulphur and red sand from the pit or mine, combined in about the following proportions:—For every 100lb. weight of bitumen—sulphur, 37½lb.; gallipot (or, in case of necessity, colophony), 25lb.; lampblack, 12½lb.; sand, 25lb.; total, 100lb. For bitumen to be applied on wood, the quantity of sand may be reduced by about 5lb. weight, and it is preferable that the wood be rough, that is to say, not planed. In preparing the bitumen, the sulphur must first be thoroughly melted in a sheet iron cauldron or an earthenware pot, the gallipot is then added, and when this has almost entirely melted the lampblack is introduced, and, lastly, the sand, and the whole is carefully mixed over a moderate fire. This bitumen may be used in the shape of bricks, or be laid as a coating upon any desired foundation. It is suitable for bottoms of reservoirs, for pavements of streets or terraces, for roofing, and other applications too varied for enumeration.—Patent completed.

3894 P. G. JARRE, Paris. *Hydro-pneumatic pump.* Dated December 21, 1868.

The object is to provide a means of employing any given motive power for drawing liquid from a spot which may be far from the motor, and of conducting it automatically wherever desired. The liquid is drawn from the place where it is found and forced to the place where it is required, without the use of a single apparatus which cannot be easily inspected and repaired. Near the selected motor an ordinary air pump is placed, the piston of which sucks and forces air. Two pipes, the one conducting the drawn or sucked and the other the forced or compressed air, passes from this pump to the place from which this liquid is to be taken. A little above the level of this liquid is a reservoir communicating by a pipe with the liquid to be drawn, and by another pipe with the spot to which it is to be conducted. Each of these pipes is furnished with an ordinary clack valve, working so that the liquor sucked in to the reservoir cannot return, and that the liquids forced from the reservoir cannot come back into it. The lid of this reservoir carries two apparatuses—the distributor and the float. The distributor is composed of two cylindrical pipes, the axis of each meeting at right angles. This combination of pipes may be dismounted in two pieces, it being cut by a plane passing through the two axes. Each piece has two circular flanges or thimbles to receive the valve chambers. On the side by which the compressed air arrives a valve plays between two seats, so as to cause the forced or compressed air to communicate either with the reservoir or the outer air. On the right, two valves, fixed on the same axle, play in such a manner that when the one is open the other is closed, and thus cause the suction to communicate either with the outer air or with the reservoir. The axles of the valves are linked to a vertical rod, by means of two small connecting rods, the axles being guided by the actual seats of the valve. Supposing the rod to be moved by an impulsion, acting from below upwards, the compressed air will communicate with the reservoir, and the suction with the atmosphere. If, on the contrary, the rod receives an impulsion, acting from above downwards, it will pull the two axles, and the compressed air will communicate with the atmosphere, and the suction with the reservoir.—Patent completed.

3895 W. E. GEDGE, Wellington-street, Strand. *Cocks* (A communication). Dated December 21, 1868.

This cock may be termed an every pressure cock, for its exterior may assume any of the usual forms, and it may discharge the liquid from beneath, or by a bent or a straight spout. It may also be a three-way cock, and be made of any kind of metal, and of all sizes. The interior arrangement of this cock consists of a metal lid or cap, pierced for the passage of the stem or plug, which governs the movement and screwed on the box, either interiorly or exteriorly, a washer of leather, india rubber, gutta-percha, or any other malleable and impervious material, seized by the inner or outer screw of the cap, and also permitting the passage of the stem or plug governing the movement, and to which is fitted indifferently a key, handle, or spanner, of any desired form. This stem passes through the metal cap and leather washer, and carries, so as to form one piece with it, an inner disc of metal coming on to a leather washer situated above it, and acting as an obturator. There is another stem or plug, independent of the first, but governed by it in the circular movement by the aid of a mortice which unites them at a certain point. This stem, like the upper one, has a metal disc of one piece with it and bearing upon a second washer of leather, india-rubber, or analagous material, which washer rests upon another disc, supporting the entire arrangement, and forming part of the cock, being cast with or brazed to it. This second leather washer is kept in place and prevented from following the circular movement by a ring or other means. A helical spring is placed between the two metal discs, tending to press them on the two leather washers above and below them. The axis and washer are pierced with two openings passing through all three in a direct line. These openings may, according to the description of cock, be four in number, or there may be but a single one; it is only requisite that the disc should be able to close them, as will now be explained. The water arriving by the barrel fills the box or chamber of the cock, and by its pressure pushes the two metal discs against the two leather washers, perfectly closing the chamber top and bottom. The helical spring is intended to assist this water power should its pressure be insufficient, and it may therefore be used or dispensed with according to requirement.—Patent completed.

3896 J. BREEDEN, Birmingham. *Valves.* Dated December 18, 1868.

The body of the tap or valve consists of a chamber, in which a conical valve seat having its greatest diameter downwards is formed. The lower division of the body of the tap communicates with the ingress pipe, and the upper division with the egress pipe. Working on the valve seat is a conical valve opening downwards. The spindle of the conical valve works in a tube on the bottom of the lower division of the body of the tap, and a coiled spring on the spindle raises the valve, and keeps it to its bearing on the conical seat described. The pressure of the liquid steam or gas also tends to raise the valve and press it on its seat. In the top of the body of the tap is an opening from which a tube depends. The tube is screwed within, and a screw rod with a hand wheel or other handle at the top rises and falls by a rotary motion in the said tube. When the handle is so turned as to depress the rod its lower end presses upon and depresses the valve, and a communication is thereby opened between the ingress and egress pipes. By reversing the motion of the handle the valve no longer pressed from its seat is raised thereto by the spring, and the communication between the ingress and egress pipes is closed. The motion of the screwed rod and valve downwards is limited by the spindle of the valve, and the motion of the said rod upwards is limited by its enlarged lower end coming against the lower edge of the screwed tube. The valve is guided in its motion by three or other number of upright guides, situated near its periphery, working in a short tube surmounting the valve seat.—Patent completed

3897 J. CLAYTON, Lancashire. *Valves.* Dated December 21, 1868.

On an axis, the partial rotation of which opens and closes the valve, a disc, having clutch teeth upon its face, is mounted in such manner that it can move longitudinally upon axis, but when it turns it carries the axis and valve with it. On this disc is an arm which by a rod is connected with the spring for closing the valve. Behind the disc is a spring tending to move it along the axis, pressing it constantly against another disc, which, by the action of the eccentric, is caused to rock to and fro around the same axis. This disc has recesses in it corresponding with the teeth of the first disc, and when these teeth and recesses are opposite to each other they lock the one into the other, and then the two discs move together, and the eccentric is so for the time coupled with the axis and the valve is opened. When the valve is to be again closed the discs are separated the one from the other, until the teeth are withdrawn from the recesses, and immediately the spring closes the valve. The separation of the discs is effected by means of inclined or cam surfaces on the first disc, which abut on an adjustable surface having other inclines upon it, and when, by the motion of the disc, the inclines meet, the disc is pushed back and disengaged from the eccentric, as already described.—Patent abandoned.

3898 G. RITCHIE, Folkestone. *Parasols, &c.* Dated December 21, 1868.

The inventor connects the outer ends of the stretchers

to the ribs by forming a bead or enlargement on the end of each stretcher to enter a groove formed longitudinally along the rib. The stretchers are at their inner ends jointed to a runner, but are made much shorter than heretofore usual. When the runner is moved upwards along the stick, the outer ends of the stretchers slide along the grooves in the ribs, and as the runner approaches the point at which the ribs are jointed to the stick, the stretchers force the ribs outwards to cause them to stand out at right angles, or nearly so, to the stick, and, similarly, if the runner is drawn downwards, they will draw the ribs inwards towards the stick. The grooves in the ribs are narrowest at the mouth, so that the projections on the ends of the stretchers cannot be drawn outwards from the grooves. The runner may be prevented from turning around the stick by a pin or stop on the runner working in a groove or slot in the stick, or in place of the stretchers being jointed to a runner and sliding in grooves in the ribs, they might be jointed to the ribs and slide in undercut grooves or slots in the stick. In this case, the inner ends of the stretchers would, in opening the parasol, be all simultaneously pressed upwards by a runner being moved along the stick, so causing a disc on the end of the runner to bear against the ends of the stretchers. When the parasol is opened, the runner is stopped from moving further along the stick by a stop, and the ribs near to where they are jointed to the stick, and at the same time be forced upwards by the stretchers against a disc carried by a ferrule fixed to the stick, and the ribs are thus held firmly. A cord is sewn on to the outer silk covering near its outer edge, to give strength, and prevent the parasol being blown inside out by the wind.—Patent completed.

3899 W. R. CLARK, Forest Hill. *Signalling in trains.* (A communication). Dated December 21, 1868.

The inventor places in the guard's van, and on the engine, a small signal lantern, the glass of which is ordinarily covered over by a screen, which is held in position in front of the glass by a small detent or stop, but when an alarm is to be given the detent or stop is caused to be withdrawn from in front of the screen, and the screen is then, by a spring, turned down on a hinge at its lower end, and so the light is uncovered and the alarm given. A continuous tube is fitted along the tops of all the carriages, and when the alarm is to be given the air in this tube is compressed, and by this means small plungers working in cylinders connected to its ends will be forced outwards, and caused to release the stop by which the screen is retained.—Patent abandoned.

3900 H. T. VANNER and E. BREST, Great St. Helen's. *Leather.* (A communication). Dated December 21, 1868.

Heretofore, in currying and dressing leather, it has been usual to employ neat's foot oil or cod or fish oil together with tallow. According to this invention, the residuum oil obtained when distilling petroleum is employed for this purpose. When the residuum oil is of a specific gravity of about 880, which is about the specific gravity of the oil as now usually manufactured, it is preferred to use it with tallow in the proportion of 14lb. of oil to 16lb. tallow.—Patent completed.

3901 L. J. PAINE, Oxford-street. *Combined collar and comforter.* Dated December 22, 1868.

This consists in a new or improved removable collar, or collar and comforter combined, for attaching above the ordinary fold-down collar of great coats, coats, waistcoats, jackets, cloaks, and other upper garments made of fur, velvets, cloth, imitation fur cloth, or any other suitable or fashionable material worn for comfort or elegance round the neck. One arrangement of this invention consists in making a collar of fur or other material of similar shape, but a little larger than the collar over which it is to be worn, and fitting a long thin hook at each end and another similar hook at the back, and having small holes made in the ordinary collar of the coat into which these hooks can be placed, thus making a double or second collar which can be easily attached or detached, and when required as a comforter the collar may be turned up round the neck of the wearer with the fur inside, so that both collars would then form a most comfortable and close-fitting cravat or muffler.—Patent abandoned.

3902 J. JENSEN, Christiana, Norway. *Reefing and unreefing.* Dated December 22, 1868.

The mainsail is to be rolled upon a boom on which the foot rope of the sail is fastened. The boom is to be placed over the main boom in two davits which are fastened on each end of the main boom where the reef boom turns. At the fore end of the reef boom is a wheel where the one end of the reef line is made fast and turned up; the other end is fastened to a windlass placed on the deck underneath the wheel and the main boom. On the middle of the reef boom one end of a piece of sennet is fastened, and the other end is put through a buckle-formed hook which grabs round the reef boom. A piece of parsling is served on the sack whereon the rollers belonging to the mast hoops revolve, when reefing or unreefing the sails. On the fore side of the reef wheel there is a comb wheel pawl. The uppermost hoop is fastened to the claw of the gaff at a proper distance from the gaff, and the other mast hoops are fastened to each other at proper distances. A line is fastened to the lowermost loop and again made fast to the masthead through a block, and so passes down to the deck. The main boom rests as usual on the collar of the mast, the boomlifts and sheet also as usual. The gaff is furnished with a claw and peakhalyard.—Patent abandoned.

3903 M. CHALLINER, Grimesthorpe. *Forks or spoons.* Dated December 22, 1868.

For the formation of forks with handles, the steel, iron, or other metal is first rolled into square rods of different thicknesses, according to the sizes of the forks required. The rods are then forged into what in the trade are called moods. These moods are then placed in prints to form the shanks and bolsters; after having been formed or shaped in the prints they are placed in dies, including prongs, shanks, and bolsters, of any pattern or design, and stamped. This is done to secure uniformity in the length of the shanks. The guard holes for carvers and cook forks are stamped at the same time instead of the ordinary method.—Patent abandoned.

3904 J. PALMER, Sutton Coldfield. *Forks.* Dated December 22, 1868.

This consists in manufacturing the forks by making the fork moulds from which the forks are made by the process of casting. The inventor makes patterns of the shape of the required fork moulds, and he either makes the casting moulds from the said patterns in sand or he makes metal or chill casting moulds therefrom in the ordinary manner, and he casts melted steel in the said casting moulds, so as to produce the said fork moulds. He finishes the forks from the fork moulds, made out of cast steel, by forging and drawing out the same, and attaching the langet thereto in the ordinary manner. Or the part to form the langet may be cast in one piece with the fork mould.—Patent completed.

3905 S. TIDCOMBE, Watford. *Paper-making machinery.* Dated December 22, 1868.

The object is, first, to facilitate the rapid feeding of the paper from paper-making machinery, or from other supply, to cutting means, in order to increase the rapidity of the cutting of it into sheets, and also when the paper is cut from long lengths into sheets to facilitate the collecting of the sheets as cut. In carrying out this part of the invention, the paper, as it passes from a paper-making machine or other supply, in place of passing to the action of one set of knives, passes between guides to conduct the paper to one and then other set of knives and similar guides, aided, when necessary, by belts or aprons, which are used to conduct the separate sheets in succession, as they are cut alternately or otherwise to lay boards, placed in opposite inclined directions or otherwise, as may be most convenient, or into other suitable receivers, to be taken by the collectors, by which an additional number of collectors may be employed. Or, in place of the hands now employed for collecting such sheets, atmospheric pressure and vacuum is used for this purpose. As each sheet is cut it passes over a box, the sides of which are perforated, and these perforations are in connection with an air pump or other means of producing a vacuum, so that as each sheet passes over the box it is drawn therein at each stroke of the knife, and as it becomes laid it forms a new button, and as the box fills the sheets can be withdrawn in packs from beneath the other, and the cutting and filling go on at the same moment. The improvements relate, secondly, to means for use in damping paper, in order especially to facilitate printing thereon. The paper to be damped is conducted into a chamber formed for this process, so as to prevent as much as possible the escape of the steam or fine spray of water admitted therein by suitable pipes. The paper to be damped is conducted by felt or other suitable sheet conductors to between two pairs of rollers, and the surface between the separate pairs of rollers is enclosed by plates, with edges bearing against their surfaces; the ends are also closed, thus forming a closed box or chamber. Other rollers also aid in conducting the sheets. Perforated pipes conduct the steam or fine jets of water into the chamber thus formed to act on the paper as it passes through it. One pair of the rollers may be heated by steam to dry the felt or other conductor after saturation; water of condensation may be drawn off by a tap or self-acting valve.—Patent completed.

3906 J. H. JOHNSON, Lincoln's Inn. *Pulleys.* (A communication). Dated December 22, 1868.

The wooden pulley being ready to receive the metal covering, a disc of the required diameter is cut out of sheet copper by any well known cutting apparatus, but it is preferred to employ a cutter, acting on the principle of a pair of shears, which are to be attached to the end of a lever. The metallic sheet is guided to the proper height and then pinched between two holding surfaces, whilst the cutters detach the disc, which falls the moment the holders are separated. In lieu of cutting discs from a flat sheet-rings of the proper width may be cut from a drawn tube made without weld. The disc above referred to is then submitted to a stamper, which turns up the edges, two holders nipping the edges until the stamper enters, whereby the folds or corrugations are prevented from forming on the turned-up edges. The metal covering is then applied to the pulley, and is forced into the groove and over the face by pressure applied thereto by the successive action of two pulleys, one of which forces the metal down into the groove of the pulley, and the other folds over and presses down the protruding metal against the face or side of the pulley. All excess of metal is then cut away by two tools acting simultaneously upon the two faces of the pulley, and tending, at the same time, slightly to imbed the metal into the wood. A forked piece detaches the pulley from the rotatory mandril upon which it is mounted when under the action of the pressing pulleys and cutting tools.—Patent completed.

3907 F. G. GISBORNE, West Strand. *Torpedoes.* Dated December 22, 1868.

The inventor encloses wi or attaches to the shell of the torpedo or other explosive charge a compound needle, which is mounted upon a pivot or centre of motion, and is suitably counterbalanced, so as to keep the point thereof away from a suitable contact piece; also in connection with the shell of the torpedo or other explosive charge. The needle is placed in metallic contact with one pole, whilst the contact piece is in metallic contact with the other pole of a suitable battery or other electrical machine, carried by the shell of the torpedo or other explosive charge, or placed at any suitable distance therefrom, and connected thereto by means of a conducting wire.—Patent abandoned.

3908 S. SMART, Bromley. *Boilers.* Dated December 22, 1868.

This relates, first, to improvements in longitudinal multitubular boilers, in the furnaces of which one or more horizontal water tubes are suspended, closed at both ends, and of such diameter as to enable the inventor to insert into them from end to end a number of fire tubes communicating at one end with the furnace of the boiler, and at the other end with a smokebox at the firing end of the boiler. A number of fire tubes pass from this smokebox through the water space of the boiler into another smokebox at the opposite end of the boiler, communicating with the chimney, and the hot gases are thus caused first to play around the suspended horizontal water tubes, and then to pass from the furnace through the suspended horizontal water tubes into the front smokebox, and thence through the second series of fire tubes into the chimney. The horizontal water tubes are held suspended in the furnace by means of short water tubes forming communications between the horizontal water tubes and the boiler at the upper and lower ends of the firebox. Each of the horizontal water tubes is fitted with one or more mud holes, for the purpose of cleaning them internally when required. The upper part of the furnace is made of increased strength, into which is fastened a series of chain tubes, into which are inserted inner tubes, hereinafter described.—Patent completed.

3909 F. G. GISBORNE, West Strand. *Gas.* Dated December 22, 1868.

The inventor employs apparatus consisting of a cylinder, which is provided with two chambers at its lower part; into the lower chamber is admitted air, and into the upper one gas. From the top of the lower chamber rise pipes or tubes, which pass up to or through the top of the gas chamber, a suitable annular space being formed around each of such tubes in the cover of the gas chamber. A combustion chamber is formed above the gas chamber and a boiler above the combustion chamber, through which boiler pass suitable tubes to carry off the products of combustion, and such tubes rise up a certain distance above the water level, and immediately above such tubes are fixed one or more retorts.—Patent abandoned.

3910 J. SNAPE, South Wales. *Pumps.* Dated December 22, 1868.

This consists in the employment of two drums, one of which is formed with six or other convenient number of convex surfaces, and the other with corresponding concave surfaces. These two drums revolve in opposite directions, and in their revolution the convex portions of one fit into the concave portions of the other. These drums, when applied to ventilating mines, are fitted at the upper end of the air shaft, and their respective convex and concave portions in their revolution move round in segments of circles. In the revolution of the convex drum, air from the shaft is drawn into the space between each successive pair of convex surfaces, and is carried off in this space round the segment until it reaches the open air; in the revolution of the concave drum air is in like manner drawn into each successive concave or recess, and carried off in the same manner.—Patent completed.

3911 D. S. PRICE, Westminster. *Iron.* Dated December 22, 1868.

The inventor uses either the alkaline metals or such of the oxides and carbonates of the same as are suitable for the purpose, or salts thereof, which, on combustion, yield carbonates, and some of the chlorides or mixtures of the above-named metals, oxides, and salts. When using the metals, he passes them by suitable known means into the molten mass of iron.—Patent abandoned.

3912 A. LEZILLE, Paris. *Corn.* Dated December 22, 1868.

The improved process consists of the following operations:—First operation.—The grain is thrown into a receptacle filled with water, and is stirred about therein for some minutes, when any defective grain will float on the top of the water, and can readily be removed. The washing has also for its object to remove dust and other impurities. After the grain has been steeped in the water for about half an hour, the water (which will be found quite turbid even with the best grain) is run off. In place of steeping the grain, it may also be merely subjected to the action of jets of water. By this first operation the pellicle of the grain is distended. Second operation.—The grain thus moistened is passed through a sheet metal cylinder or tube having a rasp-like inner surface, whereby the outer coarser pellicle of the grain is removed. The second pellicle, beneath which is the colouring matter, is removed by passing through a horizontal sheet metal cylinder with rasp-like inner surface, inside which are among stiff brushes, which act on the grain and render it as white as rice. Third operation.—This operation consists in steeping the grain, after removal of the pellicle, in a vessel filled with fermenting liquor, prepared as hereafter described at a temperature of from 68deg. to 77deg. Fah. and in the proportion of about 200lb. of liquor to about 100lb. of grain, in order that the latter may be well covered with the water. The grain is introduced after the liquor has been prepared, about from eighteen to twenty-four hours, in order that this may have attained its full energy. The grain is subjected to the action of the liquor for about seven or eight hours, during which time the fermentable matter in the liquor acts by degrees on the grain, penetrating into it gradually and extracting to a great extent the colouring matter situated beneath the skin of the grain; the liquor, which becomes of a reddish tinge, is then drawn off. The fermenting liquor is prepared by mixing with water at a temperature of from 68deg. to 77deg. Fah., about ten per cent. of fermented dough. Fourth operation.—The grain is then drained, and is placed in a hopper, which, by means of a distributer, causes it to pass between one or more pairs of revolving cylinders, which reduce it to paste as it passes through. This being completed, the requisite quantity of salt is dissolved in water, and is then poured on the dough placed in a kneading trough. The dough is then kneaded so as to thoroughly mix all the particles thereof, and the operation of making bread is completed in the usual manner, that is to say, the dough is divided into loaves, turned, left for completion of the fermentation, and at the desired moment is placed into the oven, yielding a very white and nourishing bread.—Patent completed.

3913 W. CLAY, Liverpool. *Forgings.* Dated December 22, 1868.

The inventor proposes, when forming heads, collars, or flanges upon the ends of shafts or rods, to employ a horizontal hammer of peculiar construction, which is connected with and operated by a piston working in a horizontal steam cylinder, and thereby materially to reduce the sectional thickness of the metal at the line of junction of the head, collar, or flange with the shaft.—Patent completed.

3914 J. S. JENNINGS, Lambeth. *Sewage.* Dated December 22, 1868.

The inventor employs a hollow rotating screen of conical or other form, into the interior of which the sewage is directed. The sewage, in entering the screen, is made to act on a waterwheel or on float boards or similar instruments on its axis, and so the screen is rotated. The sewage enters the screen at one of its ends, and runs through its sides and is received into a trough below, whilst the stones and solid matters are discharged at the opposite end of the screen into a cart or other receptacle. In driving the screen as above described by a waterwheel, acted upon by the sewage before it enters the screen, the power for driving the screen might be obtained by causing the sewage, as it flows away after passing through the screen, to drive a waterwheel, or the screen may be driven by other power. In some cases, the inventor employs a screen formed by joining together a number of bars, so as to form an endless straining surface. This endless surface is passed around rollers, and held distended between them. The sewage is let on to the surface as it slowly travels around the rollers. The liquid flows through and is received into a trough on the other side, whilst the solid matters are carried along and dis-

charged over the roller as the bars pass around it. The passage over the rollers tends to free the straining surface from obstructions.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated July 6, 1868.

2028 G. Buchanan, Surrey-street, Strand. Improvements in preserving animal and vegetable substances for use as food.

2029 W. B. Haigh, Oldham, Lancashire. Improvements in machinery or apparatus for cutting, sawing, and boring wood.

2030 J. Gedge, Wellington-street, Strand. An arm and reclining chair for travellers.

2031 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in apparatus or machinery for composing and distributing type.

2032 W. Walker, Dundee. Improvements in motive-power engines, rotary pumps, and fans.

2033 W. L. Wise, Chandos Chambers, Adelphi, Westminster. Improvements in apparatus for lubricating the cylinders of steam engines.

2034 C. Crockford, Amlwch, Anglesey. Improvements in the mode of treating the ores of lead or products containing lead, either isolated or in combination with other metals or minerals for the purpose of producing metallic lead and other metals and their compounds, and also in furnaces for carrying out the said operations.

2035 C. E. Brooman, Fleet-street, City, patent agent. Improvements in apparatus for heating and distilling water for boiler and other purposes.

2036 L. and L. Clayton and J. Smith, Hunslet, near Leeds. Improvements in the construction of taps or valves.

2037 W. Bray, Stockton, New Jersey, U.S.A. Improvements in refrigerators, more especially designed for railway provision carriages.

2038 W. Q. East, Drummond Hotel, Drummond-street, Euston-square, Middlesex. Improvements in the means of, and apparatus for, indicating or registering the flow of liquids or fluids from vats, casks, or other receptacles.

2039 W. Pidding, Walcot-square, Lambeth, Surrey. Improvements in the mode or modes of obtaining scents, aroma, perfume, or essential oils from flowers, and from all vegetable substances producing the same, also in the machinery or apparatus in connection therewith.

Dated July 7, 1869.

2040 J. Shore, Rochdale, Lancashire. Improvements in cards used in carding engines and other similar machinery.

2041 D. Cope, Liverpool. Improvements in apparatus to prevent waste of liquids in filling casks.

2042 H. E. Knight, Love-lane, Wood-street, City. Improvements in the construction of busks for stays, bodices, gaiters, and other articles of wearing apparel.

2043 F. Walton, Staines, Middlesex. Improvements in scrapers for removing mud from boots and shoes whilst in wear.

2044 J. B. Rogers, Hastings, Sussex. Improvements in velocipedes, motive apparatus, and wheels for the same and for other uses.

2045 V. A. Deaubeuf, Maindy, near Cardiff, Glamorganshire. Improvements in machinery or apparatus for compressing and moulding small coal and other matter or material for which great pressure is required.

2046 A. P. Price, Lincoln's Inn-fields. Improvements in producing partial or complete anæsthesia.

2047 R. Mallett, Victoria-street, Westminster. Improvements in the manufacture of iron and steel, parts of such improvements being applicable to other metallurgical purposes.

2048 F. Trappes, Ely-place, City. Improvements in the construction of velocipedes.

2049 J. Robinson, Rochdale, Lancashire. Improvements in machinery for cutting dovetails.

2050 W. E. Newton, Chancery-lane. Improvements in converting or puddling furnaces for decarbonizing iron.

2051 W. Arnold, Barnsley, Yorkshire, and W. Carnelley, Fallowfield, near Manchester. Improvements applicable to steam boilers.

2052 A. V. Newton, Chancery-lane. Improvements in the construction of chandeliers.

2053 W. R. Lake, Southampton-buildings, Chancery-lane. An improved method of, and means for, removing artificial coatings from metallic surfaces.

2054 J. H. Johnson, Lincoln's Inn-fields. Improvements in the preparation of meat for preservation, and in the preservation of the same.

2055 B. P. Faucheux, Poultry, City. Improvements in boxes or holders for matches and other articles.

Dated July 8, 1869.

2056 C. S. Berthon, Margaret-street, Cavendish-square, Middlesex. Improvements in squares for finding the centre of circles and marking the outlines of regular or irregular figures thereon.

2057 J. G. Rollins, Old Swan Wharf, Upper Thames-street, City. Improvements in reaping and mowing machines.

2058 J. Wright, Moorgate-srreet, City. An improved shaving mug.

2059 W. Davis, Merthyr Tydvil, Glamorganshire. An mprovement in the treatment of tallow used in the manufacture of candles and soap.

2060 T. Knowles, Birmingham. Improvements in wrought-iron permanent way for railways.

2061 L. Williams and R. C. H. Wallendahl, Birmingham. Improvements in machinery for the manufacture of fish hooks.

2062 I. L. Pulvermacher, Regent-street. Improvements in the construction of chains, batteries, and apparatus for producing electric currents, also in means of applying the same for medical and other purposes.

Dated July 9, 1869.

2063 W. Hutchinson, Regent-road, Salford, Lancashire. Improvements in machinery and apparatus employed in the manufacture of bricks and other articles of clay.

2064 H. H. Murdoch, Staple Inn, Middlesex. Improvements in means or apparatus for propelling canal boats and other vessels.

2065 T. James, Liverpool. Improvements in sewing machines.

2066 F. Baker, Kennington, Surrey. Improvements in means and apparatus for opening, closing, and securing railway level crossing and other gates.

2067 J. H. Jones, Field-terrace, New Wandsworth. Improvements in lamps.

2068 M. A. Muir and J. M'Ilwham, Glasgow. Improvements in looms for weaving.

2069 J. Aitken, Lasswade, near Edinburgh. Improvements in obtaining motive power.

2070 G. A. Nowell, Nuneaton, Warwickshire. Improvements in lamps.

2071 F. J. Manceaux, Paris. Improvements in breech-loading firearms, and in cartridges for the same.

2072 W. Allan and P. D. Nichol, Sunderland Engine Works, South Dock, Sunderland. Improvements in steam generators or boilers for marine purposes.

Dated July 10, 1869.

2073 A. M. Clark, Chancery-lane. An improved mode of measuring or dividing time applicable to chronometers, sextants, and other such like instruments.

2074 J. W. Jackson, Windsor-street, Brighton, Sussex. Breakwaters, sea defence walls or entrances for docks, and docks.

2075 J. Walker, Mansell-street, Aldgate, Middlesex, and P. A. Godefroy, Templer-road, Homerton, Middlesex. The manufacture of new or improved dyes or colouring matter.

2076 C. E. Brooman, Fleet-street, City, patent agent. Improvements in central-fire cartridges, and in apparatus for extracting the same.

2077 J. Gessert, Manchester. Improvements in the recovery of nitric acid in the manufacture of sulphuric acid, and in apparatus connected therewith.

2078 T. Kendrick, Birmingham. Improvements in certain descriptions of knobs for bedsteads, door handles, and other similar purposes.

2079 T. D. Waller, Palace-square, Norwood, Surrey. A self-acting measuring and tilting cask stand.

2080 C. L. Caldesi, Grosvenor-street, Grosvenor-square, Middlesex. A new or improved kitchen cart to be used for military and other purposes.

2081 J. Beard, Droylsden, Lancashire. Improvements in pumps.

2082 S. Read, Buchanan-street, Glasgow. Improvements in finishing fibrous and textile fabrics, and in the machinery or apparatus employed therefor.

2083 J. S. Crosland, Manchester. Improvements in, or applicable to, marine and stationary steam engines, boilers, and furnaces.

2084 J. B. Couper, jun., Dunfermline, Fifeshire. Improvements in horse shoes.

2085 J. Bannehr, Great Queen-street, Westminster, and H. Matthews, Gower-street, Middlesex. Improvements in means or apparatus for drying, airing, and warming woven fabrics, bottles, and other articles, and for indicating the presence of moisture therein, and in bedding.

2086 J. Worth, Church Stile, Rochdale, and W. Turner, Tonacliffe, near Rochdale. Improvements in cards for carding cotton, wool, and other fibrous substances.

2067 W. R. Lake, Southampton-buildings, Chancery-lane. An improved method of producing marquetry and other divers coloured woodwork.

2088 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for manufacturing horse shoes.

2089 W. R. Lake, Southampton-buildings, Chancery-lane. An improved safe bedstead.

2090 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for sawing, grooving, moulding, dovetailing, and otherwise working wood.

Dated July 12, 1869.

2091 Q. Dunlop and T. J. Martin, Ballymacarrett, Downshire, and W. Orr, Ligoniel, Antrim. Improvements in couplings and wheels for shafting and gearing.

2092 J. Dewar, Kirkcaldy, Fifeshire. Improvements in treating certain substances for food and for manure.

2093 C. A. Bates, George-street, Blackfriars-road, Surrey. Improvements in apparatus to be applied to the mouths or openings of letter boxes to prevent letters being stolen therefrom.

2094 E. Sutton, Regent-street. Improvements applicable to speaking pipes.

2095 L. Schalleidner, Rue de Malte, Paris. Improvements in the engine to stamp the waxlights.

2096 W. Bayliss, Cannon-street, City. Improvements in iron vermin-proof rick stands.

2097 J. Henderson, Leith, Mid Lothian. Improvements in surface condensers and refrigerators.

2098 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in apparatus for cleansing grain, more particularly applicable to flour mills.

2099 O. Mertens, Barge-yard, Bucklersbury, City. An improved construction of cartridge box.

2100 E. Pettitt, Manchester. Improvements in machinery for preparing and spinning cotton and other fibrous substances.

2101 J. H. Player, Birmingham. Improvements in utilizing the residual sulphate of lime produced in the manufacture of phosphorus.

2102 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the manufacture of white lead.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1782 H. G. Fairburn	1809 J. S. Cuthbert
1789 J. A. Salmon	1814 W. Walker
1796 A. Clark	1816 G. Haseltine
1813 G. W. Hawksley, M. Wild, and J. Astbury	1820 C. E. Austin
	1845 P. Ellis
	2184 E. Green

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1975 J. Rhodes	2077 T. Meriton
2007 T. Hill	

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

775	1924	1934	1941	1949	1955	1962	1978
1680	1925	1935	1942	1950	1956	1963	1982
1861	1926	1936	1943	1951	1957	1966	1984
1874	1928	1937	1944	1952	1958	1968	1986
1906	1931	1938	1945	1953	1960	1974	1988
1916	1932	1939	1946	1954	1961	1976	1990
1920	1933	1940					

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," July 13, 1869.

619 J. Ladley	886 J. Horsley
621 J. Rust	917 W. R. Lake
626 D. Davies	929 H. Haschke
627 J. Cliff	939 W. R. Lake
629 A. H. Honegger	970 J. H. Lloyd
644 H. W. Goldring	1031 J. Greenslade
645 R. Law and S. Hargreaves	1054 J. Robbins and J. Allbut
646 F. Andoe	1095 W. Smith
647 J. Robertson and J. Shanks	1193 J. Horsley
	1243 A. Borgnet
657 M. G. Cole	1246 W. R. Lake
659 S. Marsden	1284 H. Hall
661 J. B. Spence	1329 J. Broadfoot
667 C. Tighe	1352 C. T. Liernur
674 W. B. Waterlow	1365 R. Wappenstein
678 W. S. Meldrum	1367 J. Bullough
698 H. W. Cook	1385 C. J. Galloway and J. H. Beckwith
704 A. Mitchell	
707 W. R. Lake	1467 W. A. Lyttle
708 F. F. Villepigue	1610 R. Wheble
711 J. J. Shedlock	1667 J. Cockshoot and H. Weatherill
712 J. J. Shedlock	
717 B. Hunt	1734 F. Lewis
723 R. M. Caffall and D. Miller	1844 R. M'Hardy
	1861 J. Kirk, S. Shelmerdine and C. Froggatt
731 B. Britten	
733 J. Sax	
741 J. B. Bernier	1889 F. Forder and J. Traves
745 W. H. Clapp	
758 T. Beeley and D. Hanson	1929 J. Taylor, C. Booth, R. and J. Ingham, and J. Sharples
763 J. Porteous and H. Gibson	
	1941 F. C. Lecoultre
797 W. A. Lyttle	1953 M. Kennedy
805 W. and C. S. Catt	1956 J. Howard
835 E. A. Inglefield	2024 W. R. Lake

LIST OF SEALED PATENTS.

Sealed July 9, 1869.

88 A. Henry	194 A. M. Clark.
95 G. V. Osborne and A. J. Peerless	202 B. Craig
99 P. M. Barnett	208 T. Cook and J. Watson
100 J. Steel	223 W. M. Welling
103 L. Hannart	249 T. Reeder
107 G. D. Kittoe and P. Brotherhood	257 R. Girdwood
	264 R. M. Marchant
109 R. Watson and B. Dangerfield	336 J. R. Johnson
	435 W. J. Horton
116 J. H. Kitson and J. Kirby	547 J. and T. Leach and J. Goodyear
117 T. Cook and J. Watson	651 W. E. Newton
122 J. Steel	658 T. Howcroft and A. M'Gregor
131 T. Howcroft and A. M'Gregor	938 G. Bloem and E. Scheidt
166 W. T. Eley	1040 A. V. Newton
174 N. D. Spartali	

Sealed July 13, 1869.

113 H. Vavasseur and C. M. Wade	444 F. C. Hills
	519 H. T. and T. Jennings
126 D. P. Wright	566 H. Bessemer
130 P. Spence	587 E. D. Barker
132 E. Craddock	652 R. Wright
140 J. G. Johnson	662 T. Forster and R. Taylor
142 H. A. Silver	
144 J. Loader and W. H. Child	684 R. R. Bevis
	727 G. Spencer and J. Barker
151 M. Henry	
160 J. W. Price	799 O. Whittaker and H. and I. Wallwork
189 E. Burton	
239 J. and J. Wilson and G. Cryer	809 B. Latham
	964 F. W. Follows and J. Bate
245 H. Law	
274 J. Easterbrook, J. H. Allcard, and A. M. Wild	1341 T. Greenwood
	1348 G. Ritchie
	1429 J. Withers
282 G. Hawksley	1459 J. H. Johnson
305 C. D. Abel	1488 G. T. Bousfield
318 W. I. Palmer and W. P. Goulding	1512 W. R. Lake
	1568 G. Johnston
384 J. H. Johnson	1586 G. T. Bousfield
387 W. R. Lake	1625 R. P. Williams
419 P. Tayson	

LIST OF SPECIFICATIONS PUBLISHED

For the week ending July 10, 1869.

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3475	0 8	3524	0 10	3554	1 4	3596	0 8	3655	0 4	3680	0 4
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3521	1 0	3552	1 0								

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, JULY 23, 1869.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW AT MANCHESTER.

WE last week indicated the character and extent of the Royal Agricultural Society's Show at Manchester, which proves itself to be one of the most successful ever held. Last week was occupied by several sets of judges in testing the reaping and mowing machines, and plenty of work they had to do, the exhibits, in this respect, being unusually numerous. It would be utterly impossible for us to describe one-tenth part of these machines and implements; suffice it, therefore, to say that our tried and well-known makers maintained their reputation, whilst among new comers merit was not wanting, although some failures will have to be recorded by the judges. Following our usual course, we shall take our readers with us through the entire show, but we will not ask them to examine with us the 8,000 exhibits. We shall save them that trouble by selecting such machines and implements as are interesting to them, at the same time premising that if we do scant justice to some exhibits and omit others, it is simply from the fact that it is impossible to crowd everything into our limited space. We shall, however, endeavour to do justice to all by describing the leading exhibits of the show. We shall give a special list of the prizes in due course.

To begin at the beginning, we will take Stand No. 1—that of our old friends Messrs. Barrows and Stewart, of Banbury—although we shall not continue our numerical consecutiveness very long, the busy pressing throng forbidding our visiting each stand in rotation. Messrs. Barrows and Stewart exhibit some excellent samples of their well-made steam ploughing and thrashing machinery, consisting of one 12-horse double cylinder and one 8-horse single cylinder portable engines, two combined thrashing and finishing machines, cultivator, anchor, snatch block, rope porters, &c. The arrangement of the boilers, cylinders, &c., of these engines is such as must secure unusual strength, the greatest amount of steam space (the steam being taken from the quietest position in the boiler), and the smallest possible consumption of fuel; while the strength and simplicity of the working parts renders their management most easy—advantages which every farmer will appreciate. The thrashing machines present a variety of improvements and advantages. One has the patent wind elevator, two shaker cranks, one at each end of the shakers, and Penney's adjustable rotary corn screen, which is fixed at the end of the machine and finishes the corn fit for the market. The other machine has vibrating screens, Barrows and Stewart's improved spring shakers, crop elevators, &c., and the dressing apparatus is at the side. A simple, light, and very effective grinding mill is also exhibited at this stand. The grinding surfaces are of the best French burr stone, and will grind all kinds of corn for feeding purposes and fine flour for domestic use. The Oxfordshire wrought-iron cattle crib is another feature in the machinery manufactured by this firm. This new and cheap implement will, no doubt, come into extensive use, and will be a great saving to the farmer. The whole of the machinery has the appearance of simplicity, strength, and efficiency.

Messrs. E. R. and F. Turner, of Ipswich, exhibit, at Stand 302, in the Machinery in Motion Department, an 8-horse power portable steam engine and thrashing machine, which are excellent specimens of what such machines should be. The engine seemed to possess that most important qualification, ample boiler room and heating surface, and worked with ease and precision. It was fitted with a very simple reversing apparatus, and the feed pump is arranged so that it might be constantly working, thereby keeping it cool. The thrashing machine was adapted to thrash, dress, and deliver the grain into sacks fit for market. The riddles of this machine were so arranged and balanced that no vibration was noticeable in the machine when working, the advantage, of course, being increased durability. At the same stand is also exhibited a portable engine of 5-horse power, from which power was taken by a pulley and strap on to a line of shafting, which again transmitted power by same means to a portable corn grinding mill, oil cake breaker, and two large-sized crushing mills. The grinding mill was fitted with French burr stones, 3ft. diameter, and was of the same design and construction as that which gained the first prize of the Royal Agricultural Society of England in 1867. The feed arrangement was on the silent system, and the mill was constructed with all the latest improvements. Its adaptability for connection with similar mills, so that several might be driven by one pulley, was much in its favour. The oil cake breaker was one well adapted for farm purposes, where large quantities of cake require to be broken, or for a small oil mill. It was capable of breaking about two tons per hour. The arrangement for altering the size of pieces broken was good, as by its means both ends of the rolls were acted on at once, and equal wear of the rolls and equal sized pieces broken were thus insured. Of the crushing and grinding mills it is needless to say much, as they are so well known. Every practical farmer who studies economy should be in possession of these machines. At Stand 44, the same firm exhibit specimens of their smaller machines, amongst which, as might be expected, their crushing mills play a conspicuous part. Two specimens of oil cake breakers for hand power, and a chaff cutter, were here also shown. Some excellent gear works with intermediate motions were also exhibited. The smaller of the two was especially adapted for a pony or mule, and we should think was a very useful implement. The intermediate motion of the larger gear work was fitted with a clutch, by means of which the driven machine may be started or stopped whilst the horse is in motion. A malt mill with equal rolls was very noteworthy for the superiority of its feed and pressure arrangements. The latter was effected by a screw and compound wedge acting on both ends of the roll spindles at one time, thus ensuring equal wear on the rolls, and producing an equal sample. A machine for shelling maize attracted our notice. This was very simple and efficient, and by its action the heads of maize are thoroughly cleaned of the grain. We were informed that this was much in request where maize is grown. This firm have also a 10-horse power portable engine at the stand of the Dunstan Engine Works Company, where it is employed to drive their patent stone breaker.

Messrs. Richmond and Chandler, of Salford, Manchester, make, perhaps, the most extensive display of agricultural implements and machines in the whole yard. First in order, stand their celebrated chaff machines, and they show no less than eighteen different patterns. Two years ago, at the Bury St. Edmund's meeting, they carried off the first prize for the best hand power chaff cutter, and the first prize for the best cutter adapted for steam power, both of which were constructed on entirely new principles. Since that time, they have still further improved on these designs, and have now introduced the like novelties in four different sizes, from a small machine adapted for hand use up to a very powerful one, calculated to cut three tons of short chaff per hour. The great difficulty hitherto experienced in chaff cutters has been to get them to feed well, and at the same time to cut a good sample of chaff. This has at length been accomplished by means of the patentees' new swivelling rising cover, with spring at top, which keeps a tight pressure on the feed after the material has left the rollers and at the instant the knife is cutting it. Spiral springs, one at each side of the mouth, are introduced instead of the old plan of lever and weight, thereby obtaining a pressure proportionate to the thickness of the feed. The greater the feed the greater pressure is exercised upon it by the condensed position of the spiral springs. Two length-of-cut and an instantaneous stop motion are at the immediate command of the attendant, and are at once regulated by moving a handle working round a half-circle plate. The plan is as simple as it well can be, and there is no fear of its getting out of order. Another novelty in these machines consists of an endless feed web at the bottom of the wooden hopper, which regularly assists the hay or straw in its passage to the rollers, much manual labour being thereby dispensed with. It may, perhaps, be thought that this addition and the action of the springs tends to augment the power requisite to drive these machines, but at the last trial of the Royal Agricultural Society, 28lb. of straw was cut into ⅜in. chaff by hand in less time and with thirty-four per cent. less power than any other machine. Six sizes of corn crushers are exhibited, all adapted for kibbling oats, beans, barley, Indian corn, &c., the fineness being easily adjustable by regulating screws in front of the mills. The rollers are case-hardened and diagonally fluted, and are geared to revolve at different speeds, so that a crushing and grinding action is brought to bear on the grain simultaneously. The smaller sizes of these mills are constructed for hand use; the larger ones are for horse or steam power only. A new 1-horse gear work is shown, which for strength, durability, easy working, and moderate price it would be difficult to match. A large assortment of ploughs, harrows, cultivators, drills, mowing and reaping machines, hay makers, rakes, winnowing machines, turnip cutters and pulpers, steam engine and thrashing machines, churns, &c., &c., complete the collection.

Messrs. Robey, of Lincoln, exhibit three 8-horse power single cylinder portable steam engines, with crank shafts and fireboxes of Lowmoor iron, external plates of best Staffordshire iron, and mounted on strong travelling wheels. They also have a portable combined double-blast thrashing machine, constructed for finishing the corn for market, and which will thrash all kinds of grain without injury to the straw or kernel. This machine is fitted with an apparatus which effectually cleans and bags the chaff ready for food for cattle. It has improved straw shakers, barley mower, and a patent revolving corn screen. We also noticed a portable combined double-blast thrashing machine for finishing the corn for market, and which will thrash all kinds of grain without injury to the straw or kernel. Their straw elevator deserves notice. It is fitted with a circular hopper, by means of which it requires no manual assistance in the delivery of the straw. This elevator will deliver the straw to a height of 25ft. at any desired angle, and is fitted with Roper's patent driving arrangement, which is a decided improvement on all others yet introduced. This firm also show a 6-horse power vertical high-pressure stationary engine, resting on a strong iron foundation plate, which forms the ash pan, and also answers the purpose of a feedwater tank, in which the water is heated before passing into the boiler. We may here refer to a 9-horse power single cylinder traction engine exhibited by this firm. It is constructed with

outside cylinder, and has crank shaft and firebox of Lowmoor iron, and external plates of best Staffordshire iron. To the cylinder of this engine we are desirous of drawing particular attention, as it contains features which, as far as we are aware, are not to be found in a similar engine. The cylinder is enclosed in a wrought-iron steam dome, which not only serves the purpose of a steam jacket, but gives also an immense support to the cylinder itself. This dome is of the same thickness of plate as the boiler itself, to which it is firmly riveted, and the cylinder is so placed within the dome that all the working strain, which in this class is very great, is taken by the dome, and has not to be sustained by the bolts through the cylinder to the boiler.

One of the most attractive features of the show was a new system of brakeing for railway carriages, which was exhibited by the inventors, Mr. J. Cockshoot, jun., coachbuilder, of Strangeways, Manchester, and Mr. Weatherill, his foreman. We purpose shortly to illustrate this brake ; in the meantime, we place before our readers the follow- description :—On the centre of each axle is fixed a pinion, gearing into a sliding rack extending from end to end of the carriage, supported by a bearing or box working freely on each axle and covering the pinion. The rack is kept in gear of the pinion by springs bearing directly on the back of the rack when travelling through the grooves in the bearing boxes. By a further arrangement of springs, fixed in the centre of the carriage framing, the rack, when thrown into gear by guard or driver, presses firmly against the springs, and by their gradual compression effectually stops all further progress of the carriage or train when at full speed in an incredibly short distance. When any portion of the train with the ordinary brakes becomes detached, the arrangement is useless, unless accompanied by a guard to put the brake on. Such, however, is not the case in the Cockshoot and Weatherill brake. The instant any portion of the train becomes unhooked from its couplings, a lever, previously held in a vertical position by a clip spring, is permitted to drop, and kept down by a sliding weight. During the descent of this lever a short heelpiece at the fulcrum end falls directly over the projecting end of the sliding rack, gradually and firmly pushing it into gear with the pinions on the axles, by this extremely simple and safe action preventing further progress. Provision is also made for arresting the train when necessary before entering the station by a movable lever working upon a stud fixed to the rail or to a post. This lever may be actuated by chains or rods, as in the case of signals or switches, and in connection with the signal lights, under the control of a duly authorized person at the station. When it is desired to arrest the progress of a train to prevent threatened danger, this lever is lifted from its horizontal position by pulling the chains or rods connected to a reversing lever, and in the passing of the train strikes a small projecting lever fixed to the under part of the carriage frame ; the reverse end presses the rack into the already described position. The brake is continuous, the rack of each carriage butting or pressing on the end of each preceding carriage, and requires no couplings. The brake of each carriage is a perfect brake in itself, as was amply and satisfactorily demonstrated on a small railway with a steep incline laid down at the Manchester Show.

The same firm exhibit several specimens of their improved carriage axle, deserving of a more than passing notice. The speciality of these axles consists in a rearrangement of that portion of the axles technically known as arms or bearings, working freely in the box securely embedded in the nave of each wheel To illustrate our point, it will be quite sufficient if we state, when the axles break short off, the wheels at once become detached from the main body of the axle, and the vehicle, of whatever class, as a matter of certainty, turns over, to the discomfort if not danger of its occupants. The construction of this invention secures an unbroken connection between the vehicle and wheel, even if every axle arm or bearing is broken in the box of each wheel. By the insertion of leather washers between the collars on the arm or bearing in the box, and a simple method of screwing up, chattering or joggling—the results of loose fitting or wearing away—is obviated. The axles, as shown in several forms, is a perfect safety axle, simple in construction, durable in wear, readily oiled and cleaned, and we are sure must commend itself to the public. We select for brief notice from the sundries of inventions—all of a high class—Mr. Jos. Cockshoot's bevelled box hinge, specially adapted for landaus, barouches, broughams, and other carriages, affording greater width of doorway, increased facility of ingress and egress, while all moisture is effectually excluded from the woodwork. The same inventor patents a new shield or guard to cover the joints on hooded carriages, by which all moisture is kept from the trimmings, presenting a decidedly improved appearance. We wish also to notice the capital platform or artificial slab, 60ft. long by 21ft. wide, and about 3in. thick, laid down by the Liverpool Patent Cement Company to sustain the tramway for the working of Messrs. Cockshoot and Weatherill's patent railway brake. It is an admirable specimen of indurated stone. It is impervious to damp and unaffected by heat, and is the cheapest material out for all kinds of floorings or public footpaths. It is also superior and cheaper than bricks or stone for house building. We would advise builders and others interested in the use of such materials to minutely inspect this "big flag," and to obtain from the Company's agents further particulars as to its adaptability, utility, and cost.

Fire engines are well represented at Manchester. We have, first, Messrs. Merryweather and Sons, of London, who exhibited three steam fire engines of different sizes, all, as usual, fitted with the well-known "Field" boilers. Two of the engines are of the same pattern as the engines "Le Prince Imperial" and "L'Imperatrice," which gained the first prize gold medal for these makers at the late Paris Exhibition. The third engine is a novelty as regards weight and price ; it weighs but one ton, and being mounted on high wheels and easy springs, can be drawn by one horse or a few men ; its price is about 25 per cent. lower than any steam fire engine yet offered ; its design is strong and simple, and its finish equal to the well-known character of Messrs. Merryweather's work. These makers also showed a brigade manual power fire engine, a two-wheel or curricle fire engine, fire pumps, hoses of various kinds, hose reels, &c. With regard to the "Field" boiler, with which Messrs. Merryweather's engines are fitted, we may mention that it was exhibited as an agricultural boiler at the great show at Beauvais, France, where it obtained the only medal awarded to this class of boiler. Messrs. Shand and Mason, of London, exhibited two examples of their engines, which were types of those manufactured by this firm for the Metropolitan and other fire brigades, the Admiralty, and foreign governments. The third exhibitor in this class was Mr. Thomas Rose, of Victoria-street, Manchester, who has had twenty-five years' experience in the manufacture of fire engines. Mr. Rose had an extensive show, consisting of five fire engines of various sizes, an improved form of fire escape, reaching a height of 60ft., numerous pumps, hydrants, joints, pipes, hose, &c., &c., all of which showed careful design and good workmanship. Mr. Rose's brigade engine is used in Manchester and many surrounding towns.

Messrs. S. Owens and Co., of Whitefriars, London, have no special novelties, but what they have is well worthy of notice. They exhibit their improved double-action steam pumping engines, of various sizes. The peculiarity in these engines is in the arrangement and form of the valves, which are readily accessible. These engines are adapted for supplying farm buildings with water, breweries, &c., or feeding boilers of any size. They also exhibit various descriptions of fire engines suited for large establishments, mansions, farms, &c. ; also the noted Cassiobury fire extinguisher, as designed by this firm for the Earl of Essex, and several hundreds of these useful engines have since be supplied to the nobility and gentry in various parts of the country. There were also working models of the hydraulic ram to be seen in operation. These convenient machines are of great service for the supply of mansions, &c., where a small fall can be obtained. They are self-acting, and for every foot of fall will raise water 10ft. and force it any distance. Mr. Bernay's improved centrifugal pumps were shown, of all sizes, for drainage or other purposes where large quantities of water are required. Messrs. Owens had also their usual display of force pumps for house and garden use, stable and farmyard pumps, water carriers and garden engines, hose, pipes, and every variety of hydraulic appliance.

Messrs. Allen Ransome and Co., of Chelsea, had a fine show of wood-working machinery, which attracted considerable and well-merited notice. There was first an equilibrium deal frame (Frazer's patent). These machines are furnished with two separate swing frames worked from one crank shaft, so arranged, that when one is at the top, the other is at the bottom of the stroke ; and thus in ascending and descending, they counterbalance each other, and the result is that they can be driven at 400 revolutions per minute with less vibration than any other deal frame driven at half that speed, and the necessity for a flywheel is obviated. The swing frames are made entirely of cast steel, thus combining great strength with the least possible weight, and the crank shaft and other working parts do not require to be nearly so strong as in other frames, in which a heavy swing frame is counterbalanced by a heavily-weighted flywheel. Messrs. Ransome showed their self-acting saw-bench, into which several patented improvements have been introduced. The chief of these improvements consists in a very simple arrangement for feeding the timber up to the saw, which obviates the many disadvantages attending the employment of the complicated system of spur and bevel wheels which has hitherto been employed for the purpose. This feed motion has been fully described and illustrated in the MECHANICS' MAGAZINE. The feed motion is driven from the saw spindle, and can be varied so as to bring the timber forward at rates ranging from 15ft. to 60ft. a minute. The feed rope is coiled round a large drum at the end of the bench, and the gearing by which it is worked is boxed in and effectually protected by the framing of the machine. When the feed motion is thrown out of gear the rope readily uncoils from the barrel, which runs round freely upon a fixed pin. To these exhibits, we may add Messrs. Ransomes' general joiner, planing and trying up machines, and their plain band saw machines. These latter machines are intended chiefly for sawing curves, and among the many purposes for which they are peculiarly adapted may be mentioned sawing out hand rails, gothic work, &c., cutting out buffer blocks, break blocks, curved supports for roofs of railway carriages and trucks, &c., &c. These machines are fitted up in the best style, and by simply changing the saw it is equally adapted for cutting out the most delicate ornamental work, or for sawing through a piece of oak 15in. thick. At this stand, we also noticed a very ingenious and practical

method of coupling shafts on a self-centreing principle; we defer our description of this device until another occasion.

Messrs. Clayton and Shuttleworth, of Lincoln, had as usual an excellent show of portable, fixed, and traction engines, as well as thrashing and finishing machines, straw elevators, &c. We would here call particular attention to the rolled steel beater plates for thrashing machines made by this firm, the form of which has earned for them a reputation as being the best beaters for thrashing perfectly clean without injuring the grain. Hitherto, these plates have been made of malleable cast iron, the great objection to which is its softness and consequent liability to wear rapidly and become smooth on the surface. This objection, however, has at length been entirely overcome by the adoption of rolled steel, which invention has been patented. Messrs. Clayton and Shuttleworth have recently effected an improvement in the construction of their adjustable corn screen, which effectually prevents the steel spiral springs being broken, either by accident or otherwise. It consists in thoroughly binding every coil of the spring to each corresponding coil of the cylinder with wire, and afterwards strongly soldering all together, so that they cannot possibly work loose. The screening wires are attached to the spiral springs, which latter keep them at equal distance apart. There is a screw inside the hollow shaft for expanding or contracting the cylinder endwise by imparting motion to one of its ends. The spiral springs connect the cylinder ends together; they must consequently expand and contract with the cylinder, and in doing so they make the meshes between the screening wires coarser or finer. An important matter, as showing the demand for the portable engines of this firm, and also as a testimony of their high character, is the fact that Messrs. Clayton and Shuttleworth turned out 102 engines of this class in May, and 104 in June last, besides other machinery, and to judge from the appearance the firm made at the show, we should think the latter number will be far exceeded in July.

Messrs. F. and C. Hancock, of Dudley, exhibited at Stand No. 137, several of their new screw propellers, which are being brought into note by their superior performances. There were a pair of four-bladed screws of 30in. diameter, and which are about to be tried by Government, at Portsmouth, in a steam launch. At the same stand we saw a variety of dairy and other implements of the most ingenious character. There was, notably, Hancock's butter machine for washing butter from milk and acid, as well as for cooling and making it firm in hot weather. These points were most satisfactorily demonstrated during our stay at the stand. The machine, which consists of a small cylinder in an iron frame and a screw piston, was placed in a tub of cold water, and a sample of butter was put into the machine. The screw piston was brought to bear upon it, and in a minute the butter was pressed into the water in the form of vermicelli. The action of the water upon these thin filaments of butter absorbed the whole of the acidity and salt. The filaments were readily put together into a large lump of butter by a pair of wooden pats, and on inspecting the sample before and after the operation, we found that the butter acted upon by the machine was considerably sweeter, and quite delicate in taste, whereas the original sample was strong in scent and somewhat rank in flavour. These machines will prove a boon to every household, especially in London, where we never expect to have butter over fresh. At Stand No. 126 we found Mr. J. L. Hancock's anatomical steel bed, one of the most ingenious devices we have seen, even from this ingenious firm. The bed, which consists of a series of inclined steel bars, is simply placed upon any ordinary bedstead; a thin hair or straw mattress is placed upon the steel ribs, and the apparatus is complete. The ribs, which are 3in. wide (rounded on the surface) are placed 1in. apart from each other, and cannot possibly cut or injure the bedding. The open space under the ribs affords the most perfect ventilation, and the very gentle elevation of the upper part of the bed makes it one of the most delightful adjuncts to repose. In hot climates, where a thin, cool, and soft bed is so much wanted, it will be a boon. The inclination from the head to the foot can be regulated to any angle required, by means of two adjusting screws. As a novelty at a show of this kind, we may mention a valuable picture by Hogarth, which has never before been published, but of which Mr. Hancock is the fortunate possessor. The picture represents a romantic episode in the life of the Earl of Peterborough, the hero of the war of succession in Spain. The earl is dancing on the lawn in front of the grand portico of Bevois Mount, with the celebrated singer Anastasia Robinson, whom a year previously to his death he publicly acknowledged as his countess.

Our space demands that we should for the present bring our notice to a close, but before doing so, we would refer to the excellent display of leather machine bands made by Messrs. Webb and Son, of Stowmarket. These bands are of all sizes and lengths, whilst their quality is such that we feel a pleasure in commending them to the notice of steam power users, to whom a gennine article is of the first importance in driving. We shall resume our notice next week, when we shall describe some further novelties which we have in reserve.

THE FAIRLIE STEAM CARRIAGE.

THE steam carriage, which we partially described last week, is specially designed for working passenger traffic on branch lines or light railways, and forms, in combination with Mr. Samuel's patent, one of the systems so pertinaciously—and, we must add, ably—carried out by Mr. Fairlie. The arrangement consists in placing a long carriage on two four-wheel bogies or trucks, which respectively support the front and rear ends of a carrier frame, on which the main body of the carriage is constructed. In the construction of the hind truck there are no peculiar features, but the leading truck, which has coupled wheels 3ft. 9in. in diameter, is fitted with steam cylinders, and carries on its platform an upright steam boiler. The cylinders are inside, and are 8in. in diameter, with 12in. stroke, and the driver's platform, which gives every accommodation that the most fastidious drivers could wish for—every valve and handle being nicely arranged to his hand—is housed in much after the American fashion. The fact is, that Mr. Fairlie has made his footplate into a very comfortable place, his object evidently being to take every care and to afford every comfort to that most useful and most neglected class, engine drivers, in whose hands we risk our lives every hour, aye, every minute of the day.

At the leading end the carrier frame is provided with a strap, which completely encircles the base of the boiler, this strap being fitted with brass rubbing pieces on the inner side, so that the base of the boiler, which really forms a large bogie pin, can revolve freely to the extent of a quarter of a circle. At the hind end the carrier frame rests on the centre of the trailing bogie, this latter being arranged so that it can swivel freely, and being provided with four ordinary carrying wheels 2ft. 6in. in diameter. The carrier frame, besides keeping the two bogies at their proper distance apart, supports the carriage body and receives all shocks or strains. It is made of longitudinal frames, with cross frames and diagonals, the longitudinal frames being strengthened by truss rods, and the inside frames being connected, for a portion of their length, by plates at the top and bottom, so as to form a long shallow tank about 4ft. wide by 12in. deep, which is destined to feed the boiler. Under this arrangement, the tank serves to materially stiffen the carrier frame, and, at the same time, the weight of the water is distributed over a considerable length of the latter.

On the carrier platform is placed a carriage body, this latter being perfectly distinct from the carrier frame itself, and being merely a covering for the passengers, so that it can at any time be readily removed for repairs, and another bolted on in its stead. Instead, however, of removing the carriage body from the carrier frame, the latter may be readily detached from the engine, by simply taking out the bolts of the strap which embraces the base of the boiler. The engine can then be attached to another carrier frame. When the engine is detached, the front end of the carriage is supported on a pair of auxiliary wheels, which, by means of screws and a hand wheel with suitable gearing, can be lowered down so as to bear on the rails when desired. The ready means which are afforded for the detachment or separation of the various parts of Mr. Fairlie's steam carriage forms an important feature in his system, and one which will very greatly facilitate the execution of repairs. The construction of the carriage body is varied by Mr. Fairlie, according to the nature of the traffic which it is designed to work. That we saw tested accommodated 66 passengers (16 first class and 50 second), with a compartment for the guard; the compartments are furnished in the most handsome manner, and everything is done that careful consideration could give to the increased comfort of the passengers. The arrangement of the lamps is especially good. We strongly recommend our friends, particu larly the South-Western Railway authorities to profit by the example, if only in this respec alone, set them by Mr. Fairlie.

In the construction of the vehicles, steel is used instead of iron, in all parts where its employment is advantageous, and care has been taken, by properly proportioning the various details, to avoid all unnecessary weight. The weight of the whole vehicle without passengers, but with fuel and water for a 40 miles run, is 13½ tons, whilst with 66 passengers the weight would only be 18¼ tons, of which rather more than half would rest on the wheels of the engine. It will thus be seen that the ratio of unpaying to paying load is, when the carriage is fully loaded, only about 2¼ to 1, while as about 55 per cent. of the total weight is available for adhesion, the carriage would be readily able to mount gradients of 1 in 16, if sufficient cylinder power was provided. In the case of the steam carriage we describe, however, the cylinders have not been made large enough for this kind, it having been designed for running on lines with inclines not steeper, say, than 1 in 40—gradients which it would mount with ease. On a line with moderate gradients, say, up to 1 in 100, and at speeds varying from 25 to 40 miles an hour, such a steam carriage as we have described should be run with a consumption of about 8lb. of coal per mile, and with a correspondingly small consumption of oil, tallow, &c. The expense for wages also would be very small, as the engine could be readily managed by one man, while the guard would have charge of the brake, and would be able to collect fares. There is a wide step, or rather platform, on each side of the carriage, with a suitable hand rail on the outside all round the carriage; the guard can thus pass round the carrige with safety. The passengers from any compartment can also pass at any time to the guard, and thus there is the most perfect method of communication between passenger and guard.

Although the total wheel base of the carriages is 39ft., yet the actual wheel base, which has to be considered when estimating

the capability of the vehicle for traversing curves, is that of each bogie, or 6ft. only. With this base the carriage can be safely run round curves of 40ft. radius at 15 to 20 miles an hour, while, at a slow speed, a curve of 25ft. radius may be traversed. Thus, by placing circular curves of 25ft. radius at the terminal stations, the carriages can be run round, and the expense of turntables avoided.

The steam carriage possesses ample power to draw, under ordinary circumstances, another carriage behind it. In the case of a railway laid on the common road, such speeds as 40 or 50 miles per hour would never be attempted, a speed of 10 to 15 miles per hour being more nearly the maximum; and, in such instances, the boiler would possess ample power to supply the cylinders with steam at the full pressure admitted for, say, three-fourths the stroke, and ample tractive power would thus be afforded for drawing another carriage or trucks loaded with goods. Altogether, Mr. Fairlie's plans are exceedingly well considered, and we feel sure that, at the present moment, when light railways are the subject of much attention, they will be regarded with great interest.

THE FRENCH ATLANTIC CABLE.

SINCE our last report of the progress of this enterprise, the major and most difficult part of the work has been successfully accomplished; the entire deep sea section between Brest and St. Pierre has been laid, and communication established between the two places; the work, so far as the "Great Eastern" has been engaged in, has been completed, and the big ship is now on her way to England, to get ready for a work as great, if not greater than the present.

The table we published brought the operations of the expedition down to the 7th inst., and the statement we now give brings the important work of laying the deep sea section to a conclusion. There is but little to add to the statement, for the operation of laying progressed in a most satisfactory manner, nothing interfering to stop progress. Even a gale of wind with heavy sea seemed to raise no impediment in the way; it was only when the actual destination was arrived at, and the look-out ships met with, that delay took place. They came into a thick fog (the prevailing weather off that coast), and were compelled to buoy the cable, and it was not until three days had elapsed that the weather sufficiently cleared to allow of the splice being made between the deep sea portion and the intermediate part laid by the "William Cory." This was, however, successfully accomplished on the evening of the 14th, and on the following day, and since, frequent messages have been transmitted.

The total amount of cable paid out has as yet not been officially announced, but the amount expended has been considerably less than the amount provided; there will, in all probability, be nearly 200 miles to spare in the deep-sea section alone. From the most reliable calculations obtainable, it will be found that the entire length of cable submerged between Brest and St. Pierre is about 2,595 nautical miles, a length that constitutes this cable the longest ever laid, and in all probability it will hold its pre-eminence in that respect for many years.

The laying of the St. Pierre and Duxbury section is proceeding satisfactorily. The "William Cory" commenced paying out the shore end from St. Pierre at 10.50 a.m. Greenwich time, on the 15th, having landed the end and proceeded paying out through the night. At 9.0 a.m., on the 17th, she completed paying out what she had on board, and the weather being too rough to permit of the splice being made, the end was buoyed. The weather sufficiently moderated to allow of the splice being made on the following day, and the paying out of the main portion of the cable

STATEMENT OF PAYING OUT FROM "GREAT EASTERN."

Date.	Time. Greenwich.	Position of ship. Lat.	Position of ship. Long.	Distance run Total.	Distance run In last 24 hours	Cable payed out. Total.	Cable payed out. In last 24 hours	Rate per hour in last 24 hours.	Slack. Total	Slack. Total per cent.	Remarks.
				Naut. miles.	Naut. miles.	Naut. miles.	Naut. miles.	Naut. miles	Naut. miles		
June 21	3.30 a.m.	...	...	...	...	...	...	...	...	...	Commenced paying out.
" 22	12.0 "	48·30	8·55	174	...	...	...	...	...	...	Electrical condition perfect.
" 23	" "	...	...	294	120	310	...	5·5	16	5·4	Ditto
" 24	" "	48·30	13·53	377	83	405·7	95·7	4·0	28·7	7·6	Ditto
" 25	" "	48·34	17·06	497	120	542	136·3	5·7	45	9·0	4.32 a.m., first fault.
" 26	" "	48·37	18·57	574	77	636	94	3·9	62	10·8	Two faults cut out, one inboard; the third close to ship.
" 27	" "	48·32	22·01	697	123	775	139	5·8	78	11·2	Electrical condition perfect.
" 28	" "	48·22	25·11	823	126	916	141	5·8	93	11·3	
" 29	" "	48·06	27·50	920	97	1,038	122	5·1	118	12·8	Signals good.
" 30	" "	...	...	...	...	...	...	...	...	...	Fourth fault, heavy gale; cut and buoyed.
July 1	" "	...	...	...	...	...	...	...	...	...	No signals.
" 2	" "	...	...	1,020	...	1,143	...	...	123	12.1	Cable recovered, and fault cut out; signals splendid.
" 3	" "	47·26	33·10	1,145	125	1,281	138	5·75	136	11·9	Signals splendid.
" 4	" "	46·54	36·04	1,269	124	1,420	139	5·8	151	11·9	Ditto
" 5	" "	46·03	38·47	1,397	128	1,562	142	5·9	165	11·8	Ditto
" 6	" "	45·30	41·42	1,524	127	1,700	138	5·8	176	11·5	Ditto, heavy gale.
" 7	" "	44·36	44·05	1,639	115	1,840	140	5·84	201	12·3	Insulation high; weather improving.
" 8	" "	43·50	46·33	1,754	115	1,977	137	5·7	223	12·7	Insulation high.
" 9	" "	42·51	49·13	1,885	131	2,122	145	6·05	237	12·6	Signals very good; weather fine
" 10	" "	43·23	52·8	2,023	138	2,287	165	6·88	264	13·0	Insulation highly satisfactory; weather fine.
" 11	2.0 p.m.	45·15	50·15	...	...	2,446	...	6·1	...	...	Picked up ships; foggy.
" 12	12.43 "	...	...	...	...	...	...	...	...	...	Dense fog; cable cut and buoyed.
" 13	10.0 "	...	...	...	...	...	...	...	...	...	No news from ship.
" 14	" "	...	...	...	...	...	...	...	...	...	Ditto
" 14	5.4 "	...	...	...	...	...	...	...	...	...	Signals from "Great Eastern."
" 14	10.0 "	...	...	...	...	2,563	...	...	...	...	Message passed through announcing completion of splice.

continued from the "Scanderia." At noon of the next day, the 19th, their position was lat. 44·21, long. 62·28. Payed out from St. Pierre, 321 miles; distance run, 306 miles; slack about 5 per cent. On the 20th, at noon, lat. 43·27, long. 64·13; distance run, 399 miles; cable payed out, 421 miles; slack, 5·5 per cent.; delayed ten hours by a foul flake. On the 21st, lat. 42.5, long. 66·31; cable payed out 545 nautical miles; weather foggy. The "William Cory" had payed out of the different sizes, 173 miles of cable; the "Scanderia" had on board 450 miles, and the "Chiltern" 153 miles. Taking the present rate of progress, the work should be completed this week, and we trust that no further causes will arise to prevent the final completion of the work. We are glad to find that there is now no cause for the unpleasant rumours that were circulated relative to the prevention by the United States of the landing the end. A telegram has been received from the agent of the Company to the effect that permission for landing the cable has been given by the Government of the United States, on conditions accepted by the agent of the "Société" in the United States.

THE FALMOUTH, GIBRALTAR, AND MALTA TELEGRAPH COMPANY.

IT is now some years since the Government contemplated laying a submarine cable to Gibraltar—not only contemplated, but had progressed so far as to specify the form of cable, and its manufacture was commenced. The destination of the cable was suddenly changed, and the Gibraltar scheme lay quiet for some time. It has, however, been frequently on the *tapis* with very uncertain signs of success. It is now nearly ten years later that a company is formed for this object, and, we are glad to say, at last with every prospect of success.

There has lately been an extraordinary amount of confidence in telegraphs, partly due to the successful operations with deep sea cables, the certainty of laying them, and the feasibility of effecting repairs in deep water; and probably also due to the Government scheme for the purchase of the "telegraphs." The immediate cause of the announcement of the present company is the successful working of the direct Malta and Alexandria line, and the proposed continuation from the latter place to Aden and Bombay. The "present company has been formed for the purpose of completing the system of submarine telegraph lines between England and India, worked throughout by English hands, and under one management. This object, so important for imperial and commercial interests, has long engaged the attention of the directors and others interested in placing telegraphic communication with the East on a thoroughly sound and efficient footing. Until it is effected, messages between England and India must traverse 2,000 miles of wire through France and Italy, and will continue liable to those frequent and vexatious interruptions and delays which experience shows to be inseparable from long land lines of telegraph."

The present submarine cable system is from Malta to Egypt and from Egypt to India. The line now in course of construction will, it is anticipated, be submerged by May next. It is therefore proposed to lay the present cable from Falmouth to Gibraltar and Malta by that time, so that we should have simultaneously a long submarine route through to India. The length of cable required will be—

	Nautical Miles.
Falmouth to Gibraltar . .	1,431
Gibraltar to Malta	1,025
Total . .	2,456

Provisional agreements for working have been entered into with the Anglo-Mediterranean and British Indian Submarine Telegraph Companies, and a contract has been entered into with the Telegraph Construction

and Maintenance Company for the "making and laying (under similar conditions to those of the Atlantic cables) the line between Falmouth and Malta for £640,000, of which amount £50,000, in fully paid shares, is to be reserved until this company's engineer has certified that the whole line has been successfully laid and in working order. The cables are to be laid by May 31, 1870, at which date the entire line between Falmouth and Bombay will, it is believed, be complete." There are no difficulties in the way of the work; the soundings throughout the route are well known, and confidence now is thoroughly established in deep-sea submarine cables, that we doubt not that the whole of the capital £660,000 (less £50,000) has been readily subscribed.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

THE SETTING OF CEMENTS—DEFECTS OF GAS BURNERS—A POWERFUL GALVANIC BATTERY—TO DISTINGUISH BETWEEN PRUSSIAN BLUE AND ANILINE OR INDIGO BLUES.

THE cause of the setting of hydraulic cements has been investigated by several chemists, who have in general agreed that it is owing to the formation of a double silicate of alumina and lime and the absorption of water. The question may be said to be set at rest by some researches of M. Frémy, who has shown that when an argillaceous limestone is calcined, at a dull red heat, a partial decomposition of the clay takes place; the silica and alumina, in fact, are separated, and are made free to combine with the lime when the cement is mixed. This is not really novel information; but the truth is shown more clearly by the experiments of M. Frémy. The part which the free lime plays is also made clear. If this be dissolved out by weak acid, or water, or syrup, the residue of silica and alumina will not set under water, but the cement may be reproduced by the subsequent addition of some lime.

As an addendum to the remarks made in this journal some weeks ago on the defects of gas burners, we may mention that Mr. Kirkham, of the Imperial Gas Company, has made a further series of experiments on the burners in common use, and has found as great variations in their illuminating power as those stated by the Gas Referees. Too great prominence can hardly be given to the facts arrived at, for they concern all gas consumers, who are naturally anxious to get the full value of what they pay for, and they are of equal interest to the makers of burners, who may learn from the experiments the principles which must guide them in producing good burners. The variations in the different kinds of burners extended, in round numbers, from 15 candles to 5 candles for an equal consumption of gas. This lowest power was found in a fishtail burner, such as is in most common use; and the faulty manufacture of these is shown by the circumstance that burners of the same number, which ought, therefore to give an equal light, varied in illuminating power from 11 candles to 6 candles for the same consumption of gas. In the end, perhaps, it may be found advisable to give consumers some guarantee for the proper construction of a gas burner, for it is clear that they are at present supplied with articles which rob them of half the value of the gas they pay for.

A galvanic battery of great power is described in the French journals. Two carbons are placed together in a large porous vessel with a mixture of bichromates of potassium and sodium, and perchromate and persulphate of iron. In the outer vessel zinc and a saturated solution of common salt are used. The poles are to be placed as near together as possible, and to be of the greatest extent possible. It is easy to see that such a battery must be of great power. For equal size, it is said to have twice the power of the bichromate battery with two liquids, and eight and a-half times the force of the single liquid bichromate battery. The uses for such a battery are not numerous, but, when great intensity is required, and an instrument of small bulk is convenient, this combination may be recommended.

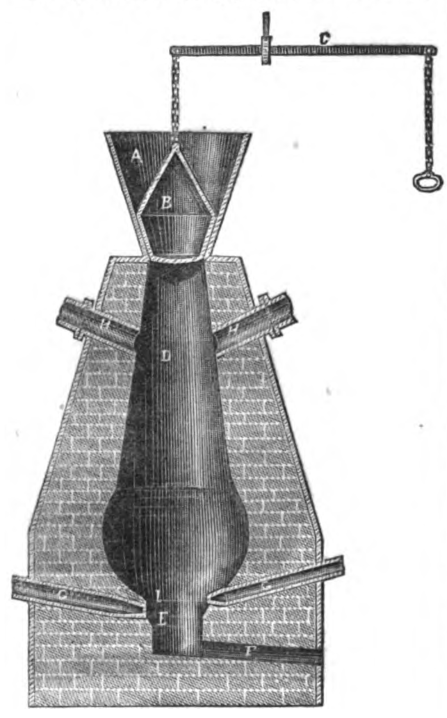
A test for distinguishing a Prussian blue from indigo and aniline blues is given by M. Nickles. Fluoride of potassium, he tells us, will discharge the Prussian blue colour and not affect the indigo or aniline colour. The information may prove of use to calico printers. Ordinary writing ink, it seems, is also decolourized by fluoride of potassium. Whether it has much effect on the paper we are not told.

MANUFACTURE OF PHOSPHORUS.

AN invention has lately been patented in England for the treatment of materials intended to produce phosphorus directly in the presence of the fuel inside a blast furnace, in which the combustion is accelerated by the application of an air blast. The invention is due to M. Claude Brison, of Châlons-sur-Saône, France. The principal advantage of this new application of blast furnaces in combination with blowing machinery, consists in substituting for the laboratory apparatus hitherto employed for this purpose an industrial apparatus, namely, the blast furnace, of simple construction and operation, thus really rendering the manufacture of phosphorus an industrial operation capable of being carried on on a large scale. This apparatus may be employed with equal advantage for producing both varieties of phosphorus, namely, the ordinary phosphorus and the amorphous phosphorus.

The apparatus employed, shown in section in the accompanying cut, consists of a furnace of fire-brick enclosed in a sheet-iron casing, at the top of which is a cast-iron hopper A, for receiving the materials, which is closed by means of a valve B, capable of being raised by the lever C. The materials to be acted upon, together with the fuel, are filled into the chamber D of the furnace, where they are heated to a high red heat, the combustion being intensified by the action of a blowing engine. They attain their highest temperature when they arrive at the tuyeres G G; the gaseous products of combustion and the vapours of phosphorus escape at the exit pipes H H, while the slag or cinder collects in the space E, from which it is run off through the passage F capable of being closed.

The operation of the apparatus is as follows:—



After having brought the chamber D to a red heat by the use of fuel only (coke or charcoal), it is filled with fuel to about the height of the pipes H, from which point it is filled with alternate layers of fuel and of the mixture intended to produce the phosphorus. The valve B is then closed and a blast is forced in of sufficient pressure to force the liberated gases through the water of the condensing vessels. The blast is continued as long as alternate layers of the carbonaceous and other materials are introduced into the furnace. The mixture employed for producing the phosphorus consists of phosphate of lime, silica, and carbonate of soda, the whole thoroughly desiccated. The addition of the soda has for its object to form the double silicate of soda and lime, which is more fusible than the silicate of lime alone. When the mixture arrives at the part I of the furnace, where it attains its highest temperature, the silica liberates the phosphoric acid from its combination with the lime, and this acid is reduced by the excess of carbon. If any part should escape reduction it would soon become decomposed in passing through the carbonaceous layers in the upper part of the furnace, in the presence of an atmosphere surcharged with carbonic oxide. The phosphorus escapes through the pipes H H, which convey it to the condensers. In this process, therefore, the phosphate of lime is attacked by the silica, producing silicate of lime; the phosphoric acid is in its turn reduced by the carbonic oxide, which, in taking up the oxygen from the phosphoric acid, is converted into carbonic acid and liberates the phosphorus.

THE BESSEMER HIGH-PRESSURE HOT-BLAST FURNACE.

MR. BESSEMER has recently filed the specification of another invention, which is of great importance in the production of iron and steel. Its main features may be regarded as an embodiment, for the purpose of fusing malleable iron and steel, of the experience gained by, and principles proved in, the Bessemer converter. It has long been understood that Mr. Bessemer has been directing his rare ingenuity to some good plan for melting old rails and similar work; and we suppose that this patent, forming by its length almost a volume on metallurgy, is one of the principal results. The system also appears to have already been thoroughly worked out in practice. Mr. Bessemer first of all refers to what is really the distinguishing feature of his converter—the rapid way in which it produces the required heat:—"Intensity of heat, rather than quantity, is the condition essential to the successful working of furnaces employed" in melting wrought iron or steel containing little carbon. A substance which requires 3,000 degrees of temperature to produce fusion may be kept at a temperature of 2,900 degrees for whole days in succession without becoming thoroughly melted, when the mere addition of only 100 or 200 degrees of heat would, in that particular case, have produced a complete fusion of the substance in a very short period of time. In order to obtain this intensity, or rapid development of the heat required, Mr. Bessemer has recourse to air at both a high temperature and a high pressure. Atmospheric air and other gaseous fluids in a heated state acquire a still higher degree of temperature by their compression "into a smaller space." "Such increase of temperature being in proportion to their reduced bulk, or to the number of atmospheres forced into the space usually occupied by one." He therefore constructs furnaces of sufficient strength to withstand an internal pressure of two or more atmospheres, observing that he does not propose by this means to generate a greater quantity of heat by the combustion or union of a given quantity of carbon and oxygen than is obtained by such means in well constructed furnaces; for the compression of the gaseous products of combustion within a furnace does not generate heat, but merely concentrates into a smaller space and gives greater intensity to the same quantity or number of units of heat as would have existed in a more diffused state had not pressure been applied. Hence, wherever the temperature produced by the combustion of fuel in ordinary furnaces, having a free escape to the chimney, is sufficient for any desired object—as, for instance, the evaporation of water in steam boilers—a loss would be sustained by compressing the gaseous products of combustion in such furnaces, for the amount of engine power required to compress the gases would exceed the power obtained from the increased quantity of steam generated in consequence of such compression, all other conditions being equal. But when the highest temperature produced in ordinary furnaces with a free escape is actually less, or where it only by small amounts exceeds the temperature absolutely required in any process, the case is entirely altered. Though a very high temperature, dependent on the pressure used, may be thus produced, Mr. Bessemer prefers, in order to have a moderate wear and tear in the furnace, a moderately rapid fusion. He states that, "in a small furnace using coke as fuel, with a cold blast of 20lb. per square inch, and a pressure of 17½lb. in the furnace over that of the external atmosphere, small test pieces of cold wrought iron were fused with

HIGH PRESSURE HOT BLAST FURNACES.

BY MR. BESSEMER.

FIG. 3

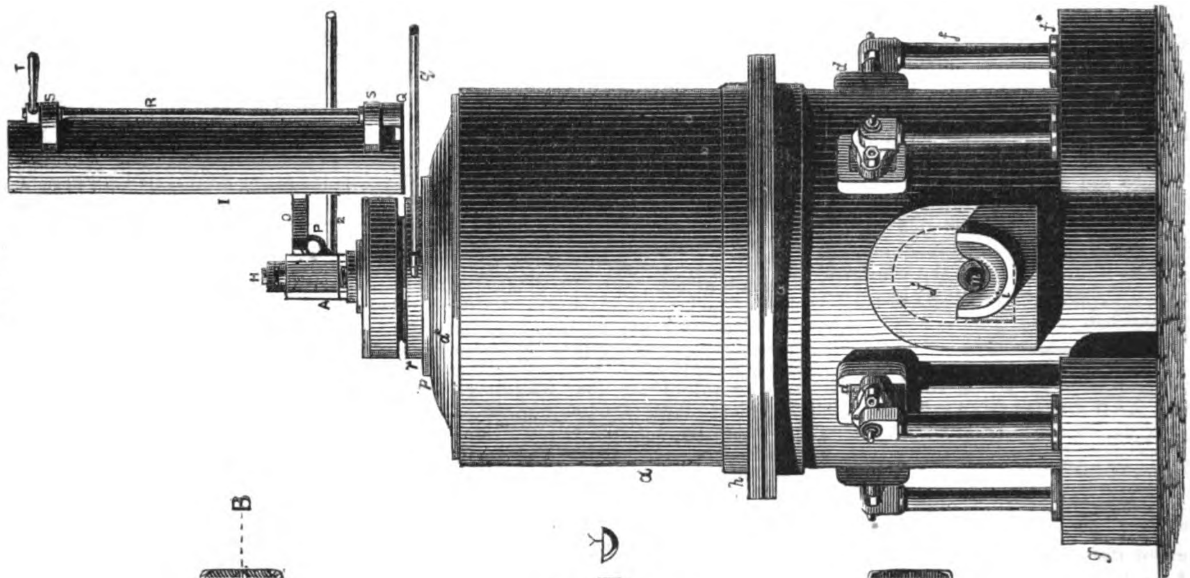


FIG. 2

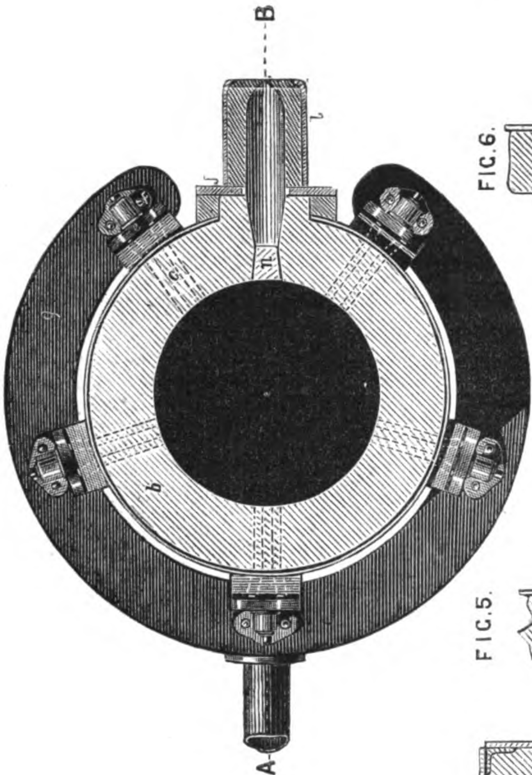


FIG. 6

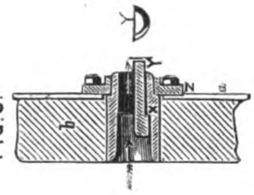


FIG. 4

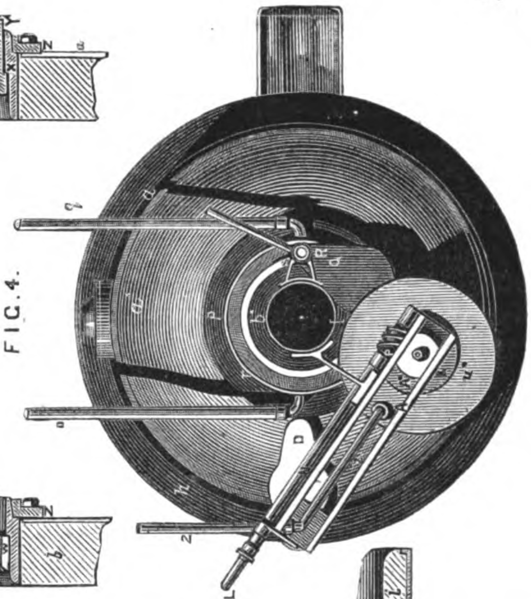


FIG. 5

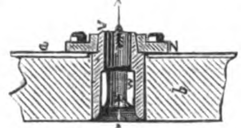
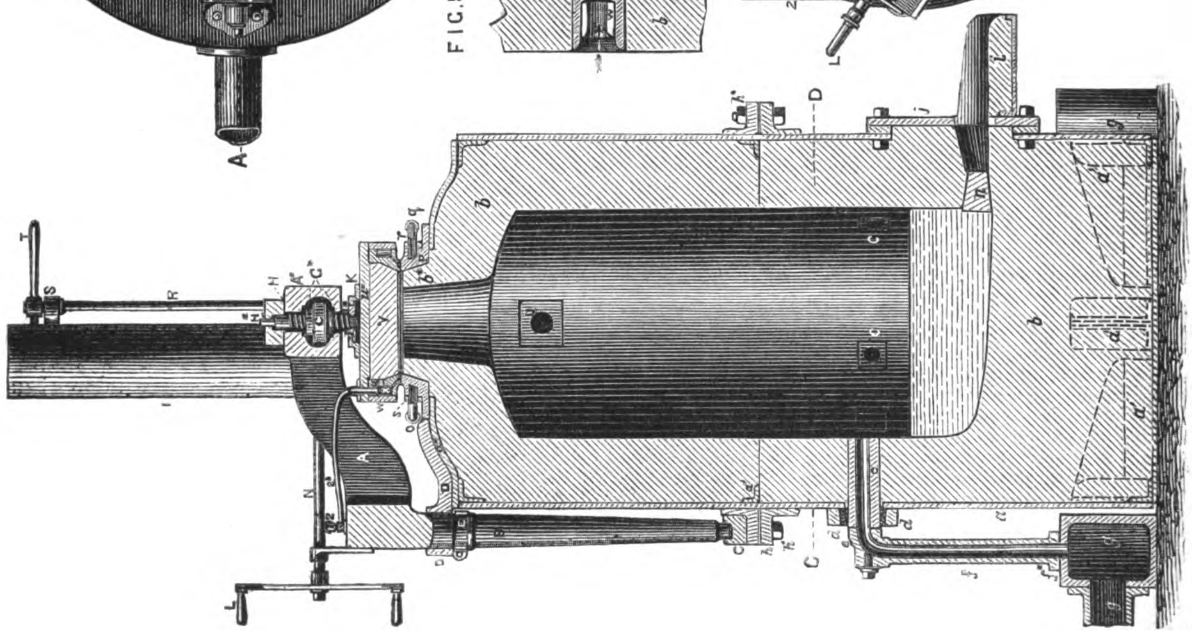


FIG. 1



great rapidity. For example, a piece of 2in. square wrought-iron bar, 12in. long, weighing 13lb., was introduced cold into the furnace and was completely fused in five and a-half minutes. In the same small furnace, 3cwt. of wrought-iron scrap was put in cold, and was poured fluid from the furnace after an interval of fifteen minutes. The furnace was then working with an average internal pressure of 15lb. to 16lb. per square inch in excess of the pressure of the external atmosphere."

He believes "that a pressure of 20lb. to 30lb. over that of the external atmosphere will be found the most economical in practice, for it is probable that if a much greater pressure is employed it would raise the temperature so high as to drive the iron rapidly off in the form of vapour," as, in fact, generally occurs towards the end of the process in the ordinary Bessemer converter. The materials to be melted in these furnaces are puddled iron or steel, finished iron or puddled steel bars cut into lengths, or steel purified by nitrate of soda, the crop ends of rails, old rails, ladle sculls, and other scrap. They are also to be employed in melting up the mixed steely metal for casting railway crossings, wheels, bells, anvil blocks, stamp heads, guns, mortars, and other articles. The system is to be applied to cupola furnaces, crucible furnaces, and reverberatory furnaces. In all these cases the outer shell is preferably made of iron or steel boiler plate, with all the joints well caulked and made airtight, and sufficiently strong to resist the internal pressure, though cast-iron shell may also be used. The furnace is to be lined with Stourbridge firebrick, Dinas bricks, plumbago, or also ground ganister on the plan now

adopted for the Bessemer converter. To fuse wrought iron or steel without so much reference to purity as to cheapness, Mr. Bessemer prefers to apply this system to a cupola furnace, having a dome through which the metal and fuel are admitted. The circular door is carried on a movable iron arm, which itself carries an upright cylinder with a movable bottom, and into which the charge of fuel and metal is put to be fed in. To preserve the door from the heat and prevent leakage of flame and gases, a hollow channel is made round the door frame, into which steam or air, at a higher pressure than that within the furnace, is conveyed. The escape opening for the products of combustion can be altered in area by the insertion of small pieces of fireclay. Several fireclay tuyeres are used for conveying the heated blast, which is also at a pressure from 2lb. to 6lb. higher than that in the furnace. A plan is also shown whereby powdered materials may be conveyed by the blast into the furnace. The cupola can be taken in two in order to be able to line it, in the same way as the Bessemer converters are lined. To show the transformation operated on the ordinary cupola furnace by Mr. Bessemer, we have chosen this form for illustration, though the cupola on trunnions, like the ordinary Bessemer converter, may be regarded as a more perfect shape.

Fig. 1 is a vertical section on the line A B of fig. 2, fig. 2 is a horizontal section on the line C D of fig. 1, fig. 3 is a front elevation of the furnace, and fig. 4 a plan of the upper part of the same, and figs. 5 and 6 vertical sections of the escape aperture. *a* is the outer shell of the furnace, formed of strong plates of iron, riveted and caulked airtight, and having gusset pieces a^1 to strengthen the bottom of it; *b* is an internal lining of firebrick, plumbago, ganister, or other refractory material; *c c* are fireclay tuyeres, moulded square externally, and having a round hole through them for the passage of the blast; they are inserted through the square iron frames *d*, which are secured by countersunk rivets to the shell *a*, and are bevelled on the inside; the outer end of the tuyeres *c* are enlarged or made taper, and the space between this enlarged part and the bevelled sides of the frames *d* is caulked with iron cement (iron borings and sal ammoniac), so that the escape of gases from the furnace around the tuyeres is prevented, and the pressure of the flanges *e* of the blast pipes *f* against the enlarged end of the tuyeres is also prevented from forcing the tuyeres *c* into the furnace by reason of its enlarged end and the iron cement around it, while the blast pipe flanges *e*, by being bolted to the iron frames *d*, also prevent the internal pressure acting on the end of the tuyeres from driving them outward; the blast pipes *f* are bolted to the main air trunk *g* by flanges f^*. An equilibrium valve is placed in the main pipe g^* near to the furnace, by means of which the blast may be turned on, or off, or moderated. The feeding door of these furnaces is so small that it is necessary to provide a special means of entering the furnace for re-lining the interior from time to time for the purpose of giving convenient access to all parts of the interior. The furnace is divided into two parts by massive angle flanges *h h*, which are faced so as to form an airtight joint, and are secured together by bolts and nuts, as shown at h^*. When the furnace is to be repaired, the upper part may be lifted off with a crane, when the lower part will be readily accessible. A small flange a^1 prevents the brickwork of the upper part from being displaced when lifted off. The furnace is provided with a spout *i*, lined with loam, for conducting the metal into the casting ladle. A door *j* is formed at this part, having only a small opening in it. By unbolting the door and removing part of the lining the furnace may be cleaned out, the lining being afterwards made up as in ordinary cupola furnaces, or a conical piece of firebrick, as shown at *n*, may be inserted, so that when the metal is to be drawn off from the furnace, the workmen, instead of having to drive a hole through the solid material with a pointed bar, will simply drive the cone *n* into the furnace, and thus open a passage at once equal to the size of piece attached. A small crossbar and screw may be employed to prevent the accidental blowing out of the cone, the bar extending across the door *j*, and the screw pressing against the small end of the cone *n*.

In order to secure the feeding door against a leakage of the products of combustion, and against the force tending to force it open, on the upper or crown plate or dome a^* of the furnace is riveted a stout ring of iron *p*, around which a hoop *r* is tightly shrunk on, leaving a space or annular channel S, in which water circulates, for the purpose of keeping it cool. The water is supplied by the pipe *o*, and after circulating round the ring *p*, it escapes by the pipe *q*; the ring *p* is also further protected by the lining of the furnace, as shown at b^*. The frame *u* has a channel *x* formed around its exterior surface, over which a hoop of iron *w* is shrunk, so as to complete the annular passage *x*. The lower surface of the frame *u* rests on the upper surface of the ring *p*. The under side of the frame *u* has a small V-shaped groove turned in it, and at about an inch apart all round this groove small holes are drilled, which pass upward at an angle and connect the V-shaped grooved channel with the annular space *s*. A pipe 2* conducts air from the main blast pipe into the channel *x*, which passes thence down the numerous small drilled channels, and thus supplies air under pressure to the V-shaped groove before named. Now, the pressure of the blast exceeds the pressure of the gases within the furnace; consequently, any imperfection in the fitting of the door frame *u* down upon the upper ring *p* of the furnace, instead of allowing the highly-heated gases to escape and act destructively on the metal fittings, such gases are prevented from escaping, because, in case of imperfect fitting of the metallic surfaces, the air under pressure in the V-shaped groove will, by reason of its superior pressure, force its way between the imperfect joint, partly escaping in the upper part of the furnace and partly into the external atmosphere.

In order to remove the door *u* from the mouth of the furnace, and readily replace it as required, a sort of crane arm is employed, consisting of two stout plate iron cheeks A A, bolted to the crane post B; this latter is supported at its lower end in a socket C, bolted to the angle flange *h*. The upper end of the crane post is supported by a strong bracket D, having a hole through it, in which the crane post turns; at E is a movable collar, fitting into a journal formed on the crane post, for the purpose of preventing the crane post from lifting upward, when pressure is applied to the furnace door; between the cheeks A a piece of iron A* is firmly bolted, having a slot in the centre, in which a worm wheel G is fitted. This wheel and its elongated bosses G* form also a screw nut, through which the screw H works, a square part H* being formed on the upper end of the screw, to prevent its turning round, but not preventing its free motion upward or downward through the block of iron A*, the holes in which are of a diameter equal to the largest diameter of the screw, and have no internal threads formed in them, the holes merely acting as guides for the screw H, which carries on its lower end a plate fitting loosely inside a flanged ring K, which is secured by bolts to the upper plate of the furnace door. The object of the ring K and the loosely fitting plate is to cause the door when lifted to be suspended in a horizontal position. The freedom thus given to the door is for the purpose of allowing it always to find its proper bearing on the ring *p*, the end of the screw H then coming in contact with the upper plate *u* of the door will bind it firmly on its seat. For this purpose the handles L are mounted on the shaft N, which also carries the worm P; this worm gears into the wormwheel G, by the rotation of which the screw H is made to rise and fall without rotation, carrying with it the door *u*. Two stops may be used to prevent the crane arm from being moved too far in either direction. For the introduction of fuel and metal into the furnace there is used a vertical feeding cylinder I, made of thin plate iron, secured by a strong iron bracket O to the crane arm. The lower part of the cylinder I has a plate Q (fig. 3) fitted to it. The plate Q is keyed on to an upright spindle R, supported by bearings S attached to the side of the cylinder, the upper end of the spindle having a handle T, by means of which the plate Q is made to close or open the bottom end of the cylinder.

While the furnace is under blast, the workmen will put a charge of coke or other fuel into the cylinder, and along with it the scrap or other malleable metal to be fused, and when the cylinder is filled the blast may be turned off, the handles L put in motion, and the door *u* lifted sufficiently to allow the crane arm to be moved round until the feeding cylinder I is brought vertically over the mouth of the furnace. A slight movement of the handle T will remove the plate G from beneath the cylinder, and allow all the fuel and metal to fall at once into the furnace. The crane arm is then quickly moved back into its former position, and the door is again forced down by turning the handles. Immediately after the closing of the furnace, the blast is turned on, and the operations of the furnace resumed, and at such intervals as is found necessary, the same operation may be repeated. In the plan, fig. 4, the crane arm is shown in the position it occupies during the time that the fuel is being discharged into the furnace. The plate Q is also shown removed from under it. Mr. Bessemer prefers to take the supply of air to the door *u* from the main blast pipe at a point where the equilibrium valves does not shut off the supply. The air will thus continue to flow during the time the fuel is being supplied to the furnace, and the act of moving the door again over its seat will cause the numerous jets of air from the small drilled passages before named to blow away with considerable force any small particles of fuel or other matter from the surface against which the door fits.

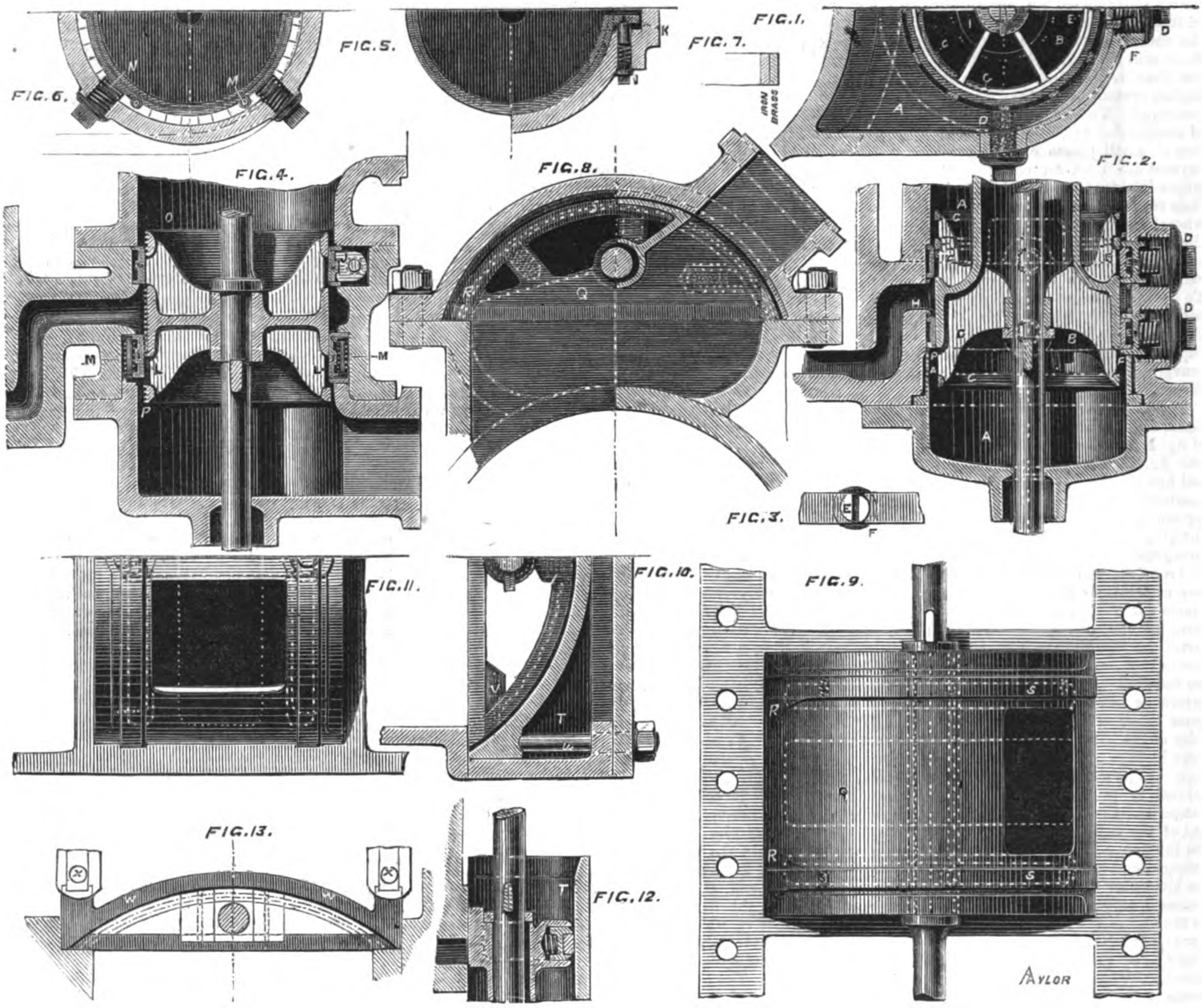
In order to admit of the motion of the crane arm and to continue the connection with the air supply, the pipe 2 is taken to the top of the crane post, and is there jointed to the pipe 2*; this piece of pipe 2* is made of thin copper or pewter, and will spring sufficiently to allow of the slight rise and fall of the furnace door. One of the chief peculiarities of this mode of working furnaces under a high pressure of the gaseous products within them is the outlet for the escape of flame, so different to the ordinary cupola furnace, where the outlet is generally equal to the full diameter of the furnace. When working under pressure in one of these high-pressure furnaces, an opening of 2¼in. in diameter has been found sufficient for a furnace whose transverse area is 572 square inches, the outlet being about 144th part of the sectional area of the furnace. Thus it has been found that with an internal pressure of 16lb. to 18lb. per square inch in excess of the atmospheric pressure, one square inch area of outlet may be reckoned approximately as the area required for every 2cwt. of coke burned per hour in such furnaces.

The outlet of the furnace at U in its simplest form consists of a square block of firebrick, having a round hole in it of the desired size. It is made with a shoulder externally, which abuts against the interior of the casing *a*, to prevent its being forced out by internal pressure; a slight difference in the area of the outlet materially affects the condition of the furnace. In fig. 5 is a vertical section of the outlet block V, having two internal diameters, forming a shoulder. Into this a small fireclay cylinder W is put, for the purpose of contracting the area of outlet; and at fig. 6 a similar outlet block is shown at X, having a small piece of moulded firebrick Y inserted therein, and projecting sufficiently to be lifted out by a pair of tongs and be replaced by other pieces of different sizes. In both figures is shown a flange plate Z, by which the outlet blocks are retained in place. By unscrewing this flange plate, the outlet block, when too much worn, can be readily replaced by a new one.

The amount of pressure up to which the gaseous products are kept within the furnace will depend chiefly on the regulation of the pressure of the blast, the escape aperture being also regulated so as to prevent the pressure going below or getting above the point desired. In some cases, the escape of the flame and heated matters may be regulated by a loaded valve, the face of which is formed of well-burned clay, in which case, a stop may be provided, so as to prevent the valve from entirely closing. There is also specified and illustrated, as before stated, a cupola movable on trunnions, but embodying a similar mode of constructing the outer shell, of making and fixing the tuyeres, the crown and upper part and crane post, furnace door, and feeding cylinder. The fuel used in these furnaces is preferably hard coke or anthracite coal; but combustible gases may also be used. The gas is generated in the ordinary way, and forced by a blowing engine into a gas receiver, where it is compressed. The form of furnace then used for melting steel and malleable iron by gas is the reverberatory, of brickwork, as usual, but enclosed in a strong iron casing, with a door on the plan described for the cupola. In the reverberatory form of furnace, liquid hydrocarbons can also be employed, either alone or with solid fuel. The liquid fuel is introduced into the blast pipe, and taken in by the blast in the form of spray. The metal to be melted may be protected from undue oxidation by coating it with a mixture of clay, lime, and sand, with or without red ore or alkaline salts. Crucible furnaces on this system are made with a cylindrical fuel chamber, supplied with blast in the same manner as the cupola furnace, with a similar regulation for the pressure.

IMPROVED SLIDE VALVES.

BY MR. BEATTIE.



BEATTIE'S SLIDE VALVES.

In our notice of the last conversazione of the Institution of Civil Engineers we briefly referred to an improved slide valve, which was exhibited by Mr. Beattie, the locomotive engineer of the London and South-Western Railway. We now place before our readers full particulars and illustrations of that gentleman's invention in that respect, which he has recently patented. We may premise that Mr. Beattie's improvements consist in constructing slide valves in such a manner as to relieve them from or to reduce the pressure of the steam thereon and the consequent friction attending their movement. For that purpose he forms the valve and the interior of the steam chest of a cylindrical shape, and extends the steam ports partly round its circumference. He forms the steam port bars of loose circular rings of metal, in one or more parts, inserted in grooves in the steam chest, and compressed against the cylindrical valve by metallic springs or by an adjusting screw, arranged to draw the ends of the rings together, so as to form a steamtight contact with the valve, and to compensate for the wear of the valves and rings. At each part where the rings are cut a circular recess is made in the steam chest, larger in diameter than the width of the rings, and into this recess is fitted a small cylinder, grooved across the end to receive the ends of the ring, and shaped to the same radius as the inside of the rings, and in this manner the steam is prevented from passing through the space between the ends of the rings. Beyond each end of the valve, and inside the exhaust port of the valve, a ring of metal is projected, forming part of the valve and connected with it, and turned to the same diameter as the body of the valve, so that the packing rings are prevented contracting to a less diameter than the valve when it is open for the admission of steam or for the exhaust.

This invention and its modifications are shown in the accompanying engravings. Figs. 1 and 2 show transverse and longitudinal sectional views of a cylindrical steam chest A A and valve B B. The valve B B is formed smaller in diameter than the interior of the steam chest, and is carried by the circular rings C C, which form the bars of the steam ports, and are compressed on to the valve B B by the springs at D D. The packing rings are formed of the section shown at C C, fig. 2, and are cut at E E. At the parts where the rings are cut the steam is prevented passing between the ends by means of the cylindrical bolts F F, figs. 1, 2, and 3, which are formed to receive the ends of the rings and to overlap the openings. At suitable distances from the body of the valve the rings G G are formed, and placed so as to prevent the packing rings contracting to a less diameter than the valve when it passes beyond them. In figs. 1 and 2 the rings C C are shown retained in their position by the rings H H, which are not in contact with the valve and serve only to control the position of the rings C C, and are suitably formed for that purpose. The valve is shown constructed to allow the passage of steam through it at I I. Figs. 4 and 5 show the rings designed so as to be contracted on to the valve by the screws at J J acting on the lugs K K, and placed so as to be adjustable from the exterior of the steam chest.

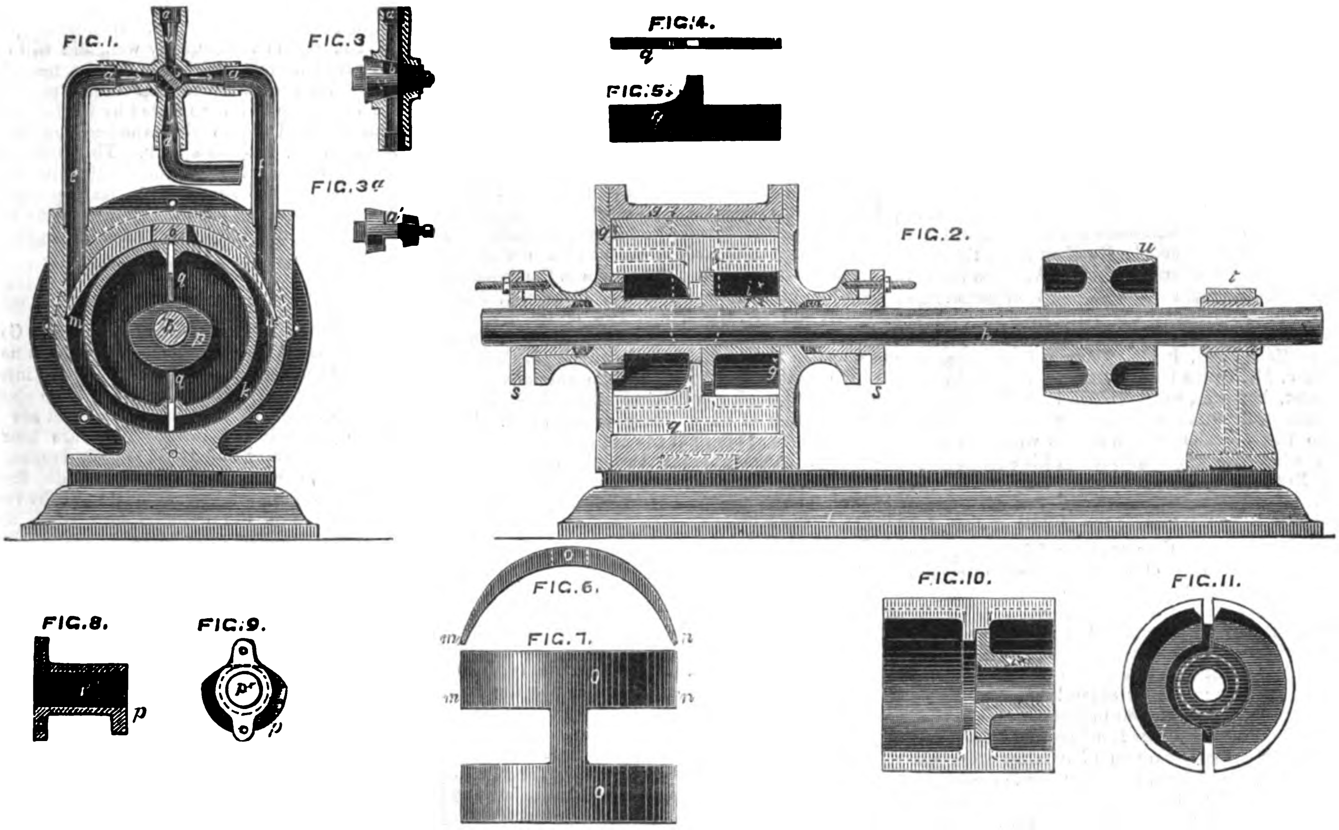
Figs. 5 and 6 show the packing rings formed of two narrow rings connected together laterally by suitable projections and recesses L L, and expanded against the sides of the grooves which contain them by the springs M M. In fig. 5 the steam chest is shown constructed in several parts for the facility of introducing the packing rings. The packing rings may be contracted inwardly by the springs N N, or fitted externally with rings of some more expansible metal, and riveted together at the ends where cut so that they will be contracted together inwardly when warm (see fig. 7). At O O, fig. 5, the outside of the valve is shown, having grooves formed in it to assist lubrication, and reduce the pressure of the rings if the steam be admitted behind them, as at P P, figs. 5 and 2. The valve shown at fig. 5 is for the steam ports of one end of the cylinder, and is connected with the valve of the other end of the cylinder by means of the valve spindle.

Fig. 8 is a transverse sectional view of a valve and steam chest, and fig. 9 is a plan of the valve. The valve Q Q is formed to a slightly less radius than the interior of the cover, but is fitted to the cover, as shown at R R, for a short distance of the curve. The rings S S are pressed into the angles formed by the cylinder facing and the steam cover. The valve is formed hollow to allow the passage of steam through it, and the exhaust steam passes out through the back. The packing rings are pressed against the cover by springs, as shown at *s s*.

Figs. 10, 11, and 12 are views of a valve adapted to the common form of steam chest. The cover T T is secured to the cylinder face by the studs U U, and the valve is shaped to a less radius than the interior. The packing rings are in two pieces, and the steam is prevented passing the ends where the rings are cut by the cylindrical cover plate, as described in figs. 1 and 2. The ends of the rings are pressed by the springs at V V into the angles

BENNISON'S ROTARY ENGINE.

MANUFACTURED BY MESSRS. BRAE AND CO.



formed by the cylinder facing and cover. Part of the back of the valve between the packing rings is removed to allow the exhaust steam to circulate there, and to reduce the weight of the valve.

Fig. 13 shows a valve adapted for the inside cylinder of locomotive engines, and is similar to the valve shown in figs. 8 and 9, with the exception that the valve spindle is attached to one end only, and the valve is not hollow for the passage of steam. The steam covers W W are pressed to the cylinder facings by the wedge bolts X X.

BENNISON'S ROTARY ENGINE.

WE have recently examined a novelty in rotary engines and pumps, which works without friction or loss of steam. The credit of the invention, which is illustrated in the annexed engravings, is due to Mr. H. L. Bennison, of Greenwich. The engine is constructed with a four-way cock for working supply and exhaust, and has the larger cam made H-shaped in plan, by which means, while the advancing pallet is kept in its necessary position by the extremities of the H, a free passage for the steam or water is provided on both sides of the pallet. By this means, the force exerted by the inner cam to work the pallet is reduced to a minimum, and the back pressure, which otherwise would be exerted against the advancing pallet, is entirely removed. There are also other improvements in detail which will be seen as we proceed with the description of the engine. In our engraving, figs. 1 and 2 are transverse and longitudinal sections of the engine. Fig. 3 is a section through the improved four-way cock. Figs. 4 and 5 show one of the pallets; figs. 6 and 7 the larger cam; figs. 8 and 9 the smaller or inner cam; and figs. 10 and 11 the internal cylinder by which the motion it receives is transmitted to the driving shaft of the engine.

The four-way cock is seen in figs. 1 and 3, at the extremity *a* in each arm; the internal form is circular, and thence, as seen in fig. 1, it changes by a diminishing taper to or very nearly to the plug seat or plug *b*, which, in the figure, appears in cross section; but, in fig. 3, which presents the plug to view so as to show its side or length, it will be noticed that the internal form changes from *a* by an increasing taper to the plug seat or plug. Fig. 3^a is the plug removed, side view showing the recesses a^1 a^1 on each side, which make the communications between *a a a a*, fig. 1. As placed in the engraving, the upper and lower arms of the cock are for supply and exhaust respectively, and the side arms for passage ways through pipes *e f* communicating with the engine, and to be used one for supply and the other for exhaust, but interchangeable in the use accordingly as the engine is to be worked in one direction or the other. *g* is the external cylinder forming the stationary case of the engine; *h* is the driving shaft passing through its ends; g^x g^x are the cylinder covers, and *i* the internal cylinder which revolves; *k* (fig. 1) is an annular space or pressure chamber between the cylinders, into which the ports open from the pipes *e f* between the extremities of the H-shaped cam *m m* and *n n* respectively of the larger H-shaped cam *m n o*, the extreme ends being recessed into the inner surface of the case *g*, and the central portion *o o* being truly fitted and seated against the top and along the entire length of the annular space, as seen in fig. 2.

By this means, the larger cam occupies a fixed position; *p* is a smaller cam formed at extremity of a flanged collar p^x by which it is held to one end g^x of external cylinder, and also occupies a fixed position; *q q* are the sliding blades or pallets or pistons which lie across the annular space when compelled to do so by the smaller cam (see lower pallet in fig. 1), and lie sheathed within a recess formed for them in the internal cylinder, when compelled to do so by the larger cam (see upper pallet in fig. 1), the action of the cams ensuing on the revolution of the cylinder, which is driven by the pallets, and these being driven by the steam or water power employed. The inner cylinder is so constructed that, in its rotary motion, its periphery forms, by its close contact with the lower side of the H-shaped cam, and with the inner sides of the covers g^x g^x, a perfectly steam tight joint, or nearly so. The internal cylinder is keyed on to the shaft *h*, as at i^x, and drives the shaft *h*. The stuffing box bearings *s s*, at ends of cylinders which partly support the shaft and its further bearing *t* and driving pulley *u*, present no features of novelty. We have described the apparatus as an engine for driving the shaft *h*, but, when employed as a pump, the shaft *h* is used as the driver, the other (moving) parts being driven.

This apparatus is being manufactured by Messrs. J. A. Brae and Co., of the Phœnix Wharf, Greenwich, where we recently examined the working of several which were being used both as engines and as pumps. The engine and pump were each 6in. diameter, the pump having three pallets and the engine two. The engine was geared to the pump by spur wheels, and the latter had a 2-inch suction and a 1½-inch delivery pipe. On being timed, the little pump delivered 75 gallons of water per minute, throwing it to a considerable distance. Both the pump and engine worked very easily, and at high speeds; at low speeds, also, the action was equally even and uniform. It is easily started, and is stopped very quickly. The engine has been driving machinery in Messrs. Brae's shop for the last seven months, and has not required any repairs whatever. In Messrs. Brae's turning and planing shop we found a 12-inch engine which was used for driving machinery that had previously been driven by a much heavier engine. We were well pleased with the working of this engine, which will assuredly find favour with the public on account of its simplicity, efficiency, and economy.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

A GENERAL meeting of the members of this Society was held at the Society of Arts on the evening of July 14. The chair was occupied by Mr. Charles Brooke, F.R.S., and there was a considerable attendance of members.

Mr. F. W. Brearey, the hon. secretary, requested permission to say that he had lately received a newspaper from Chicago, United States, giving very full particulars of an intended balloon voyage across the Atlantic. Some months ago he had seen an announcement that a M. Chevalier was preparing to leave Liverpool with a balloon of large capacity, having that object in view, but as several such statements had been made, which had resulted in nothing, he had not paid much attention to this one. M. Chevalier claims credit for the discovery of an uniformity of currents. He says:—"In every ascent during his long career, he found, on reaching an altitude anywhere between 8,000ft. and 10,000ft., that the wind was invariably from the west, or rather from the north-west, whichever way the wind was blowing near the ground. And it is for the glory of establishing this theory, rather than of sailing 3,000 or 4,000 miles over the water, that he undertakes this voyage." But this is certainly no discovery of M.

Chevalier's. Mr. Wise, an American aeronaut, says that he "early made it an object to note the influence upon the course of my balloon of the currents of air which I might then happen to encounter. The result of my observations was the discovery of an uniformity in their direction, so marked as to leave it almost impossible that it could be the effect of accident, or otherwise than the natural and prevalent condition of the atmosphere in that portion of the ethereal space. Under whatever circumstances I made my ascent, however contrary to the direction of the winds below, I uniformly found that, at a certain elevation, varying occasionally, but always within 10,000ft. of the earth, a current from the west, or rather from the north of west, invariably prevailed, nor do I recollect a single instance out of 275, the number of my existing aeronautical excursions, in which a different result ensued." He then gives this as a reason why he should fix upon America in preference to England as the point of departure from which to cross the Atlantic. Mr. Low, also an American aeronaut, has made the same observation; and, lastly, though first in point of time, Mr. Green has expressed the same theory. It must, however, be remarked that Mr. Glaisher has recorded "that the too readily accepted theory as to the prevalence of a settled west or north-west wind was not confirmed in his experience." Mr. Brearey said that we might soon have the truth about this theory established, as M. Chevalier intended to start about the middle of July.

Mr. D. S. Brown then read the following paper "On the Economy of Using Power Intermittently for Aerial Support; also Observations on Light Motors and on Balloons":—

In a former paper, I alluded to the apparent ease with which birds support themselves in the atmosphere, notwithstanding that the specific gravity of their bodies exceeds by several hundred times that of air; and I endeavour to account for the fact, by the theory, that power is not required to sustain a weight where no elevation of it takes place, not even in the atmosphere, beyond what is consumed by friction, and the loss, if any, occasioned by the support being of a yielding kind. But, although the air is a yielding support, it is, nevertheless, a most substantial one, for birds use it as a fulcrum in flying, just as well as they do the ground in walking. I therefore inferred that more depended on the application or manner in which force is employed for aerial support than on its absolute quantity, and directed attention to the econmy likely to result from using the power intermittently, as done by birds, and to a still greater extent by insects. The principle is based on the rate at which bodies fall by the force of gravitation, this rate being, as well known, an accelerating one; for example, a body which falls 16ft. in a second only passes through a space of 1ft. during the first quarter of that time, so that if it were momentarily arrested four times during its course, it would only fall 4ft. instead of 16ft., or if arrested sixteen times, only 1ft. It is very desirable that this theory should be put to a practical test, by experiment on a large scale, which may be done in an inexpensive manner, by attaching artificial wings to a light framework, a large central pair, for instance, to act alternately with two smaller pairs on either side of it. By such an arrangement, the machine would be properly balanced, and a sufficient number of strokes obtained to secure permanent support. The wings could be moved by bellows engines, worked by atmospheric air, conveyed in any quantity or manner required, by an india-rubber tube from a pump placed on the ground, and worked by a powerful steam engine, where weight would be of no consequence. If the ground apparatus were placed on a railway carriage, and made to follow the machine in its horizontal course, the aeroplane theory of support suggested by Mr. Wenham could also be tested, and thus the actual amount of power required for flight under every known circumstance ascertained. The intermittent principle may also be tried with rockets, by allowing the gas to escape from them by a number of rapid explosions, following in quick succession, instead of, as at present, in a continuous wasteful stream. Hydrogen gas, or any other explosive substance, could be employed, or even jorks of steam.

A great deal is expected from this society, but I think we may complain of the little support we receive from the public. There is no subject more important than locomotion, and we aim at accomplishing the most perfect system known. Of this, what can be a greater proof than the fact that a small bird like a swallow can in a few days fly from here to Africa, and in as many more cross that continent from one side to the other, whilst it has taken Dr. Livingstone years to perform the same journey on the ground, amidst heat, dust, and other obstacles too numerous to mention. We are not wanting for suggestion, and the scientific resources at our command are unlimited. I have no hesitation in saying that if only a thousandth part of the money which has been worse than thrown away in horse-racing had been expended in aerial experiments, the problem would have been solved long ago.

(To be continued).

NEW POWER LOOM.

DURING our recent visit to the show at Manchester we came upon a power loom which, for simplicity of construction, gives promise of a great change in the arrangement of the working parts of such machines. The loom is the patented invention of Mr. Moore, of 83, Piccadilly, Manchester, and Mr. Gadd, and two of them are in operation in Brown-street Mill, Salford. The loom in question has no crank shaft or tappet shaft, or their consequent wheels, all the motions being conveyed through one driving shaft, placed in the usual position of an ordinary crank shaft. The shaft revolves at one-half the ordinary speed—that is to say, the loom makes two picks during one revolution of the shaft, the cam causing the sley to perform two complete strokes during one revolution of the said cam. The cam is formed with a flange, the outer surface of which operates upon an anti-friction bowl, revolving on a pin fitted in bearings formed in the sley-sword, while the inner surface of the flange operates upon a second anti-friction bowl revolving upon a stud fixed to a drag link, the link oscillating to some extent around the centre of motion of the bowl as the cam revolves, in order that the bowl may accommodate itself to the movements of the cam. As the cam revolves, the bowls are acted upon alternately, and the sley is caused to vibrate, moving forwards to beat up the weft when the one bowl is acted upon, and backwards to admit of the passage of the shuttle when the other bowl is acted upon, the form of cam being such as will impart a movement to the sley similar to the movement which would be imparted thereto by a crank and connecting rod acting in the ordinary manner. The picking shaft is actuated by a tappet fixed upon the shaft, the tappet acting on the arm of the picking shaft, a corresponding arrangement being employed at the other end of the loom. The healds are actuated by levers, a vibrating motion being imparted to them by means of eccentrics mounted on the shaft. Attached to the loom is a new arrangement for putting the requisite drag on the yarn beam without the use of levers and weights, with a very simple letting-back motion—worthy of notice, as it is a cheap substitute for the heavy and cumbrous levers and weights ordinarily used. As the patentees state that the cost of one of their looms, including royalty, is at least 10 per cent. less than the cost of looms similar in reed space and strength hitherto and now being made, it becomes a matter of interest to machinists and manufacturers to give care and attention to this new loom, and to decide whether a radical change in loom construction, such as that here shown, is henceforth to obtain. We hope to illustrate this machine in the course of a week or so.

METALLIC TUBING MACHINE.

AN apparatus has just reached England from the States, which promises to effect a revolution in the manufacture of various kinds of tubes. As we purpose in our next to give an illustrated description of this machine, it will suffice here to say that it consists of a frame or table fitted with a succession of variously grooved rolls set at different angles. The metal strips are fed in at one end of the machine, and the perfect tube rapidly appears at the other. There is also a table with a pair of cutting rolls, by which the sheets of tube metal are cut into strips of sufficient width for the tube. The inventor is Mr. C. Granville Smith, of Chelsea, Mass. We saw yesterday one of these machines in operation at 42, Kirby-street, Hatton-garden; it was working exceedingly well, and turning out lock-jointed tubes with rapidity and exactness. These machines will produce all the various kinds of pipe in common use, either with the lap joint, lock joint, or butt brazed. The lap joint it produces ready for soldering or brazing, and the butt joint the same, while the lock joint leaves the machine completed and in marketable condition without soldering. All these various kinds of pipe or tubing the machine produces at the rate of 60ft. to 80ft. per minute, in any length required. The metal to be made into pipe is passed into the machine in a flat sheet of the proper width, and, passing through, leaves the machine at the opposite end completed. The apparatus is operated by one man, whose only duty is to feed the machine. It works copper, brass, tin, iron, or zinc, equally well, and will certainly prove a great acquisition to tube manufacturers. We are informed that tubing produced by this machine has been tested by the following pressures of cold water:—Brass and copper, 250lb. to square inch, without a leak. Tin, 70lb., with slight leak at about 18lb. Iron, 250lb., with slight leak at about 75lb. Zinc, 115lb., leaking slightly at about 25lb. These are the results of many tests on tubing 1in. in diameter and 12in. in length.

THE GREAT WOLF ROCK.

THE dangerous pile of rocks lying off the Cornish coast known by the above name, is now about to be converted from a source of peril into a beacon of warning. The rocks are situate about eight miles S.S.W. of the Land's End, and are in extent 56 yards by 88 yards. They are nearly covered at low water, and to add to their dangerous character, the water immediately beside them ranges from 30 to 40 fathoms. Placed at the very commencement of the Channel navigation, and their existence almost completely concealed, they have caused the loss of many ships and of many hundreds of sailors. For nearly eight years the Trinity Board have been engaged in the erection of a lighthouse upon this dangerous point, but from the peculiar nature of the foundation the work has been arduous and progress necessarily slow. The time available for working on each tide has been reckoned by minutes, and in the whole eight years the greatest number of hours during which workmen could land has been 313 in one year, but in some years that number has been as low as 83. On Monday the last stone of the lighthouse which now surmounts the Wolf Rock was laid by Sir F. Arrow, the Deputy-Master of the Trinity House. The lighthouse tower is built of solid granite, and stands 110ft. above the high-water level. The lantern and lens have yet to be fitted, but it is hoped that these works will speedily be completed, so that before the present year has run out, the Wolf Rock may no longer be dreaded by the homeward-bound sailor as a hidden peril, but be looked for as a guiding beacon to his welcome home.

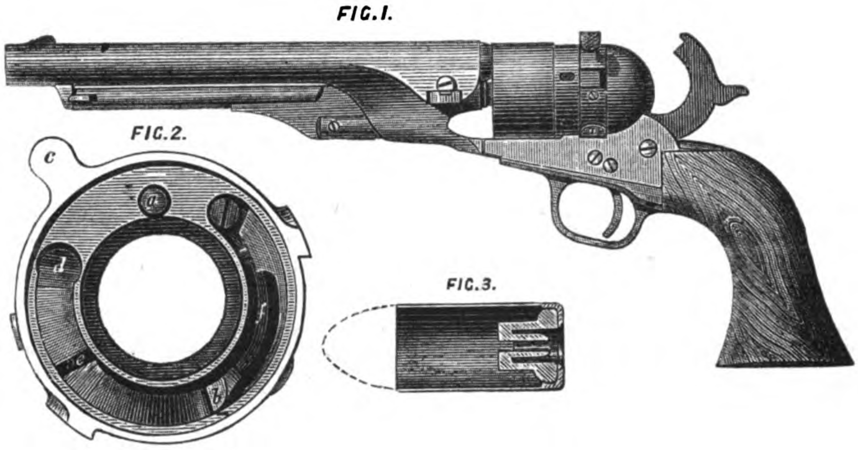
A NEW HOT SPRING.

A STRANGE geological phenomenon caused some excitement last week at Murat, a village situated between the valley of Mont Dore and that of St. James. A civil engineer had caused a rectangular well to be sunk to a depth of 53 metres through a stratum of hard tufa, which covers the primitive formation in that district. At this depth, which is insignificant compared to the shaft of a mine, the heat, nevertheless, became so intense that the workmen had to be relieved at short intervals. Their wooden shoes soon got intolerably warm, and they could not lie down to rest themselves on the hot ground. On the other hand, the appearance of the tufa denoted that the well had nearly reached the granite. The engineer, on leaving the spot for a while, had recommended his men to be very careful during his absence, and to content themselves with removing the rubble, without going further down. One of them, however, in throwing the last shovelful into the skip, took it into his head to remove with his pickaxe a piece of tufa, about 30in. in circumference; but no sooner had he done this than he saw the bottom of the hole he had made swell up. At the same time a loud rumbling noise was heard. The men in a fright jumped into the cage and called to be pulled up; but they had barely got to a height of a dozen metres when a thick column of hot water, preceded by a violent report, rose up in the air, projecting huge stones upwards. The water in falling scalded the men grievously. The jet diminished, and the well filled rapidly, the poor fellows succeeding, however, in getting out in time. In the course of ten hours the well got quite full, and from that time a rivulet of thermal water has been flowing from the spot into the Dordogne. The liquid, on arriving there, still retains a temperature of 40deg. Centigrade. Upon analysis it has been found to contain upwards of 20 milligrammes (nearly half a grain) of arseniate of potash per litre, a proportion unheard of before.

THE COLT BREECH-LOADING REVOLVER.

IT has always been our opinion that breech-loading firearms could only come into universal demand when measures were afforded the user of making—or, rather, of re-making—his own cartridges. A breech-loading weapon, firing cartridges carrying their own ignition, would be useless in some parts of the world, where fresh cartridges were not procurable, after the stock in hand had became exhausted. On the other hand, gunpowder and caps can be had almost anywhere, so that if we give a man a central-fire cartridge, the case of which can be reloaded and primed, we prepare him for almost any emergency of time or distance. The Colt Firearms Company—whose offices are at 14, Pall Mall, London—appear to have had these ideas in view when working out the most recent improvement in their revolvers. This improvement consists in converting the ordinary Colt muzzle-loading revolver into a breech-loader, and especially in providing a cartridge which can be fired and the case re-charged and re-capped a great number of times. The new arm is seen at fig. 1 of our engraving; fig. 2 shows the breech disc, whilst fig. 3 is a section of the new cartridge shell. In converting the present muzzle-loading Colt revolver to a breech-loader, the rear end of the chamber with the cap nipples is cut off, and the disc shown in fig. 2 is substituted. This disc contains the striker and the injector. The striker is a pin, acting freely in the ordinary way; the action of the injector will be gathered from the following descriptions of the manipulation:—The cartridges are placed in the chambers from the front in the ordinary way, and after firing, the disc is rotated a short distance by the projecting lug *c*, until the head *d* of the extractor arrives under the hammer, where the striker was previously. On pulling the trigger, the hammer drives forward the head of the striker and the small bar hinged at *e*, and at the same time causes the ejector *b* to strike smartly the base of the shell, and so to drive it forward out of the chamber. The spring *f* returns the ejector when the hammer is raised. The new cartridge consists of a cylindrical shell of thin sheet brass, open at the upper end, but closed at the lower with a slightly concave disc, which is perforated in the centre, the edge of the orifice being raised externally to receive the cap. The cap having been placed on this projection or anvil in the base of the cartridge, the shell receives a charge of three-fourths of a drachm of powder, over which is laid a lubricated wad, and the whole is surmounted by the conical bullet, and rammed close. The necessary apparatus for re-charging the cartridge cases, consisting of five pieces, is supplied with each revolver, and is very easily manipulated. Some public trials were recently made at the Crystal Palace with the improved revolver and ammunition, and which clearly demonstrated their value. Accuracy and penetration were all that could be desired, whilst it was abundantly proved that with a pound or two of powder and a handful of caps, a man could keep himself well supplied with central-fire cartridges for a very long time. This improvement is a step in the right direction, and will add to the fame of the already far-famed Colt revolver.

THE COLT BREECH-LOADING REVOLVER.



THE "CITADEL" WEDGED-BOLT LOCK.

BY MR. HODGSON.

FIG. 1.

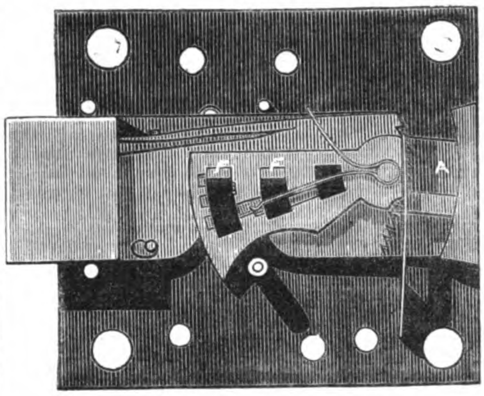
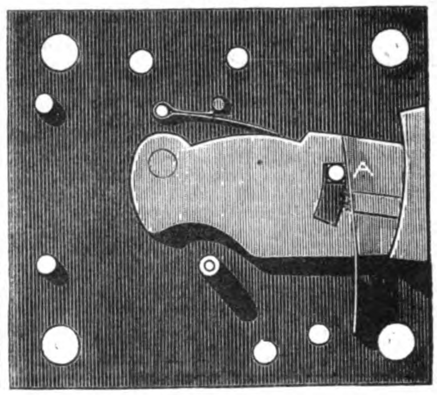


FIG. 2.



THE "CITADEL" WEDGED-BOLT LOCK.

THE liability of all locks made up to this time to be opened by violence, *i.e.*, by forcing the bolts back, is well known to locksmiths and probably also to most of our readers. The whole resisting force against violence has hitherto been simply the small pin or stump, as it is technically called (marked F in our engraving), which is riveted into the bolt. Thus, whatever the thickness of the head of the bolt, the whole real strength of all other locks depends upon that small pin, and directly that is broken off, the bolt slides back. The object of the inventor of the "Citadel" wedged-bolt lock was to render a lock impregnable against violence as well as fraud, and the "Citadel" lock has therefore a tumbler or lever turning on a pivot underneath the bolt, and carrying a block or wedge A, which, when the bolt is shot out on locking, descends between the rear end of the bolt and the end of the lock, and thereby completely and mechanically fills the space hitherto left vacant behind the bolt of all other locks, and securely wedges the bolt in its locked position. The absolute security from violence, which is the most ordinary fraudulent method of opening a lock, will be apparent to everyone. The key to unlock the bolt first arranges the levers in the usual way, and then, by a simple action on an incline on the talon of the bolt, sends it just sufficiently far forward to release the teeth of the wedge-lever from those of the bolt, and then adjusts the wedge-lever correctly, and withdraws the bolt in the ordinary manner.

The construction of the lock is not complicated in any way, as may be seen from our illustration, nor is there any part of the lock that is liable to get out of order. There are only the same number of pieces as in any other of the best patent locks, but, by their arrangement and action, a double lock is formed by a single action, and thereby double security given against fraud, and, mechanically speaking, absolute security against violence. The principle of the "Citadel" lock is applicable to locks used for every purpose. The engraving, fig. 1, shows a lock made on the "Citadel" principle for banks, iron safes, or other purposes where extraordinary strength and security are required. This lock has a secondary bolt-slide carrying another stump, also marked F. Fig. 2 shows the wedge-lever, with all the other parts of the lock removed. We would add that the "Citadel" lock is the invention of Mr. Hodgson, and is manufactured by Mr. Hodges, at the Bloomsbury Works, Wolverhampton, whose offices are at No. 114, Chancery-lane, London, where we recently inspected several varieties of locks made on the above principle, which is one involving perfect security at a very small cost. The inventor has perfected a highly ingenious mechanical arrangement, and has embodied it in a lock which will ensure the safety of our goods and chattels wherever it is adopted.

THE MAURY BAROMETER.

(E. T. LOSEBY'S PATENT.)

THIS instrument, invented by Mr. E. T. Loseby, of Leicester, in 1860 and 1861, and patented by him, is named after the eminent American geographer and meteorologist, Captain Maury, late director of the Washington Observatory. Captain Maury while visiting England in 1860, pointed out to Mr. Loseby that an accurate and durable pocket barometer was much wanted for many purposes, especially for measuring high mountain ranges, and urged him to exert his mechanical skill in an attempt to produce such an instrument. The conditions laid down by Captain Maury were that the new barometer should range through not less than 15 barometric inches, should be readable to hundredths of an inch, should be compensated for change of temperature, and should not be larger than an ordinary pocket chronometer. Mr. Loseby undertook the task, and in the beginning of the year 1861 he completed an instrument perfectly fulfilling these conditions. But to produce such an instrument in sufficient numbers for successful sale, a staff of workmen, trained to this particular manufacture, was necessary. Meanwhile aneroids were reduced from the original diameter of 5in. to about 3in., and subsequently still further to a size that could be carried in the waistcoat pocket. Time has, however, shown that although the pocket aneroids are handy little instruments, the reduction of size has augmented the errors inherent in the principle. Many inquiries have been made for Mr. Loseby's patent, and one foreign government has offered any reasonable price for it. But it cannot be manufactured for sale to the public until complete arrangements are made for setting up the special machinery which has been invented for producing the several parts in large numbers quickly and accurately, and until workmen have been trained to the use of the tools; considerable division of labour being necessary, to secure cheapness and accuracy. A company has therefore been formed for the purpose of co-operating with Mr. Loseby in carrying out his arrangements for the production and sale of the instrument in large numbers. In the following description, the details of the new barometer are compared with those of the aneroid, in order that the difference of construction may be clearly understood. The Maury barometer contains a vacuum box resembling that of the aneroid in appearance, but made of a material and by a process which give greater permanence to its elasticity in long ranges. The rise and fall of the box is measured by a fine micrometer screw, worked by the observer, and furnished with an index hand. The range may be extended through 24 barometric inches, if required, and the indications will still remain more accurate than those of an average aneroid through one quarter of the range.

The main spring, which keeps the vacuum box distended, is about four times longer than that of the best aneroids, and thus the spring is enabled to expand and contract through four times the range without more strain on each portion of its length. This and the permanent elasticity of the vacuum box are important points; for if their elastic force varied, the top of the vacuum box would not rise and fall equal distances, under equal variations of atmospheric pressure. This rise and fall is exceedingly minute. In the Maury barometer it is only 1-50,000th of an inch for a rise of 10ft. in elevation, and in a pocket aneroid of the same size it is much less, because the Maury vacuum box is larger in proportion to the size of the case, and exposes more than twice the area to the action of the atmosphere. To enable this minute motion to be realized, it may be mentioned that a piece of ordinary note paper would require to be split about 160 times to represent it. To render this motion visible to the eye, it is multiplied in the aneroid by a system of pivoted levers, ending in a chain which is coiled round a small drum, having the index hand attached to its spindle. Now, it will easily be understood by those acquainted with fine mechanism that such minute motions as 1-50,000ths of an inch will be absorbed by the flexure of the levers, the necessary play of the pivots in the holes, and the irregular action of the links of a plate chain not lying closely to the small drum, with only a few grains of power to overcome the stiffness of its riveted links, and displace any dirt that may prevent its close contact; and, further, that the slightest resistance at the multiplied end of the motion will become a large force at the vacuum box, where it will be increased some hundreds of times, seriously opposing its free action; and this disadvantage is increased in the aneroid by the vacuum box having to move all the mechanism and overcome its friction, &c.

In the Maury, the motion of the vacuum box is multiplied by a fine micrometer screw, which is brought into contact directly with the top of the vacuum box, so that its entire motion is shown on the dial by a hand fixed on the screw, and all the intermediate mechanism of the aneroid is dispensed with. The power required to work the screw is supplied by the observer; the vacuum box has nothing to do with moving the indicating mechanism, but is left perfectly free and disconnected with it at the time of observation, with nothing to oppose it in truly balancing itself against the pressure of the atmosphere. The simplicity and firmness of its mechanism, and the small number of acting surfaces, render the instrument very durable, and not liable to injury. It may be subjected to violent shaking or other rough usage, short of breaking the glass or bruising the case, without interfering with its subsequent action; whereas the aneroid is easily deranged by a jerk or a violent shaking. The Maury is compensated for change of temperature, and the higher priced instruments are tested in artificial heat and cold, in a chronometer apparatus, and adjusted until all error from change of temperature has been removed.

The dials have the divisions engraved in a spiral of several coils from the outside towards the centre, and the hand in traversing the whole scale makes as many revolutions as there are coils. This distinguishing feature of the Maury enables the scale to be very long, and allows about four times the number of divisions that could be put on the dial of a pocket aneroid of the same size, if it ranged through as many barometric inches, because the hand of the aneroid would only make one revolution. By this method, and in a small compass, a longer and more open scale is obtained than even that of the upright mercurial barometer, for if the spirals were straightened out, the line would be longer than a corresponding number of inches on the mercurial tube. The dials are usually divided to show feet of elevation direct, without having to refer to a table, as this is found far more convenient for general use in measuring altitudes; but for meteorological purposes they will be divided to show barometric inches instead. Each dial is graduated under the air pump throughout the range, to suit the individual vacuum box to which it is applied, and this is done with all the works in place as they will be used; so that any irregular motion of the box will be allowed for in the dial.

In the aneroid a few points only in the scale are correctly determined; and the interspaces are then divided equally; thus any irregular motion of the vacuum box will always give an erroneous reading at that point; and as it is impossible to make vacuum boxes rise throughout their range with perfect uniformity to the 1-50,000th of an inch, such erroneous readings must be frequent in the aneroids. The table generally used for graduating the Maury dials to show feet of elevation is one prepared by the Astronomer Royal, and a copy of it will be supplied with each instrument, to enable any one to convert the readings into barometric inches, or to employ a different table of values for altitudes. The few acting surfaces in the Maury are of hardened and polished steel, and the workmanship throughout is of a high order. The weight of the instrument is only 8½oz. troy, and of this the silver case forms a large proportion.—"Horological Journal."

PROPOSED GREAT DOCKS FOR THE BRISTOL CHANNEL.

Two schemes of great importance are now occupying much attention in the mercantile circles of Bristol, Gloucester, and South Wales. The Gloucester and Berkeley canal, 16 miles long and of sufficient depth to float ships of 1,000 tons, was constructed 40 years ago by the two greatest engineers of that time—Upton and Telford. The trade, mainly in timber and corn, has rapidly increased, until now it has overgrown the facilities of the port, having regard especially to the enormous vessels employed in the mercantile navy. Brunel, Harrison, Page, and other eminent engineers, have from time to time been consulted, and have recommended extensions, but all their plans were deemed too costly. Last year, the trade of Gloucester was immense, and in consequence of the short time given for the entrance and outlet of ships, and the limited area of the tidal basins there, ships were often detained in Kingroad for weeks. To remedy this state of things, the "Times" states that a plan of improvement has been proposed by Mr. Clegram, the resident engineer, and endorsed by Mr. T. E. Harrison, the hydraulic engineer, for an extension from a point one mile above the present outlet to Holy Hasle Pill, three-quarters of a mile below. It is more than curious that this extension has never been proposed before, inasmuch as by an outlay of £150,000 a new entrance can be provided, with a tidal basin 700ft. long and 300ft. wide; a lock 320ft. long—inside this a dock 2,000ft. long and 355ft. wide; and a new communication to the present canal of about 800ft. in length, 150ft. in width at the top, and with a depth of water of 19ft. Thus accommodation would be given for the largest ships that can navigate the estuary of the Severn from Kingroad to Sharpness. This scheme may, therefore, be regarded as that for the greatest improvement of which the port of Gloucester can at any time be capable. The Board of Trade has been consulted, and it is understood that the president has approved the plan; and as the harbour, in the event of war, would furnish a refuge for gunboats and a means of repairing them, the right hon. gentleman is believed to be prepared to recommend the Government to make the grant of the necessary capital. The new docks would enable steamers of the largest ordinary class to discharge, and then to turn before leaving; they would avoid in many cases the necessity for swinging ships in the rapid tidal way of the Severn; and as the site is only some four or five miles from the trunk line of the Midland Railway, the docks and the line might easily be brought into communication. In connection with this matter has been revived the great project of bridging the Severn, which, it will be remembered, excited so much attention in Parliament, when, four or five years ago, Mr. Fowler proposed a monster bridge, and an Act for its construction was obtained, notwithstanding that the scheme was opposed by all the local and nearly all the railway interests; the purpose was the bridging of the river from Oldbury across the sands to the western shore, a distance of five miles, at an estimated cost of about £800,000. Nothing has been done, either by way for carrying out this scheme or of carrying out another for which an Act was also obtained—that for bridging the river at Newnham, some ten miles higher up. A plan is now under consideration for constructing a subway from the western shore to near the contemplated new docks. This would materially shorten the distance between London and the Dean Forest and the South Wales coalfields; and the result of a recent survey is that by the construction of the new docks and of the subway, or of an equivalent bridge, the Government mineral and woodland property in Dean Forest, 25,000 acres in extent, would be improved to the value of £40 an acre, or, in all, £1,000,000 sterling. The cost of the subway is set down at £250,000—a mere trifle when contrasted with the enormous cost of the gigantic bridge at Oldbury, which would be the largest in the world, and not greater than the cost of the Newnham bridge. The present scheme would be far more efficient than either of the other two; for it would connect the South Wales and Midland systems, and would afford a constant export trade in coal and iron from the contemplated docks at Hazle Pill. Last year, shipping representing between 200,000 and 300,000 tons left Sharpness empty to seek cargoes in South Wales. If the docks are constructed and the subway is made, ships will be enabled to load at Hazle Pill, and the consequent improvement in the value of the Forest of Dean coalfield will be enormous. It is therefore understood that the Office of Woods and Forests is prepared to recommend a loan of £250,000 for the construction of the subway. The Gloucester and Berkeley Canal Company will meet within the next few days to decide whether they will apply to Parliament for powers to carry out as much of this great work as they are immediately interested in.

Mr. Theed has finished the heroic-sized marble statue of Lord Derby, for which he was commissioned by the town of Liverpool, and which is about to be placed in the Town-hall.

Correspondence.

RIFLING SMOOTH-BORE GUNS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In the Mechanics' Magazine for May 14 1869, we observed a drawing and description of a plan for enabling smooth-bore guns to spin elongated projectiles by means of a spiral rod secured to the breech of the gun in the centre of the bore. The plan is there attributed to Mr. C. Pemberton, R.N., who is stated to have commenced his experimental firing with it in 1865. We wrote on May 21 to inform Mr. Pemberton that the plan had been invented by us more than three years before his experimental firing commenced; but the letter, which was addressed to the Mechanics' Magazine Office, has been returned to us without having found him; we therefore send the facts for publication in your journal.

Our experimental shooting with the plan commenced in February, 1862, and was chiefly carried on by Colonel Sir H. Halford and ourselves at his private range at Wistow, near Leicester. The shooting occupied some months at various ranges from 200 to 700 yards, and led to some important improvements which advanced the principle considerably beyond the stage shown by Mr. Pemberton. During the experiments, many hundreds of rounds were fired from our different small models, and the accuracy of our smooth-bore "spit gun," as we named it, exceeded that of a gun of the same bore rifled in the ordinary way. Having arrived at this point, Messrs. Robertson, Brooman, and Co., of 166, Fleet-street, took out a provisional patent for us in June, 1862, and we submitted the invention to the Government in September following, and asked that the plan might be tried on large guns. But the Government declined to take up the matter, and we found that any experiments in shooting large guns would have to be conducted at our own expense, and further trials were therefore stopped.

But the results we had obtained left no doubt then, and we have none now, that the principle will answer for large guns in the form we left it seven years ago; and that it will either spin elongated shot for accurate shooting at long ranges, or discharge spherical shot for battering at short ranges.—We are, Sir, yours, &c.,

M. Turner and E. T. Losbey.

Leicester, July 17.

[Not having Mr. Pemberton's address, we inserted two notices in the Mechanics' Magazine to the effect that a letter awaited Mr. Pemberton at our office. This failing, we opened and returned Messrs. Turner and Loseby's letter to them.—Ed. M. M.]

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscriber of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

Received.—R. N.—J. B.—T. and F.—H. M. L.—G. W. H.—M. and Sons.—R. and Co.—B. J.—L. B.—F. L.—M. T. and E. T. L.—H. and J. K.—C. H.—R. S.—H. T. and Co.—T. C.—R. M.—H. R.—G. W. H.—W. L.—R. S.—B. C. and Co.—F. W. B.—J. H.—R. J.—H. S.—T. R.—J. N.—R. S.—L. W.—T. F.—E. B.—W. S. and Co.—J. T.—F. B. M.—H. L.—W. P.—F. S.—T. H.—H. R. and Co.

Naval, Military, and Gunnery Items.

From a Parliamentary return issued on Monday it appears that the expenses incurred in connection with the royal naval review at Spithead, in honour of the Sultan in July, 1867, as nearly as can be determined, were £8,882 14s. 6d.

An official report of the Minister of Militia and Defence of the Dominion of Canada states that the Imperial Government has intimated its opinion that the naval and military assistance afforded by Great Britain to the Dominion must be largely reduced. Halifax is to be considered, however, an imperial station, and 2,000 men are to be left for its defence

CAPTAIN W. E. LEOHE has had the honour of submitting and explaining to his Royal Highness the Commander-in-Chief the principle of his new repeating and breech-loading rifle.

AN armour plate supplied by Sir J. Brown and Co., of the Atlas Works, Sheffield, and selected from a batch intended for the armour of the "Swiftsure," now building, was tried on board the "Comet" target ship in Porchester Creek, Portsmouth Harbour, on Tuesday. The extreme length of the plate was 16ft. 6in., width 3ft., thickness 6in., and weight about 5 tons. It was secured by 16 2½-inch bolts, with ordinary nut and screw, to the backing in the testing battery.

MANY reductions in the coastguard service are about to be made by the Government. The first step in this direction will be immediately taken by the abolition of the coastguard stations at Sittingbourne and Conyer, on the Kentish coast. Judging from the fact that between 7,000 and 8,000 vessels annually enter the creek upon the shore of which Sittingbourne and Conyer stations are situated, many others on less important points of our seaboard are likely to meet a similar fate.

IN the House of Commons on Tuesday evening, Mr. Mills asked the Secretary of State for War whether any decision had been arrived at as to compensation or remuneration to Mr. Parsons for his invention in strengthening cast-iron guns, and, if not, if he could state whether it was probable that such decision would be made at an early date. Mr. Cardwell said that upon a point of considerable importance a reference had been made to the President of the Institution of Civil Engineers, whose report had only been received that morning. No delay would take place in arriving at a decision.

A DARING attempt was made early on Monday to obtain possession of about £4,700, which had been deposited in an iron chest, and placed in the paymaster's office on the main deck of her Majesty's ship "Octavia," Captain J. H. J. Alexander, C.B., lying off the southern jetty at Portsmouth. John Aickin, a marine belonging to the ship, was on duty as a sentry on the jetty when he saw two men coming out of the port on the main deck leading from the paymaster's office. They had an iron safe in their hands, and had lifted it on to the half-port, from whence he supposed they intended to lower it on to a stage. He gave an alarm and the men made off, but were pursued and captured. They are both watermen living in Portsea.

THE King of Prussia has awarded a telescope to Captain George D. Taylor, of the barque "Flying Fish," of London, in acknowledgment of his services to the crew of the Papeuburg ship "Maria" in February last; also gratuities of £5 to the second mate, and £3 to each of the four seamen who manned the boat of the "Flying Fish," by means of which the crew of the "Maria" were rescued. The "Maria," whilst on her voyage from Runcorn to Cette, became so leaky that it was deemed advisable to abandon her. In answer to her signal of distress the "Flying Fish" bore down and launched a boat manned by the second mate and the four seamen above alluded to, who, after great exertions and considerable risk, succeeded in taking the crew, seven in all, safely on board the "Flying Fish." Some days afterwards they were transferred to another vessel, which landed them at Dover.

THE National Artillery Association commence their annual competition at Shoeburyness on August 2 next, under the same rules and regulations as hitherto existed. The sum of £50 given by the National Rifle Association, which has been heretofore distributed in carbine prizes, and competed for at Wimbledon, has this year been given over to the National Artillery Association, and by the council appropriated towards great gun prizes. Artillery volunteers in general think this sum ought still to be maintained for carbine prizes, the competition for which might be carried out at Shoeburyness. It is to be hoped that some improvement will be effected this year in the *cuisine* department of the camp, and that better means of conveyance from Southend to Shoeburyness, and at a cheaper rate, will also be established.

ATTENTION has been directed to the question of the consumption of coal by our ships of war, and on Friday week, the "Lucifer," 1, paddle vessel, went out of Portsmouth harbour, and made a run outside of the Wight, for the purpose of testing some Lancashire coal. At the present time, Welsh coal is generally used, at a considerably higher cost than north country coal, which has been considered objectionable in consequence of the large quantity of smoke it produces. The experiments made on Friday week, proved, however, that by using a smoke-consuming apparatus, no more smoke is produced than from Welsh coal, and it is anticipated that the north country coal will be brought into general use, by which means a considerable reduction in the heavy item for coals is expected. Captain E. B. Rice, A.D.C. to the Queen, and superintendent of the steam reserve at Portsmouth, and Mr. George Murdoch, inspector of machinery afloat, were on board for the purpose of witnessing the result of the experiments.

Miscellanea.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending July 17, was 8,349. Total number since the opening of the Museum, free daily (May 12, 1858), 1,604,884.

A DISCOVERY was made on the 7th inst., at Herculaneum, of two gold brooches of moderate size still fastened to two pieces of stuff. They probably served as the clasp for a peplum. A small faun was also found—an indifferent copy of a very valuable original.

ON Friday, the bronze statue of Mr. George Peabody, the work of Mr. Story, the American sculptor, was placed on its granite pedestal in the enclosed small area at the north end of Exchange Buildings and Treadneedle-street, opposite the Royal Exchange. It is stated that the unveiling of the statue is to take place to-day.

ARRANGEMENTS have been made, by permission of the directors of the East London Railway, and of Mr. Hawkshaw, the engineer, for a visit of the members of the Society of Engineers to the works, on Friday, the 30th of July. Members are to meet at the Wapping shaft of the Thames Tunnel at 2 p.m., proceeding thence to New Cross.

A DESPATCH from San Francisco (June 29) says—"Successful experiments have been made in this city with a working model of an aerial navigation machine. It not only ascended into the air, but was propelled in any required direction by the machinery, and it has the capacity for carrying eight or ten persons, being constructed for the purpose of making trips to New York. The inventor is confident that the trip can be made in 24 hours."

THE number of visitors to the South Kensington Museum during the week ending July 17, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,707; Meyrick and other galleries, 2,303; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,892; Meyrick and other galleries, 245; total, 15,147. Average of corresponding week in former years, 12,715. Total from opening of Museum, 8,624,876.

A FEW days since a thunderbolt struck Mdlle. Franconnet, aged 19, who was with her mother in the vineyard of Neuves-Maisons, Vosges, France. The young girl expired on the spot; the electric fluid, entering by the feet, furrowed all the right side of the body and came out by the chin. The unfortunate mother, who was also prostrated, was enabled to rise from the ground without serious injury, but the sudden death of her daughter appears to have affected her intellect.

DURING a storm at Strasbourg recently three soldiers were sitting on a bench under the shelter of a tree when the electric fluid fell upon them, killing one instantly, his shako and necktie being strewed about in minute fragments. The second was struck on the back of the neck, and only lived a few minutes. The third had his legs burned, but not severely. A Custom House officer, who was standing not far off, was flung down, but received no injury. His watch was, however, broken into a great number of pieces.

THE General Omnibus Company have hit upon a style of omnibus which is calculated to reduce their dividends for the summer quarter. That would be a slight matter if the health of the public also were not involved. They have succeeded in so constructing their newer omnibuses as to absorb as much heat and to exclude as much air as possible. On several days last week, the air of these omnibuses was like that of a badly ventilated Turkish bath. The new windows are fixtures—they cannot be opened; and the feeling of closeness produced by this arrangement on a hot day is intolerable. Oh! for the double-ended tramway cars.

MR. H. A. CHURCHILL, C.B., her Majesty's consul and political agent at Zanzibar, has just arrived in this country, and we are happy to hear that he speaks with confidence as to the safety of Dr. Livingstone, from whom he has had letters of a date more recent than that of his reported murder. It is Mr. Churchill's opinion that Dr. Livingstone, having heard of the discovery of the northern portion of Lake Albert Nyzanza by Sir S. Baker, has directed his route in search of the southern boundary of that lake, and that in the course of a few months it is probable that further news will be heard from Dr. Livingstone himself.

AN appalling disaster has fallen upon the usually busy and thriving town of Gefle, in Sweden. On Saturday, the 10th inst., a fire broke out in a carpenter's shop in the centre of the town, and a strong gale from the west blowing at the time, the fire spread rapidly, and in a few hours the whole of that part of the town which is situated on the north side of the river was burnt down; 700 houses and tenements were destroyed, and 8,000 houseless persons, out of a population of 13,000, having lost almost everything they possessed, are now camping i the open air. The loss is estimated at above £500,000.

THE Netherlands International Exhibition a Amsterdam was opened yesterday week by Prince Henry of the Netherlands, his Royal Highness o on arriving at the palace being received by the Ministers, the Corps Diplomatique, the civic authorities, and a number of distinguished foreign visitors invited to take part in the ceremony. There are 14 countries exhibiting, the Netherlands numbering 928; Belgium, 338; France, 308; Great Britain, 201; Austrian, 144; North Germany, 129, out of a total of 2,325 exhibitors. Mr. Thurlow, at present attached to her Majesty's Legation at the Hague, has been instructed by the Foreign Office to draw up a detailed report upon the exhibition for presentation to Parliament.

THE Marseilles journals state that a mine having been exploded in a quarry on the side of the hil Notre Dame de la Garde, an enormous mass of stone, containing not less than five cubic meters, and weighing about 15 tons, was detached, and rolled down the declivity as far as the church of St. François d'Assizes, on the Bouleuard Vauban. It broke through the wall of the sacred edifice, making a hole of five square yards in extent, and only stopped at the high altar, part of which it smashed. Happily the building was empty at the time or the consequences might have been most serious. The block was so large that it was obliged to be sawn in pieces to get it out of the church.

A PARLIAMENTARY return on the subject of the adulteration of food shows that, in the metropolitan district in the year 1866, 22 persons were convicted under the Revenue Acts of adulterating food and drink; in 1867, 7 persons; and in 1868, 5 persons. In 1866, the convictions were all for selling adulterated coffee, adulterating chicory with mustard husks, or having in possession materials for adulterating beer; in 1867 and 1868, the convictions were all for possessing or supplying materials for adulterating beer. In 1866, the penalties, as mitigated by the Board of Inland Revenue, amounted to £153; in 1867, to £97; in 1868, to £236. These cases are doubtless but a small percentage of the offences committed by adulteration of food.

DURING Sunday night and Monday storms o much violence passed over the north-east of Yorkshire, hanging chiefly to the Cleveland edge of the moors. The crops in the course have been considerably knocked down, but will recover themselves, being yet quite green. Damage in this way will be slight, particularly as most of the district is moor, and the storms did not reach the corn-growing districts, and the wolds altogether escaped. In Barkley Howl Wood, a great number of trees are demolished, a shed was fired, and a cow roasted. In Eskdale, the Egton vicarage, a new house, inhabited for the first time, was struck and damaged. The Marquis of Normanby's seat, near Sandsend, was also damaged by the lightening.

MORE than 300,000 head of cattle have been lost in Sicily by typhus. The pasturages produced nothing, and the animals remaining are insufficient for the cultivation of the corn crops. The prices of milk and meat have risen considerably, and there is a complete dearth of the latter in the centre of the island; at Palermo, it has become an article of luxury, and is sold in the markets at 1f. 25c. and 1f. 50c. a pound. The middle and lower classes have almost ceased to eat animal food, and, in a town of 200,000 inhabitants only about twenty oxen a day are killed, and a portion of those are for the use of the troops and the hospitals. Even to provide for the small consumption in Sicily, recourse has to be had to importation. Foreign breeders might therefore find a good market for their produce in that country.

ON Wednesday morning, a colliery explosion occurred in the 9ft. mine at the Queen's Colliery, Haydock, belonging to Messrs. Evans and Sons, seven miles from Wigan, at the same place where there was an explosion at the beginning of the year. One hundred colliers went down in the morning, and, after the explosion, at 11 o'clock in the forenoon, about one-half of them fought their way through the choke-damp and escaped. Forty-eight dead bodies are lying at the bottom of the shaft; one man has died since he was brought out, and the searchers are groping in the dib-hole for others who are believed to be there. A large crowd surrounds the pit, waiting for the bodies which will be brought up at dark.

IT appears by the last accounts from Australia that the advices received by the Melbourne Meat-Preserving Company respecting the sale in London of their tinned meats, had given very great satisfaction throughout the country, and that in consequence it was confidently expected the various boiling-down establishments will have factories for similarly preserving and shipping to Europe the large quantities of meat hitherto literally wasted and destroyed by the process of boiling down the stock to extract the tallow. At one establishment near Ballarat 180,000 sheep were boiled down for tallow during the past

eighteen months, and the mutton destroyed by the process is estimated at 1,800,000lb. weight, which, if preserved, might have been sold in Europe for £41,000.

THE Dominion of Canada has enacted a new patent law, which goes into operation at once. It is a ponderous statute, filling nearly four columns of the Montreal "Telegraph," but inasmuch as it excludes all non-resident alien inventors from the benefits of its provisions our inventors can feel no special interest in its full details. Section 6th provides, however, that "any person having been a resident of Canada for at least one year next before his application, and having invented or discovered any new and useful improvement not known or used by others before his invention or discovery, may obtain a patent therefor." This provision, to say the least, is one step in advance of the old law, as, under the new system, a citizen of the United States who is willing to suffer an exile of one year by summering and wintering in the Dominion may secure a patent for his invention.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—3991
BUILDINGS AND BUILDING MATERIALS—3031, 3936, 3939
CHEMISTRY AND PHOTOGRAPHY—3954, 3959, 3967
CULTIVATION OF THE SOIL, including agricultural implements and machines.—3951, 3966
ELECTRICAL APPARATUS.—3925, 3932
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3915, 3960, 3968, 3970
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—3918, 3920, 3923, 3929, 3937, 3942, 3947, 3948, 3949, 3950, 3957, 3958, 3961, 3964, 3969
GENERAL MACHINERY—3924, 3926, 3928, 3935, 3940, 3952, 3956, 3962, 3963, 3972
LIGHTING, HEATING, AND VENTILATING—3917
METALS, including apparatus for their manufacture—3930, 3944, 3965, 3971
MISCELLANEOUS—3819, 3927, 3973
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—None.
SHIPS AND BOATS, including their fittings—3916, 3933, 3938
STEAM ENGINES—3922, 3941
WARFARE—3946

3915 B. NORTON, Huddersfield. *Pile fabrics.* Dated December 22, 1868.

The inventor applies colour, or it might be lacquer, or resist or discharge, to the tips of the pile by means of circular revolving brushes. The pile fabric, whether it be a cut pile or a raised pile, is led around a portion of a circumference of a roller or drum, with the pile outwards, and whilst so supported by the roller or drum, colour or lacquer, or resist or discharge, is applied to the pile by means of the circular revolving brushes. It is preferred to employ two revolving brushes, which act in succession upon the pile surface; as the fabric is moved onwards continuously each of the brushes may be supplied with colour, lacquer, or resist by rollers from a trough, or the first brush only may be thus supplied with colour or material, and the second brush may be employed to rub it more intimately into the pile surface. Both brushes may also be made to revolve in opposite directions, as they may both revolve in the same direction, but it is preferred that they should revolve in opposite directions. In addition to the revolving brushes, other brushes may be employed, either circular revolving brushes or flat brushes, to move to and fro endwise across the piece or otherwise when the colour, lacquer, or resist is required to be worked very deeply into the pile. Any or all the rollers which supply the colour or material to the brushes may, if required, be heated by steam or by other means. The trough containing the material may also be similarly heated.—Patent completed.

3916 W. E. GEDGE, Wellington-street. *Floating docks.* (A communication.) Dated December 22, 1868.

This floating dock is composed of main supports or ribs placed in a plane perpendicular to the keel, and about 6ft. 6in. apart from axis to axis. Each of these ribs is composed of five rows of pieces of wood, placed end to end, the one above the other and breaking joint; the fall of each of these ribs is about 36in. for the straight parts. They are strengthened at the curves and above the keel; these pieces are united to each other by a number of pins of compressed wood or of iron, passing through at least three pieces, and by bolts or iron passing through all the pieces and the ceiling or foot-walling. The head of the ribs is tied by two braces bolted together. These ribs are kept apart from the interior by sixteen rows of braces, which serve at the same time to uphold the scaffoldings. The ribs may be composed of ten, fifteen, and twenty pieces, the one on the other, and breaking joint, and the pins of compressed wood or of iron should pass through at least half the thickness. Once bolted or pinned together all these pieces of wood become dependent upon each other. On these ribs is placed the ceiling or foot-walling, composed of horizontal pieces from bottom to top until under the planking of the bridge. This foot-walling is fastened on the ribs by pins of compressed wood or of iron passing through two or three rows of the pieces of wood composing the ribs. On this foot-walling is placed the frame, which is composed of two thicknesses of planks or timbers; this frame is placed obliquely; it passes all round the dock, and envelopes the foot-walling. All this combination is jointed on the entire extent of the dock, and with cross joints sloping in inverse direction. This frame is held on the ceiling by a quantity of treenails of compressed wood passing through the whole, and it rises to the bearing line of the gallery.—Patent completed.

3917 B. W. MAUGHAN, Goswell-road. *Heating water, &c.* Dated December 23, 1868.

This consists in exposing the water or other liquid intended to be heated directly to the action of heat, the liquid being submitted to the action of the applied heat while in the condition of thin streams or sheets. The water or other liquid intended to be heated is conducted through a suitable pipe, fitted if necessary with a regulating tap or valve, into the upper part of a chamber or box or any equivalent receptacle, which acts as the heating chamber. This chamber may be conveniently made of metal or other material, capable of sufficiently resisting heat, and may be covered externally with a substance that is a non-conductor of heat. The chamber is fitted internally with a diaphragm or diaphragms or their equivalents, down or along which the liquid is caused to flow in thinly divided sheets, or to trickle in numerous small streams, so as to expose a large surface of the liquid to the action of heat, and so facilitate its absorption by the liquid.—Patent completed.

3918 E. M. THORNTON, Holborn. *Footstools, &c.* Dated December 23, 1868.

This consists in adapting to, and employing in the interior of a footstool, foot cushion, or hassock, a square or other conveniently shaped vessel or receiver, constructed of metal or other suitable material, to contain boiling or hot water. The vessel or receiver is enclosed in the footstool, footcushion, or hassock, and is surmounted on all sides except the top with a non-conducting material or substance to prevent the escape of heat from the water, excepting through apertures or holes in a perforated cover, which is attached by hinges or other fastenings to the vessel or receiver.—Patent abandoned.

3919 G. M. WOLMERSHAUSEN, Mayfair. *Modelling figures.* Dated December 23, 1868.

This consists of a jointed combination of metallic bands or belts provided with clips and catch fastenings for arranging and adjusting the same to the body through the medium of perforations formed in the under slips (constituting the bands or belts) with corresponding projections on the upper ones, which are made to slide together in their position face to face, and admit of being extended or contracted to the various sizes and inequalities in the measurement of the body by the employment of sliding loops together with the spring catches aforesaid, and at the same time prevent their shifting out of place whilst being adjusted to or removed from the figure.—Patent abandoned.

3920 W. G. REEVE, Greenwich. *Inkstands.* Dated December 23, 1868.

This consists in supporting in bearings or pivots on a suitable frame a cylindrical or other shaped vessel or reservoir, for containing ink, the cylindrical reservoir or other vessel having an opening and lip in any convenient part thereof, for the admission of ink into the reservoir, and the supply of ink to the pen, and being so balanced by a weight, or acted upon by a spring, that on liberating a catch engaging in a notch or recess on the cylinder, the cylinder will by the gravity of the weight or the action of the spring turn upwards on its axis, thereby causing the opening to come in contact with a plate above the cylinder, by which means the opening is closed, the ink returned to the reservoir, the evaporation of the ink prevented, and the entrance of dust avoided.—Patent completed.

3921 G. HOOKMAN, Oxford. *Sash lines.* Dated December 23, 1868.

Instead of the ordinary sash line made of cord, the inventor uses a strip of steel, either tinned or otherwise plated to preserve it from rust, or, in addition, he binds it with wire to improve its appearance, and the better to adapt it to run on the pulleys. If bound with wire, it may be coated, in addition to or instead of the tinning, with gutta-percha or some other waterproof material, or a solution of such material, the wire covering the whole. In some cases, he uses a line of gut, similar to the small bands of lathes and other machinery. This he also binds with wire in the same manner, and for the same purpose as in the former case, and this prevents its wearing, and forms a spiral spring which does not interfere with the flexibility of the gut; or a hempen line, heated with a solution of gutta-percha or other waterproofing material, might be substituted for the gut. He fastens the above lines to the sash frames and to the weights in such a manner as to obviate the necessity of removing the sash from the window frame on each occasion of replacing a broken line; to this end, he ploughs or forms a groove along the whole length of the side of the sash frame.—Patent completed.

3922 G. LOWRY, Salford. *Ferrules.* Dated December 23, 1868.

This consists in forming a ferrule or bush of malleable iron or other suitable material with a flanch at one end; this ferrule or bush is inserted in a hole previously made in the barrel, into which the ferrule or bush has to be fixed, the said flanch coming against the stave of the barrel. An expanding mandril is then introduced inside of the ferrule, which presses or bulges out the ferrule with sufficient force to make it secure and a water-tight joint.—Patent completed.

3923 H. G. THOMPSON, New York. *Carpets.* Dated December 23, 1868.

According to this invention, when weaving the above-named fabrics, after the warp threads have been raised to the surface in such order as they are successively required to form part of the ornamental surface or design, they are woven for a short distance (one, two, three, or more picks) into the body of the fabric, and then withdrawn and cut off from the back of the fabric, the ends of such threads when again required being first woven into the body of the fabric next raised on to the surface to form the pile or figure, then again woven for one, two, three, or more picks into the fabric, and then withdrawn and again cut off from the back of the fabric. A Brussels carpet or other terry or cut pile figured fabric manufactured according to this invention will have as large a quantity of the more costly figure or ornamenting threads thrown on the surface throughout the entire length of the fabric as those heretofore manufactured, but in place of such more expensive yarns extending and being hidden from view within the body of the fabric, between the points at which they appear upon the surface of the fabric, such yarns in a fabric manufactured according to this invention are only introduced into the fabric when and so long only as they are required to form part of the terry or cut pile or other ornamental figured surface. According to the invention, a "stuffing chain" or additional warp threads are introduced, to fill up and give substance to the fabric, and take the place of the more expensive figuring or ornamenting threads which have been withdrawn.—Patent completed.

3924 J. H. JOHNSON, Lincoln's Inn-fields. *Teeth.* (A communication). Dated December 23, 1868.

This consists essentially in making the plates to which artificial teeth are secured of an elastic or springy material, and of such shape or form that whilst adapting themselves to the form of the mouth they will be held in their place when inserted in the mouth by their inherent elasticity alone without the aid of clasps or suction. This is accomplished by cutting away from plates, as ordinarily made of an elastic substance, the roof or upper part thereof having wings or spring-like arms, or by forming the plate holding the artificial teeth of an elastic strip fitting the sinuosities of the roof of the mouth at or near that part of the mouth which corresponds to the roots of the teeth.—Patent abandoned.

3925 W. E. GEDGE, Wellington-street. *Electric bell.* (A communication). Dated December 22, 1868.

This consists of a wooden box more or less ornamental holding the pile composed of a piece of gas retort charcoal dipping into a liquid coming from a glass vase or reservoir, the lower part of which extends over the entire breadth of the box, and presents a cavity in which the coal dips being immersed in an excited liquid, always maintained at the same level, although used and evaporated by contact with the air and a temperature more or less warm. This action, however, takes place but very slowly, the liquid offering but a very small surface to contact, being under the same conditions as an ordinary bottle uncorked full of liquid, and with a narrow neck dipping in a small vase of the same liquid when reversed between the reservoir and the coal. A zinc cylinder is superposed on the surface of the exciting liquid, into which it lowers and is to be immersed, and thereby constitute an electric pile acting on a combined bell-ringing or alarm-sounding apparatus and indicating board or plate. This pile may remain charged and sufficiently powerful for use during as many years as may be desired, according to the capacity of the square glass vase contained in the box. The immersion of the lower extremity of the zinc is effected by pressing on a knob communicating with the upper part of the box, and which rising again by means of a spiral spring instantly interrupts the current. The zinc is held perpendicular in a copper tube, which permits its being slightly lowered, when by long use it has lost its usual position. This pile in action for 24 hours without interruption with the striking work, and the indicator admitting that each apartment rings twenty times a day, which may be done twenty times in a minute, the pile being excited by about the 1-10th of a quart of exciting liquid, is only used 365 minutes in a year for twenty times a day, equivalent to 7,300 touches; and as there are more than three times this number in 24 hours, would be equivalent to more than three years' service. A 1-10th part of a quart of liquid would be absorbed by contact with the air during this period, but it is replaced by the reservoir.—Patent completed.

3926 F. P. WARREN, Lee. *Cooking.* Dated December 23, 1868.

The apparatus consists of a grate supported upon a box or ashpit contained in a casing, the lower part of which is formed to contain water. The boiler is made of wrought iron and has two projecting parts of peculiar form so arranged that the space between the lower parts of their inner sides constitutes a furnace or fireplace, the side walls of which are formed by the said projecting parts, and the crown of the furnace or fireplace is formed by the under surface of a boot projecting from the inner side of the projecting part, and this boot takes into a corresponding cavity or recess situated between an upper boot and a lower boot of the inner side of the projecting part of the boiler, thereby forming a peculiarly curved flue, by which the product of combustion first pass for a certain distance, horizontally in one direction, between the under side of the boot of the projecting part and the upper side of the lower boot of the projecting part of the boiler, thence upward for a short distance in a semicircular or curved direction, afterwards proceeding horizontally or nearly so for a short distance between the upper surface of the boot of the projecting part and the under side of the upper boot of the projecting part of the boiler, in a contrary direction to their first-mentioned horizontal course, and, lastly, in a vertical direction till they enter the flue, situated between the upper surfaces of the projecting parts of the boiler and the under side of the oven, from whence the products of combustion proceed to the flues or spaces, and at the sides and top of the oven, and escape into a suitable pipe or tube provided for the purpose of inducing a draught and conveying them away.—Patent completed.

3927 T. W. WILSON, Craven-street. *Hydraulic lifts.* Dated December 23, 1868.

The inventor sinks in the foreshore of the estuary of a river or other suitable locality, two parallel lines of hollow columns or hydraulic cylinders, set at such distance apart as will enable any vessel or vessels which it is desired to raise out of the water to be floated in between them. These cylinders he prefers to make of cast iron, and he determines their number, capacity, and distance apart according to circumstances or the requirements which the hydraulic apparatus is intended to meet. These cylinders will stand up out of the water any desired height, determined somewhat by the height of lift required. At their upper ends all the cylinders of each line are connected together by means of compound hollow longitudinal girders, which are fitted with transverse partitions and bottom plates, whereby a large portion of the space comprised within the hollow girders is converted into water tanks. The several tanks formed in each girder are connected together by horizontal pipes, so as to equalize the height of the water in all the tanks of the series. Each of the cylinders is provided with one of these tanks, and leading down from the horizontal pipes connected with the tanks are pendant pipes which enter the cylinders from

the top, a vertical recess or hollow rib being cast in the cylinder from end to end thereof to receive them. A sluice cock or valve is provided at or near the point of junction of the pipes with their respective pipes, for regulating the discharge of water from the tanks into the cylinders.—Patent completed.

3928 A. V. NEWTON, Chancery-lane. *Cod liver oil.* (A communication). Dated December 23, 1868.

This consists in the employment of carbonic acid gas, either in a gaseous form or in the form of a carbonated water, in combination with oils and fatty substances, the said combinations being either chemical or mechanical, or both. In order to sweeten oils and fatty substances, the rancid material is worked over into a vessel charged with either carbonic acid gas or carbonated water, and the plan of preserving these substances is to seal them up in airtight vessels charged with carbonic acid gas or carbonated water. In general, it is preferred to have a pressure of the gas within the vessel, so as to insure the contents against any possible entrance of the external air. In preserving milk it is preferred first to condense it by any known process used for this purpose, and then to charge the condensed milk with gas in a vessel completely air tight.—Patent completed.

3929 A. M. CLARK, Chancery-lane. *Gas burners.* (A communication). Dated December 23, 1868.

A burner is provided with a central air space and with a screwed stem bored for the passage of gas. The burner is cast in a single piece, and the part is connected to cone by arms, also made hollow, and uniting with the orifice for the admission of the gas. There is a cap enclosing the burner, to which it is fitted. This cap is perforated at the top, and receives the gas from arms. A socket carrying the burner screws on to the stem, or it may be made in one with the cup. The ordinary mounting of the burner, through which the air is supplied thereto, supports the gallery which holds the chimney.—Patent completed.

3930 W. H. WALLEN, West Holloway. *Copper and brass.* Dated December 24, 1868.

The object is to enable the electro deposition of copper and brass upon iron and other substances to be made with less battery power, with greater economy, and more solidly and perfectly than has hitherto been done. A solution for electro-depositing brass is made as follows:—Crystallized sulphate of zinc (1 part by weight) and crystallized nitrate of copper (2 parts) are dissolved in the smallest quantity of water that is possible. Sufficient strong ammonia water is added to precipitate, and then fully redissolve the oxides. Then the purple tint of this solution is completely removed by a standard solution of cyanide of potassium. The resulting solution should be left to stand for a day or two, and may then be worked with from one to three battery cells, using heat if a brass anode be employed. It is, however, preferred to work this solution by either of the porous cell arrangements hereinafter described, the hydrated oxides of copper and zinc being from time to time supplied, and, if necessary, ammoniuret of copper being added. Before adding the hydrated oxides, it is advantageous to add as much of the cyanides of the metals as will dissolve in the menstruum. ammonia water and a standard solution of cyanide of potassium should be added occasionally to this depositing liquid, in order to keep the salts of copper and zinc well in solution. The hydrated oxides of copper and zinc are mixed and thoroughly incorporated in the proportion of two parts by weight of the hydrated oxide of copper to one part of the hydrated oxide of zinc before they are added to the solution. During working, little or no hydrogen should be evolved from the article.—Patent completed.

3931 T. WARREN, Glasgow. *Glass furnaces.* Dated December 24, 1868.

This consists, first, in making the sides of the melting tank of solid brickwork; second, in making the furnaces with the outer parts of their roofs considerably lower than at the inner end; and, third, in forming a thin air flue under the passage or throat leading from each furnace to the tank, air being admitted to such flue from the heating flues below, and continuing on to the air inlets into the tank.—Patent completed.

3932 J. H. JOHNSON, Lincoln's Inn. *Telegraphic despatches* (A communication). Dated December 24, 1868.

It is proposed to adopt a stenographic arrangement of the letters of the alphabet, single letters being not only indicated by certain conventional signs but also such combinations of two or more letters as must frequently occur in the common words. The despatch to be transmitted is first printed upon a strip of metallized paper in non-conducting ink by the aid of type, worked by three series of keys, each series being composed of two rows containing four keys in each row. The signs which are printed by the type on the paper in transverse lines consist simply of broad and narrow square dots, used either singly or in various combinations of not more than four, and with the spaces or internals between the dots differently disposed, according to the particular letters or cominations of letters required. This printed despatch is then conveyed to the transmitting instrument, wherein tracer points are caused to traverse along each line of signs previously printed in non-conducting ink on the metallized paper, and thereby, as is well understood, direct the corresponding currents along the line wire, the message being received and recorded by the well-known Morse instrument.—Patent abandoned.

3933 W. R. LAKE, Southampton-buildings, Chancery-lane. *Carriage boats.* (A communication.) Dated December 24, 1868.

The boat has a flat bottom which is double as far as above the water line. Between the two bottoms, which are very slight and thin, and which are made of sheet metal or wood, is placed a thick bed or layer of cork, which renders the boat buoyant. In the fore part of the boat is arranged a driving shaft, which is supported upon the hull by two bearings, and which carries at its centre a crank. On the extremities of the said shaft outside the hull are placed two large wheels, which serve as driving wheels when the boat is on land. The shaft may also be provided with paddle wheels. A connecting rod is attached to the crank, the other end of the said connecting rod being jointed to a horizontal rod which rests on rails supported on small columns or standards. Small rollers attached to this rod at suitable distances apart permit the same to work without friction on the rails. Above these rollers, and through rings or eyes, are passed transverse bars which serve as handles, whereby the sailors sitting on seats provided for them can impart a reciprocating motion to the horizontal rod, and thereby turn the driving shaft.—Patent completed.

3934 C. D. ABEL, Southampton-buildings, Chancery-lane. *Rolling mills.* (A communication.) Dated December 24, 1868.

The object is to convert the sliding friction of the axles of the rolls of rolling mills in their bearings into a rolling friction, and thus to obviate almost entirely the loss of power which results under existing arrangements from the first named friction. For this purpose the rolls have gudgeons running in ordinary bearings in the headstocks, as heretofore, but these bearings do not take any of the upward and downward pressure exerted by the rolls, but only serve to steady them in their motion, the pressure being taken by the following arrangement:—At the inner side of the headstocks framing necks are formed on the rolls, the necks on the lower roller being made with V grooves, while those the upper roller are made with projecting V surfaces. The necks of the lower roller take a bearing directly upon corresponding projecting V surfaces on the inner circumferences of large strong rings or hoops, which pass round the necks of both rollers, being of such a diameter, however, that the upper roller does not bear directly upon their inner surface, but through the intervention of antifriction rollers having V grooves corresponding with the V surfaces of the upper roller and the ring.—Patent completed.

3935 H. ROBINSON, Lewisham, and J. SMITH, Carshalton. *Millstones.* Dated December 24, 1868.

This consists in dressing millstones so that the cracks or lines are made coarser or wider apart at or near the skirt or periphery of the stone than near the centre thereof. In order to carry out this invention, the inventors place in or near the eye or centre of the stone a pivot supported by a flange, which may be screwed or otherwise fastened to the said stone during the operation of dressing. Upon the pivot a hollow casting having a curved slide affixed thereto is bolted or otherwise fastened, so that the casting and its curved slide can revolve on the pivot by reason of the bolt heads running in grooves cut in the flange above mentioned, the nuts on the bolts being screwed tight when the casting and its slide are in a proper position for working; or the said grooves may be dispensed with, and a check nut used in lieu thereof.—Patent completed.

3936 R. BOBY, Bury St. Edmunds. *Floors for malt kilns, &c.* Dated December 24, 1868.

The panels composing the floor consist severally of a rectangular frame of wrought iron of about 3ft. square, fitted with rods or wires set parallel to each other, and sufficiently close to prevent the escape of wheat or other kernels between them. These rods or wires the inventor rivets to the panel frame, and he further supports them by intermediate crossbars also made fast to the frame. When applying the panels as a flooring for a kiln or drying room, he supports them on iron girders and transverse beams, carried by the walls of the building, and he thus forms a strong floor, which will effectually expose the superincumbent grain or produce to the action of the ascending currents of air. When the drying season is over, and the use of the kiln is not required, the panels may be lifted out of their place, oiled, and packed away, to prevent all unnecessary exposure, and the consequent oxidation of the metal which would take place if the panels remained in place in the kiln.—Patent completed.

3937 R. C. M. TURNBULL, Piccadilly. *Working punkahs.* Dated December 24, 1868.

This consists of a train of wheels caused to rotate by means of weights, so as to drive a flywheel to which the punkah or fan is connected by cords or otherwise, the apparatus being, when out of gear, wound by a crank handle, or otherwise, so as to raise the weights to their highest position, the apparatus is ready to act. As soon as the parts are put into gear the weights begin to descend, and in so doing drive the train of wheels and the flywheel, and thus work the punkah. In order to give a sudden movement or jerk to the punkah, which it is desirable it should receive at one portion of its travel, the inventor weights the flywheel at one part of its periphery. When this weight in its revolution passes the centre of gravity it temporarily increases the speed of the flywheel, and thus gives the necessary jerk. The inventor leads the two ordinary suspending cords from the ends of the punkah rod to a ring at the centre of the rod, and he leads the steadying cords to the same ring. The four cords can thus be readily let out or drawn in, and the punkah lowered or raised as required.—Patent completed.

3938 H. CLIFFORD, Greenwich. *Cables.* Dated December 24, 1868.

This consists in coating or serving the core with powdered silica. The silica is preferably made to adhere to yarn or tape which has been previously steeped in tar, pitch, or other suitable material, the yarn or tape being afterwards wound upon the core outside the usual serving of yarn. The core is afterwards surrounded by the usual outer covering.—Patent completed.

3939 W. H. RIDGWAY and F. W. WALKER, Hanley. *Bricks.* Dated December 24, 1868.

This relates to a peculiar method of inlaying bricks, tiles, slabs, and other articles composed of ground clay, or what is commonly called "dust." The inventors use, in addition to the ordinary plunger a loose plunger or plungers, built up of two or more parts, and placed on the surface of the dust in the mould, by which they are enabled to inlay and press up a tile or slab with the face upwards by the usual stroke of the fly press. The loose plungers are composed of two or more plates or sections perforated to any pattern, the inner plate fitting accurately into the outer one, and both being removed from the press every time a brick or tile is made. The loose plungers are made from 1-8th to about 3-8ths of an inch thick, but their thickness will depend upon the depth of the inlaid portion and strength of plate required. In a pattern of elaborate character the loose plungers are divided into several sections, each of which is manipulated separately and then adjusted together with the others, in order to be placed on the dust in the mould.—Patent completed.

3940 A. C. PILLINER and J. C. HILL, Oakfield Works, Newport. *Motive power.* Dated December 24, 1868.

The inventors obtain their object by mounting one of the wheels of their machine upon a stationary axle which is hollow and has fluid admitted to its interior. A number of slots or ports are formed in the axle, which are made fluidtight by the wheel fitting truly on to the axle, with the exception of certain passages formed in the wheel, which, as the wheel revolves, pass over the slots or ports in the axle, and so allow the issue of the fluid. The inventors usually employ wheels having eight teeth, but with only every alternate tooth adapted to make a tight joint with the casing. In this arrangement there will be four passages in the wheel, one for each quadrant of the wheel, and the passages lead through the wheel into the spaces between the teeth—Patent abandoned.

3941 G. T. BOUSFIELD, Brixton. *Steam valves.* (A communication). Dated December 24, 1868.

The first portion of the invention is designed to obviate the tendency of the water to prime or be drawn over with the escaping steam, and this is accomplished by the use of an auxiliary valve secured to the lower end of the primary valve or its stem, the auxiliary valve also serving the purpose upon failure of the spring by fracture or otherwise, of closing the lower end of the steam passage of the valve and entirely cutting off the flow of steam. In carrying out this part of the invention the inventor screws or otherwise secures to the lower end of the valve stem of the primary valve an auxiliary valve, and he also forms in the base of the steam chamber or passage of the valve an auxiliary valve seat disposed below the primary valve and valve seat or another valve, the two valves being so arranged with respect to each other and their seats that, when the primary valve is controlled and operated as designed by the valve spring, the auxiliary valve shall be and remain open, so as not to obstruct the action of the steam upon the primary and acting valve. The auxiliary valve is designed to perform two offices, first, to prevent a current of water being drawn by and with the escaping steam into the open air, upon the sudden action of the steam upon the primary valve; and, second, to act as a stop safety valve in the event of the fracture or breaking of the spring of the valve. Should the spring which serves to depress the primary valve become broken or disabled, the upward pressure of the steam upon the lower and auxiliary valve will force such valve tightly up to its seat, and by this means prevent the escape and loss of steam which would otherwise find free vent into the open air, and probably lead to fatal results.—Patent completed.

3942 W. EHRAHARDT, Birmingham. *Watches.* Dated December 24, 1868.

This relates, first, to keyless watches, that is, to watches which are wound up by the rotation of an axis passing through the pendant of the watch. The inventor arranges the mechanism for winding up the watch by means of the axis, and also for setting the fingers of the watch, in the following manner:—The inner end of the axis carries a bevelled pinion which engages with a toothed wheel working in the manner hereinafter described on one of the plates of the watch. The toothed wheel engages with a second toothed wheel, and the second toothed wheel with a third toothed wheel, all in the same plane. The third toothed wheel acts directly on the spring barrel of the watch, and is provided with a click to prevent its return motion. The axis of the first-named toothed wheel is not fixed to the bottom plate, but is stationed in a slot nearly concentric with the circumference of the said bottom plate, and the axis is capable of a slight motion in the slot; a spring bearing against the axis presses it in the direction proper to make the first-named toothed wheel engage with the second-named toothed wheel. By turning the winding axis in the proper direction the winding up of the watch is effected. When the winding axis is turned in a direction contrary to that proper to wind up the watch, the pressure of the teeth of the first-named wheel against those of the second-named wheel causes the axis of the first wheel to recede in its slot, and the teeth of the first-named wheel to escape over the teeth of second-named wheel without injury to the winding mechanism.—Patent completed.

3946 C. GORDON, Goswell-road. *Firearms.* Dated December 26, 1868.

This consists in certain improved combinations and arrangements of mechanism in the construction of breech-loading firearms in which central-fire ammunition is employed. The mechanism hereinafter described may be inserted in and carried by a shoe attached to the rear end of the barrel (a portion of which has been previously removed), or the "shoe" may be dispensed with, and a portion of the rear end of the barrel removed for the admission of the mechanism. The breech block or closer is hollow, and has two parallel vertical faces respectively coinciding with the rear end of the barrel and the face of the breech plate or tang. The breech block is attached to a longitudinal bar or spindle which is placed at the side of the breech chamber and mounted in suitable lugs or projections attached to or formed on the rear end of the barrel and the breech tang, and in which it is free to rotate when the breech block or closer is elevated or depressed. On the side opposite to the before-mentioned bar or spindle (which may be termed the "hinge spindle") is a circular bar mounted in suitable lugs or bearings attached to or formed on the breech block, and in which it is capable of rotating. This bar may be termed the "cocking bar," and on the exterior thereof is formed a V-shaped groove and also a longitudinal groove connecting the arms of the latter for the reception of the stud or pin on the discharging "block" hereinafter mentioned. The cocking of the bar is actuated by means of a lever or projection attached thereto. In the interior of the breech block is placed the discharging and percussing mechanism.—Patent abandoned.

3947 G. ELDRIDGE, Dalston, and J. SMITH, Islington *Casks.* Dated December 26, 1868.

The inventors screw into the bunghole or into the tap hole of a cask, as the case may be, a metal ring or bushing with a flange or collar upon it, which in screwing the apparatus into its place is drawn tightly up against the cask, so as to ensure a good joint. This ring or bushing is prolonged so as to form a hollow cone which projects into the cask, and the sides of the cone are perforated. Into this cone another similar cone is fitted, and is secured in its place by a screw passed into its end through a disc applied at the extremity of the first cone. When the perforations in the two cones coincide, free passage is provided for the liquid into or out of the cask, but by turning the inner cone partly round the passages are closed.—Patent abandoned.

3948 J. P. MILLS, Middlesex. *Musical instruments.* Dated December 28, 1868.

According to this improvement, when the string (whether wire or catgut) is wound up to the required pitch, the spring being confined in the plate or wood and working in the groove of the flute in the rest pin or key, cannot return, whatever the strain may be, without withdrawing the pin at the end of the spring, which, when

withdrawn, allows the pin or key to turn either way, as the pin or key in present use. The present pin or key, from its construction, begins to give or move from the moment it is wound up, there being no check.—Patent abandoned.

3949 A. S. HARINGTON, Piccadilly. *Tobacco pouch.* Dated December 28, 1868.

The exterior portion of this pouch is made of leather, skin, or similar or suitable good wearing material (pig skin being preferred, as being considered more durable than other leather). The pouch is made with gussets and an overlapping cover (also of the same material), the whole being so made to roll up into a portable form. To this cover is firmly attached a strong narrow piece or thong of the same or similar strong material, long enough to be passed two, three, or more times round the pouch, so as to secure it when closed, and either full or only partially filled, in a very simple and effective manner, without any other fastening. The inside of the pouch is formed of vulcanized india-rubber, which is firmly attached as a lining (by stitching or otherwise) to the external casing of leather or other material, and fits closely the interior of the pouch both inside the gussets and the overlapping cover.—Patent abandoned.

3950 W. R. LAKE, Southampton-buildings, Chancery-lane. *Machinery for pegging boots, &c.* (A communication). Dated December 28, 1868.

This consists in operating the driving bar by a rack and pinion, the rack being secured to the driving bar and the pinion (which is revolved by a crank) being provided with teeth on a portion only of its surface. The invention also consists in producing a positive motion of the feed lever by means of a cam, and it also consists in an improved device for adjusting the gauge to regulate the distance of the pegs from the edge of the sole. The invention furthermore consists in improved mechanism for feeding the peg wood forward into the peg tube at the required time, and in a peg tube of peculiar form, and peg holder.—Patent completed.

3951 H. YORATH, Cowbridge. *Corn, hay, &c.* Dated December 28, 1868.

The object is elevating corn, hay, and other crops, into stacks. For this purpose the inventor erects a mast by the side of the stack, and stays it suitably with ropes. Upon the mast there is a gaff with haulyards to raise and lower it. The gaff carries two pulleys, one at its outer end and the other close up to the mast. A rope passing over these pulleys descends to a third pulley at the foot of the mast, and after passing this pulley a horse is harnessed to the rope. The other end of the rope descends from the pulley at the outer end of the gaff, and is attached by a swivel to a fork resembling a hay fork, but much larger. This connection is made close up to the prongs of the fork, and to the end of its long handle a line is attached which the workman holds in his hands. The fork having been stuck into a sheaf or bundle of the crop, the horse is driven along a horse run, and so the fork with the bundle upon it is lifted, the fork, as it rises, being held by means of the hand line in such a position as to retain the bundle upon it, and the hand line also serves to guide the fork. When the fork is raised sufficiently high the hand rope is released, and the bundle dropped on to the stack. The mast is erect, in a position inclining towards the stack, so that the weight of the bundle causes the gaff to swing over the stack, when, by the hand line, it is allowed to do so. The horse is back to lower the fork, which is guided down by means of the line.—Patent completed.

3953 J. A. A. LANDER, Paris. *Engraving.* Dated December 29, 1868.

This consists in certain improved machinery for engraving letters, medallions, and other ornaments in stone or metal. The machinery consists of a table or foundation on which the machine is placed; of a sliding bed plate for adjusting in advance or backwards the plan or design to be engraved by means of the screw provided with a ratchet scale indicator which regulates the distances; of a plate for removing the plan to the right or left by means of a shaft provided with a ratchet indicator. This rod carries a movable bevel pinion which gears with another bevel pinion fixed to the screw, the bearing of which is in the plate. The two pinions having the same number of teeth, the movement given to the shaft is communicated to the screw in a convenient manner. There is a turning plate for obtaining circular movements to form radial lines, circles, small oval or variegated devices operated and controlled by a quick-threaded screw furnished with a spring rack and tooth; and there is a bracket supporting the pantograph and its apparatus for suspension and motion. This bracket rises and falls in the vertical slide by means of a screw worked by a crank, placing the pantograph at the exact height necessary for bearing on the plan to be engraved.—Patent completed.

3954 G. BROWNE, King William-street. *Manufacture o as.* (A communication). Dated December 29, 1868.

This consists in operating upon petroleum or other hydrocarbon, and some of the products derived therefrom, in novel and improved apparatus, for the purpose of producing illuminating gas. In two closed tanks the inventor places crude petroleum and benzole, separately. The tank containing the petroleum he places above the ground, and that containing the benzole below the ground, and surrounds the latter tank with water. In tank one he places a worm or steam coil, to heat the liquid in the tank; he also connects an air pump with the bottom of this tank, for forcing air thereinto. He conveys the warm vapour and carburetted air from tank one into tank two by a pipe reaching nearly to the bottom of tank two, and from the top of this tank he leads a pipe to deliver the non-condensable or permanent gas into the gas holder or gasometer.—Patent abandoned.

3956 F. A. V. MICHEL, Paris. *Printing surfaces.* Dated December 29, 1868.

The object is the production of printing surfaces from set up or composed type; also from engraved plates and surfaces bearing letters, characters, devices, or designs. For this purpose the inventor first produces by pressure from the type, engraved plate, or surface, whence the printing surface is to be obtained, a mould, matrix, cast, or impression, in unsized and damped paper, which he coats, covers, impregnates, or treats with an agent, which renders it water and acid proof, that is to say, resistant to moisture and the acids or chemicals used in the process of electrotype or electro-metallurgy. The agent which the inventor recommends for the purpose is a solution of resin or a resinous substance in alcohol or spirit of wine, preferring, in many cases, one part resin with two parts alcohol. But other proportions and ingredients may be used. The paper mould, cast, matrix or impression, after having been duly coated, impregnated, or covered, is placed in the galvanic electrotyping or electro-metallurgical bath or cell with the suitable acids or chemicals used in the electro-chemical and electro-metallurgical process, and a metallic deposit, cast, copy or shell will be obtained. To impart the required strength, evenness, and thickness to the electrotype, lead, or other ductile material is run behind the deposit, cast, copy, or shell, and made true and smooth to form a backing. The electrotype is fixed to a wood or other rigid block by nails, screws, hooks, or other fastenings. For this purpose the inventor forms round the paper mould, matrix, or impression a frame or border having a flange or projecting portion with inclined sides and with a flat rim beyond, level with the mould surface, so that a corresponding frame or border will be produced on the electro metallic deposit or copy in the electro bath, having, of course, a sunken or recessed part, with sloping sides, corresponding with the projecting part of the paper mould frame, and also a flat rim. Ridge pieces are placed on this flat part, and the molten lead is run in. The nails or other fastenings used to fix the backed plate to the wood or other block, used as a foundation, are inserted or applied so that their heads or tops are in or on the bevelled or sloping border or edge of the electro-plate, and thus do not project to or come flush with the printing surface.—Patent completed.

3957 J. GILLMAN, Wolverhampton. *Scales.* Dated December 29, 1868.

This consists of a lever with arms of unequal length, acting upon the principle of distance. The fulcrum supports the beam or lever, and on it the latter plays freely, as upon an axis. A bent arm is extended from the pillar of the fulcrum to support the long arm of the lever. The long arm is graduated into divisions by notches and figures, and there is a ball of a certain heaviness which can be slipped along the bar to any required point.—Patent abandoned.

3958 H. M. GISBORNE, West Strand. *Sewing machines.* Dated December 29, 1868.

The object is to improve the means for giving motion to sewing machines. For this purpose he employs a weight, which, by special arrangements of gearing, gives motion to a toothed pinion taking into a toothed wheel fixed on to the driving shaft of the machine, or, if desired, motion may be communicated to such driving shaft by means of pulleys and straps or bands. The weight is connected to a drum or pulley by means of a chain, cord, or band, which is wound upon such drum or pulley in any suitable manner, as will be readily understood. Upon the axis of this drum or pulley is fixed a broad internal toothed wheel, which is caused to rotate by the falling of the weight, and in so doing it gives motion to a toothed wheel carried by an arm mounted loosely upon the axis, and causes such arm to travel around the axis. This toothed wheel gives motion to a pinion, also mounted loosely on the axis, and fixed rigidly to another arm carrying another toothed wheel, which, in its rotation around the axis, also receives motion from the internal toothed wheel, but at an increased speed, and so on, there being as many pinions and arms carrying toothed wheels mounted on the axis as may be required to obtain the desired speed, the last pinion being fixed to a toothed wheel giving motion to the drum or toothed wheel by which the driving axis of the machine is driven. In order to enable the speed to be regulated as desired, the inventor employs a brush surface, which is pressed up against the periphery of a wheel by means of a screw, so as to apply such an amount of friction thereto as may be required to regulate the speed.—Patent abandoned.

3959 G. T. BOUSFIELD, Brixton. *Extracting colouring matter.* (A communication). Dated December 29, 1868.

The colouring matter of madder has hitherto been found to be practically insoluble in water. This invention is based upon the discovery that when the madder root is subjected to a temperature of about 305deg. Fah., the colouring matter becomes soluble in pure water, and can be removed from the woody fibre by successive washings with water of about that temperature, and that the colouring matter carried off by the water may be precipitated in a flocculent state from the water, the precipitation being effected by cooling down the solution from the said temperature. The invention consists, first, of the process of extracting the colouring matter of the madder root by treating it with water at a temperature of about 305deg. Fah., and then precipitating the colouring matter from the water while out of contact with the madder root. The invention consists, further, in the process of extracting the sugary and colouring matters from the madder root by dissolving the sugary matter in water at a moderate temperature, and extracting the colouring matter by treatment with water at a high temperature (say about 305deg. Fah.) and precipitating the colouring matter from the resulting liquid out of contact with the ligneous matter of the root.—Patent completed.

3960 G. SLATER, Lamb's-passage. *Plaiting cloth.* Dated December 29, 1868.

This consists chiefly in the peculiar method in which a pair of rollers are caused to operate, in combination with a folding bar or plate to feed forward the fabric and form the plaits or folds transversely in the same; and it also consists in the mechanism for giving the required motion to the various parts of the machine. The rollers are formed with suitable journals, which are fitted to turn in bearings in a vibrating or oscillating frame, whose axis or centre of motion is the axis of the lower roller, or some point below the same. The two rollers are geared together, and the lower roller is connected by suitable gearing with the driving shaft. The shaft is provided with a crank, which is connected by a rod to the vibrating frame, which is thus, by the rotation of the said driving shaft, caused to vibrate and give to the upper roller a reciprocating motion upon the lower roller, while the two rollers rotate on their axis. The folding plate is fixed in front of the vibrating frame, with its edge resting upon the lower roller, and in such a position that as the frame moves towards the plate or bar a fold of the fabric is carried over its edge. This fold is then compressed between the two rollers, and the plait thereby formed is held between the rollers while the frame moves back and carries the fabric forward far enough to form another plait.—Patent abandoned.

3961 J. MARSH, Westminster. *Corking bottles.* Dated December 29, 1868.

Instead of placing over any cork or stopper of the bottle, jar, or surface, pieces of leather or other similar substance, binding the same with string or wire, and then cutting or shaping the same into proper form, as ordinarily adopted, the inventor takes india-rubber, vulcanized or prepared, so as to be really elastic, or other suitable elastic substance, and manufactures the same into caps or covers, which, when placed on the bottles, jars, or surfaces, and over any corks or stoppers, tightly fit upon the same, that is to say, he makes them in the form of small conical or sugar loaf or other suitably-shaped caps. These caps he presses on to and over any corks or stoppers of the bottles, jars, or surfaces to be capped or covered, so as to tightly encompass the same, and prove a secure and efficient closure without the necessity of using string or wire.—Patent abandoned.

3962 R. and T. HUGHES, New Cross. *Velocipedes.* Dated December 30, 1868.

The front part of this velocipede consists of the wooden horse or seat for carrying the rider. This is placed over the front or steering wheel, which has the usual guiding bridle rising from its axle and passing upwards. It partly supports the horse, and is actuated by the hands of the rider, enabling him to turn the wheel, and with it himself and the horse in any direction. The horse is partly supported by and attached to a pair of shafts (preferably metallic), which connect it with a pair of hind or trailing wheels mounted upon an axle and supporting a seat within which one or more persons may sit. The distance between the front wheel and the horse and the hind wheels with the seat may be increased or diminished according as the shafts are made long or short, and when not in use they may be detached from each other by removing the horse from the shafts.—Patent abandoned.

3963 J. LAURIE and J. WHITTAKER, Chester. *Screwing and tapping.* Dated December 30, 1868.

This consists in applying to any practicable part of ordinary bolt and nut tapping and screwing machines, but preferably to a disc holding or attached to the chuck, a band or other mechanical contrivance acting as a brake, which, by an adjusting screw or other means, causes the part to which it is applied to remain a rigid portion of the machine, while the thread is cut on the bolt or in the nut; but should any foreign substance or any other cause intervene to prevent the thread being cut, the resistance of the brake is overcome, and the part which had before been rigid revolves with the other moving parts of the machine. The action of cutting a thread thus ceases, or the machine continues in action without those parts to which the invention is applied, and the same effect produced.—Patent abandoned.

3964 S. and W. FOX, J. REFFITT, and G. GRANGE, York. *Cutting wood, &c.* Dated December 30, 1868.

This relates, first, to constructing a machine for roughing or preparing wood to be afterwards formed into bobbins or spools. This machine consists of a suitable framework, on which is a stationary headstock with a centre point, pin, or holder, and a slidable headstock, carrying a rotary hollow spindle, on which is mounted a cutterbox, having three or more cutting tools, and another sliable headstock, carrying a spindle or pin capable of sliding in the hollow spindle, and having a centre point, pin, or holder thereon; also a rotary shaft carrying a cam or tappet mounted in this framework, formed and set to operate upon the two slidable headstocks at suitable times. The slidable spindle being pushed forward to hold the block of wood to be operated upon betwixt itself and the pin or holder of the stationary headstock, while the said cam also operates upon the headstock carrying the hollow rotary spindle and cutter box, which thereby cuts and reduces the block of wood to the proper size and form, according to the setting of the cutters, the cam also operating to return the cutter head and the slidable spindle when the block thus roughed is thereby released and another introduced to be roughed in like manner, and so on.—Patent completed.

3965 A. S. CAZALAT, Paris. *Steel.* Dated December 30, 1868.

The inventor employs a peculiar construction of continuous reverberatory furnace, which he urges with compressed hot air and superheated steam, alone or combined together, escaping under the grate by a jet or jets. Through the vault of the reverberatory furnace he makes openings, in which he places the pigs of iron to be melted vertically, their lower ends resting upon the hearth or floor of the furnace. In similar openings he also places cylinders or hollow cases containing the titaniferous or other mineral to be mixed with the cast iron. When the furnace is urged to the required heat, the pigs of cast iron run down and flow into the hearth, after which he augments the temperature of the bath of metal by jets of superheated steam or air, or both combined. The vessel containing the titaniferous mineral or other mixture becomes fused, and the several ores and metals mingle in fusion upon the hearth, from whence he draws off the fused steel into suitable moulds.—Patent abandoned.

3966 J. and A. HUTCHESON, Glasgow. *Elevators.* Dated December 30, 1868.

This consists, substantially, in the construction and use of a fixed or stationary pipe, hollow barrel, or cylinder, having a smooth-surfaced deep-threaded screw revolving within it, driven in the opposite direction, to which the screw ascends at the necessarily sufficiently higher speed within it, so as to effect the screwing, raising, or elevating of water or other liquid or semi-liquid or fluid, granular or lumpy substance, or a mixture of these, such as could easily pass into the lower end of the screw and pipe, from this lower end and level to the top of the pipe, whether it be placed vertically or at an angle, the lower end being immersed in the particular substance to be raised, and the upper end provided with a slanting spout or other convenient or equivalent means of delivery, all against the gravitating power and tendency to run down the screw, owing to the angle of the thread allowing the fluid to run down on all sides round to the lower level, and in contradistinction to the modes in use of having elevating screws with their axles lying at such an angle that the rising incline or angle of the thread really runs down to the horizon, on the side rising out of the liquid or substance, running in and down the screw by its gravitation and fluidity, and thereby rising up the screw at whatever speed the screw is turned, and rather assisted than obstructed by the revolving of the case or cylinder along with the screw.—Patent abandoned.

3967 T. F. HENLEY, Pimlico. *Gum lac, &c.* Dated December 30, 1868.

This consists in placing stick lac, or gum lac, or seed lac, either broken up or otherwise, in bags or chambers of any required shape; in placing the same between heated

metallic surfaces, to which heat may be applied by means of the circulation of steam or oils or otherwise, or the plates may be heated in an oven; and in placing the same in a press—preferably an hydraulic press. Under these circumstances the heated surfaces liquefy by convection the resinous portion of the lac material, whilst the pressure being applied causes the fluid resin to exude in a filtered state through the texture provided, leaving the colouring matter or lac dye as a residue, to be afterwards removed and ground into powder, or otherwise treated for the purposes of the dyer.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated July 12, 1869.

2103 C. F. Dunderdale, New York, U.S.A. An improved apparatus for generating hydrogen gas, and for carburetting hydrogen gas or atmospheric air for illuminating and other purposes.

Dated July 13, 1869.

2104 C. A. C. de G. de Lianeourt, Queen's-road, Da'ston, Middlesex. Improvements in life belts.

2105 C. Chapman, Salford, Lancashire. Improvements in the application of pumps to artesian wells.

2106 J. Piret, Boulevard Bonne Nouvelle, Paris. Improvements in the slide valves of steam engines and elastic power engines generally.

2107 T. Restell, Birmingham. Improvements in breech-loading arms and cartridges, and a pouch or cartridge-holder.

2108 C. P. E. Roche, Rue Sainte Appoline, Paris. Improvements in the conversion of cast iron into a metal having a steelified nature, or forgeable steel.

2109 W. P. Bain, Poplar, Middlesex. Improvements in sails for ships and vessels.

2110 F. J. Smith and L. J. Abbot, East Dereham, Norfolk. Improvements in effervescing and aerated drinks and waters.

2111 R. Craig, New Battle Mills, Dalkeith, Mid Lothian. Improvements in machinery or apparatus for paper making.

2112 A. V. Newton, Chancery-lane. Improvements in mowing and reaping machines.

2113 R. Whitaker, Birmingham. Improvements in tee-totums.

2114 S. E. Crispe and J. West, High-street, Poplar, Middlesex. Improvements in apparatus for heating by means of steam.

2115 J. Barnett, Minories, City. Improvements in breech-loading firearms.

Dated July 14, 1869.

2116 I. Baggs, High Holborn, Middlesex. Improvements in the generation and treatment of ammonia.

2117 C. Shether, Edmund-place, Aldersgate-street, City. A duplicate lock or fastening.

2118 J. A. Horlick, British Hotel, Cockspur-street, Middlesex. Improvements in the construction of piano-forte hammers.

2119 J. A. Horlick, British Hotel, Cockspur-street, Middlesex. Improvements in the construction of piano-forte bridges.

2120 T. Richards, Wincanton, Somersetshire. Improvements in stoves or fireplaces.

2121 R. Willcox, Kingston, Dublin. Improvements in appliances or instruments for finding and for picking up submarine cables, and apparatus connected therewith.

2122 M. Jack, Crammond, Mid Lothian. An improved agricultural implement.

2123 J. W. Reid, Great Western-terrace, Bayswater, Middlesex. Improvements in beating engines employed in the manufacture of paper.

2124 J. Leetch, Broadley-terrace, Blandford-square, Middlesex. An improved self-adjusting spring stopper for closing the mouthpiece of speaking tubes and bottles, and for other like purposes.

2125 J. Leetch, Broadley-terrace, Blandford-square, Middlesex. Improvements in apparatus for effecting communication between the different parts of a railway train in motion.

Dated July 15, 1868.

2126 V. Coine, Boulevard Bonne Nouvelle, Paris. A vertical aero-hydraulic engine with a double action.

2127 J. Crowther, Blackburn. Improvements in the construction of the seats of railway carriages, so as to lessen the force of concussion when trains meet or run into each other.

2128 J. Crowther, Blackburn. Improvements in working hoists.

2129 J. Crowther, Blackburn. Improvements in velocipedes.

2130 J. and J. Leeming, Bradford, Yorkshire. Improvements in looms for weaving.

2131 G. Lowry, Bury-street Foundry, Salford, Lancashire. Improvements in machinery for dressing and preparing flax for spinning.

2132 W. W. H. Smith, Birmingham. New or improved machinery to be used in the manufacture of upper leathers for boots and shoes, and other articles made wholly or mainly of leather.

2133 B. J. B. Mills, Southampton-buildings, Chancery-lane. An improved process and apparatus for annealing metals.

2134 A. Adamsz, Hoxton, Middlesex. Improvements in cigarettes.

2135 C. de Bergue, Strand. Improvements in locomotives and other railway carriages.

2136 J. J. Cousins, Allerton Park, Chapel Allerton, near Leeds. Improved apparatus for indicating the points made, and registering the number of games played, at billiards and other games of skill.

2137 J. T. A. Mallet, Boulevart St. Martin, Paris. A new and improved mode of, and apparatus for, charging atmospheric air with oxygen.

2138 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in coiled springs, and in the machinery employed for making the same.

2139 J. T. Way, Russell-road, Kensington. Improvements in the manufacture of hydrochloric acid.

2140 J. Bernard, Salisbury-street, Strand. Improvements in smelting, and in furnaces, machinery, and apparatus connected therewith.

2141 J. H. Johnson, Lincoln's Inn-fields. Improvements in agricultural implements.

2142 J. Bernard, Salisbury-street, Strand. Improvements in the obtaining and utilizing heat in the operation of smelting.

Dated July 16, 1869.

2143 J. E. Millar, Sowerby, Halifax. Improvements in machinery or apparatus for raising the nap of woollen cloth.

2144 W. Hosack, Edinburgh. Improvements in evaporating liquids, and in the means or apparatus employed therefor.

2145 W. Hosack, Edinburgh. Improved ship or vessel specially applicable for rapid transit on water.

2146 J. Grint, Battersea, Surrey. Improvements in circular saw benches.

2147 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in propelling machinery for canal boats and other vessels.

2148 R. P. Williams, Great George-street, Westminster. Improvements in railway crossings.

2149 J. W. Ormiston, Shott's Iron Works, Lanarkshire. Improvements in the construction of blast furnaces.

2150 G. Yates, Heaton Norris, Lancashire, and J. R. Williams, Bowden, Chester. An improved apparatus for opening and closing the lights of cucumber and other frames, so as to give air, and for actuating and regulating the ventilators in hothouses, and in other places where it is necessary to maintain an even temperature.

2151 F. G. Fleury, Merrick-square, Southwark, Surrey. Improvements in apparatus for drawing or raising and forcing liquids.

2152 R. B. Evered, Drury-lane, Middlesex, and R. Hurst, High Holborn, Middlesex. Improvements in apparatus for raising, forcing, and regulating the flow of water.

2153 A. Rollason, Pembroke-road, Clifton, Bristol. Improvements in the mode of extracting ammonia, purifying gas liquor, and utilizing the same.

Dated July 17, 1869.

2154 B. Russ, Lime-street, City. Improvements in bicycles, velocipedes, and manumotive carriages.

2155 P. Murray, Chancery-lane. Improvements in rocking firebars for steam boiler and other furnaces.

2156 W. Pidding, Walcot-square, Lambeth, Surrey. Improvements in the mode or modes of the production or manufacture of cut piled mosaic, mosaic, textile, and tesselated fabrics, in the treatment of materials used, and in machinery and apparatus used for the said purpose.

2157 H. Mege, Paris, Boulevart de Strasbourg. The preparation and production of certain animal fatty bodies.

2158 E. F. Jones, Middlesborough-on-Tees. Improvements in machinery for making nails, spikes, and like articles.

2159 H. E. Newton, Chancery-lane. Improvements in breech-loading firearms.

2160 H. E. Newton, Chancery-lane. Improvements in electro-magnetic machines.

2161 A. Simpson, Chiswell-street, Middlesex. Improved apparatus for cleaning knives.

2162 M. Eyth, Steam Plough Works, Leeds. Improvements in carrying the steering or other road wheels of implements, traction engines, or other machines adapted for moving over common roads or fields.

2163 D. N. Defries, Metropolitan Works, Euston-road, Middlesex. Improvements in gas meters.

2164 A. Ancion, Liege, Belgium. Improvements in breech-loading firearms.

2165 C. Hook, Bridgewater, Somersetshire. Improvements in velocipedes.

2166 J. H. Johnson, Lincoln's Inn-fields. Improvements in blasting, and in the apparatus or means employed therein.

2167 C. J. Harcourt, Dozells, Aston Manor, near Birmingham. Improvements in axle pulleys for suspending window sashes, and for other like purposes.

2168 J. Bernstein, Bethnal-green. Improvements in the manufacture of umbrella, parasol, and walking-stick handles.

2169 W. Furness, New-street, Borough-road, Surrey. Improvements in cutting files and rasps and in the machinery to be employed therein.

2170 J. H. Johnson, Lincoln's Inn-fields. Improvements in sewing machines.

2171 J. Imray and G. G. M. Hardingham, Great George-street, Westminster. Improvements in sewing machines.

2172 B. Looker, Kingston-on-Thames, Surrey. The construction of an improved earthenware box or pan for growing, raising, or forcing seeds, plants, or cuttings.

2173 W. Leftwich, Tufnell Park, West Holloway, Middlesex. Improvements in the construction of velocipedes.

2174 W. Macgeorge, Castle-court, Birchin-lane, London, and A. Bigg, jun., Chester. Improved mechanism for starting and working steam engines, partly applicable to other purposes.

2175 R. Neale, Brooklyn, New York, U.S.A. An improvement in transfer engraving.

2176 W. E. Gedge, Wellington-street, Strand. An improved method of and apparatus for generating steam.

2177 A. M. Clark, Chancery-lane. Improvements in cables for the transmission of electric currents.

2178 R. Schoelesser and J. Irving, Manchester. A new process of converting wood shavings, flax, tow, hemp, jute, esparto grass, straw, hay, and other materials of a fibrous nature into paper pulp.

2179 V. E. Mauger, The Temple, Liverpool. An improved blotter or ink absorber.

2180 B. Hunt, Serle-street, Lincoln's Inn. Improvements in looms for weaving.

2181 R. Duerre, Chelsea. An improved lever manumotive apparatus.

2182 J. B. Fondu, of Braine-le-Comte, Belgium. A new and improved process and compound for blowing glass and for the apparatus connected therewith.

2183 T. Thomas, Bridge End, Cardigan, Pembrokeshire. Improvements in mills for grinding and crushing corn or other grain.

2184 W. Williams, Edinburgh Veterinary College. An elastic horse boot.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1861 W. Thompson
1863 G. Plant
1874 N. Salamon
1915 G. Mountford and G. L. Loversidge
1936 G. B. Woodruff
1979 W. Beaumont and W. M'Master
2146 J. Whitworth
2325 E. Fitzhenry

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2027 R. Ridley and J. G. Jones
2067 C. A. Day and T. Summers
2042 R. Dunn
2060 R. Barrett
2088 T. King
2096 A. Vignon

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," July 20, 1869.

669 F. Windhausen
677 R. Badger
680 A. Morrall
687 J. A. M'Elroy
695 H. Tylor
729 W. Walker
732 W. Weldon
743 W. Wells
744 G. Glover
750 W. E. Newton
754 H. Ormson
755 J. M. Napier
769 C. E. Brooman
770 L. Labadie
774 W. H. Harfield
778 E. W. and M. Slade
780 C. Vero
782 W. T. Carpenter
784 J. Tenwick
789 C. D. Abel
798 W. M'Adam and S. Schuman
804 J. L. Norton
818 J. H. Bennett
822 G. R. Mather
825 J. H. Johnson
837 F. W. Fox
855 J. Kay
889 J. B. Fell
907 J. R. Baillie
954 A. Barclay
994 W. Allan
1027 W. Jones and T. Sheffield
1070 J. Pattinson
1335 J. R. Jefferies
1358 B. Hunt
1443 B. J. B. Mills
1557 Z. E. Coffin
1593 W. Mitchell
1804 W. E. Newton
1899 W. R. Lake
1939 C. Cochrane
1948 W. H. Perkin
1964 H. Yates
2004 W. A. Biddell and J. Redgrave
2009 P. G. Gardiner
2036 L. and L. Clayton and J. Smith
2048 F. Trappes
2103 C. F. Dunderdale

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 16, 1869.

157 P. Oldfield
165 H. and J. Parnall
167 S. G. Archibald
169 G. Lowry
170 W. and J. Pain
172 J. Armstrong
178 J. Siddeley and F. N. Mackay
179 F. A. Paget
184 P. C. Evans and H. J. H. King
199 W. R. Lake
210 W. E. Gedge
213 J. Beattie
217 W. Huggins and H. Horsnaill
215 J. Ortton
233 R. J. Green
259 J. Silman
277 W. M'Lean
287 F. Jay
299 J. Tolson
311 C. Hoult
315 D. Joy
372 J. C. Shaw
462 C. W. Lancaster
715 I. Hudson
1214 M. Andrew
1479 C. W. Lancaster
1647 W. R. Lake
1682 W. R. Lake

Sealed July 20, 1869.

203 M. Tildesley
219 H. H. Murdoch
220 B. Mountain, T. Richmond, and G. Duffield
232 H. D Bowyer
237 E. D. Ruston and W. W. Mills
238 J. D. Ellis
242 J. Pickering
283 G. Price
308 A. V. Newton
329 A. S. and A. R. Stocker
348 J. Vavasseur
349 E. Morewood
362 J. Halford
383 R. W. Bow
401 G. F. G. Desvignes
404 J. H. Johnson
442 W. E. Newton
582 B. P. Walker
620 R. J. Goodbody and R. E. Donovan
887 F. de Bowens
942 E. Morewood
988 J. B. Rowcliffe
1119 J. Easton
1292 W. Prowett
1317 A. Meredith
1369 T. Perkins
1394 I. and G. Battinson and T. Whitehead
1427 W. E. Newton
1510 W. R. Lake
1567 W. R. Lake
1577 W. R. Lake
1613 W. Palliser
1649 T. Clarke

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1183	1948	1979	1999	2009	2019	2030	2038
1185	1964	1981	2000	2010	2021	2031	2040
1249	1965	1985	2001	2012	2022	2032	2042
1557	1967	1987	2002	2013	2023	2033	2044
1888	1969	1989	2003	2014	2025	2034	2046
1913	1971	1991	2004	2015	2026	2035	2050
1927	1973	1993	2006	2016	2027	2036	2052
1930	1975	1997	2007	2017	2029	2037	2054
1947	1977	1998	2008	2018			

LIST OF SPECIFICATIONS PUBLISHED

For the week ending July 17, 1869.

No.	Pr.	No.	Pr	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d		s. d.		s. d		s. d		s. d.
3025	0 4	3613	1 0	3650	0 10	3721	0 4	3756	0 4	3779	0 4
3369	0 4	3615	0 8	3658	0 8	3724	0 4	3758	0 4	3781	0 4
3396	0 4	3616	0 10	3659	0 6	373[illegible]	0 4	3761	0 6	3782	0 4
3539	0 8	3619	0 8	3682	1 0	373[illegible]	0 4	376[illegible]	0 4	3784	0 4
3560	0 8	3625	0 8	3687	0 6	3740	0 4	376[illegible]	0 8	3785	0 4
3568	1 4	3626	0 10	3691	1 0	374[illegible]	0 4	376[illegible]	0 4	3786	0 4
3574	0 8	3628	0 6	3692	0 6	375[illegible]	0 4	377[illegible]	0 4	3788	0 4
3575	0 10	3629	0 10	3696	1 2	375[illegible]	0 4	377[illegible]	0 4	3790	0 10
3593	0 10	3638	0 8	3697	0 8	3752	0 4	377[illegible]	0 4	3863	0 4
3608	0 8	3644	1 0	3716	0 4	3755	0 8	377[illegible]	0 4	3917	0 4
3612	1 0	3649	0 8	3717	0 4						

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, JULY 30, 1869.

THE COURT OF CHANCERY AND SEWAGE WORKS.

EVERY Act of Parliament tends to prove that "law begets law." It appears to be beyond the power of our legislators to frame an Act that shall be "self executing," and the birth of every fresh offspring of St. Stephen's, duly baptised with the comprehensive name of "Victoria, by the grace of God," must be hailed with delight by the gentlemen of the long robes. Some years ago, legislation was brought to bear vigorously upon the sewerage and drainage of our towns, and, in fact, upon all matters intimately connected with the sanitary welfare of our ever increasing population. Ever since the authorities took up the question, not a session has passed without witnessing some increase of the already existing regulations bearing upon it. The pollution of rivers, streams, and watercourses, by the discharge of sewage matter into their channels, has been expressly forbidden, and yet we have recently a couple of instances where it has been necessary to apply to the Court of Chancery to have the law enforced. Surely, it appears somewhat of a farce to be compelled to apply to the law to enforce its own provisions. If sewage and other refuse prohibited by an Act of Parliament is discharged into a stream, it does not require all the roundabout proceedings of a chancery suit to discover the fact and apply the remedy. No wonder that local boards and ratepayers complain of the infliction of sewage works, when their commencement is attended with heavy legal expenses which might be altogether dispensed with. If local authorities are to be saddled with the costs of a chancery suit or other legal process before they lay a drain or sewer of proposed works, our national progress in sanitary reform will be rather slow. It is true, that by its own proceedings a local board may draw down upon itself a serious responsibility in the matter of expenditure, as has happened frequently; but the question is whether it is just to the ratepayers that such should be the case. If the authorities of a town wilfully violate a law, the aggrieved parties should have some shorter and quicker remedy against them, than entailing upon the unfortunate ratepayers the onus of a chancery suit. However willing the corporate bodies of a place may be to carry out their duties and avail themselves of the advantages of sewage irrigation, it is by no means an easy task for them to do so. The Legislature has certainly provided some facilities for enabling them to execute sewage irrigation works, but there are so many obstacles in their way that they are in the position of a person whose friend has pointed out the road for him, but has previously dug a plentiful supply of pitfalls in it for his benefit.

Recently, the corporation of Halifax and the local board of Merthyr Tydvil have been in the same boat. While hard at work in endeavouring to "get rid of their sewage," instead of adopting the only safe method of dealing with it—by irrigation—they were altogether oblivious of the legal maxim

Sic utere tuo, ut alienum non lædas.

Reckless of what the consequences might be to others, they both discharged their sewage into the nearest watercourse. The former party polluted the Hebble, and the latter poisoned the Taff, inflicting, in the one instance, a serious nuisance upon large collieries, and, in the other, upon the whole establishment and inhabitants of an extensive worsted manufactory. If we consider the case of the Merthyr Tydvil people, it appears that nearly a year ago an injunction was granted against them, and yet the authorities persisted in the same course notwithstanding. The law is evidently here defective. It is absurd to grant an injunction to restrain evil doers, and subsequently take no measures to insure its enforcement. Virtually, the injunction becomes a farce, unless some private parties who are injured by the nuisance appeal to have it executed. At the same time, a reasonable period should be allowed after the issuing of an injunction, before it be stringently enforced, as in many instances it would be absolutely impossible to carry out its provisions in a summary manner. This is particularly the case where local boards are concerned, as may be readily perceived. A certain watercourse has been used from time immemorial, for the reception of the town sewage, and no one perhaps ever gives a thought to the discharge of it anywhere else. As their fathers did, so do they, and so they would continue to do, in spite of all consequences, but for the legislative enactment forbidding the continuance of such a system. Thus it happens, in the majority of cases, that when an injunction is granted, closing the only outlet a place has had for the disposal of its sewage and drainage, the authorities are completely "at sea." It has probably never occurred to a single member on the Board, that the time must come when some other means must be adopted for draining the town, and, therefore, naturally, it is in a dilemma. But it should at least make a vigorous effort to emerge from its usual lethargic state. The authorities should as speedily as possible determine upon some definite course of action, and set vigorously to work to remedy the many abuses that must inevitably attend a persistence in the old system of sewage and drainage. Instead, however, of acting in this manner, the Merthyr people have allowed matters to remain *in statu quo*, alleging that they cannot obtain the land necessary for utilizing the sewage by the only correct system, namely, that of surface irrigation. There may be a good deal of truth in this statement, and it is here where the legislation is defective respecting sewage regulations. It is true, that it confers upon a local board powers of compulsory purchase of land for the purpose of sewage irrigation, but it by no means follows that the powers can always be exercised in its favour. One or two instances where it has been sought by the authorities to put these powers into operation have failed completely, although there was no doubt of the eligibility of the land in question, with respect to position and other advantages of a local nature. Before sewage irrigation can be thoroughly carried out, greater facilities must be afforded for the acquisition of the necessary land. It is idle to say to the local authorities of a town, "You must no longer discharge your sewage into the river, you must dispose of it in some other manner," and then to practically bar the only remaining avenue for so disposing of it.

Proceeding to the Halifax case, it is interesting to notice the defence set up. It consisted partly of the assertion that the plaintiffs, as actual members of the council, had not only assented to the poisoning of the stream, the Hebble, but had even by their own decisions contributed to that circumstance. The Vice-Chancellor, however, looked at the question in a broad light, as a public nuisance, no matter how, or by whom it might have been created, and granted an injunction against the town council. It is quite time that a stop should be put to such pleas, as a denial of the nuisance in a case where it is beyond doubt that the sewage of a town is discharged into the nearest river or stream. The committal of such an act must be a nuisance, and the sooner it is understood that it will be recognized and treated as such by the Legislature the better. There is no need of any evidence respecting the magnitude of the alleged nuisance, or of any defence whatever. Let it be once shown that the sewage of a town is discharged into a river, and the single fact ought to be sufficient to establish the case and obtain the requisite injunction. The large increase of the population of most of our manufacturing towns has considerably contributed to hasten the crisis with respect to the compulsory disposal of sewage by other means than those formerly employed. The purifying action of a large volume of water, together with the influence of the atmosphere, exercises a certain amount of neutralizing effect upon sewage matter, and thus it is that where a small quantity of it is discharged into a considerable volume of water, it is exceedingly difficult to trace it at some distance down the stream. But the question assumes another aspect when the proportion of the sewage is large compared with that of the water into which it flows, more especially when it is permitted to semi-stagnate for weeks and weeks, forming a daily augmenting evil. In summer time, many of our small streams, which are at present the receptacles of the drainage and sewage of the houses in the neighbourhood, have scarcely, in some parts of their channel, 12in. of water, and yet the drainage can be seen trickling into them, and constituting accumulations which are neither slow in their formation nor their consequences.

THE FRENCH ATLANTIC CABLE.

SINCE our last notes of the above cable appeared, the work has been brought to a completion, and Europe is now united to America by three submarine cables, and communication has been freely carried on by the new route. Our latest account stated that 545 nautical miles had been payed out of the St. Pierre and Duxbury section. Since then, the work proceeded steadily onward until the "Scanderia" had payed the whole of her cable; the submerging was then continued from the "Chiltern" until 2 p.m. on the 23rd, when they anchored off Duxbury, and prepared to land the shore end, which was successfully accomplished at 5 p.m. The tests were perfect, and the cable at once taken over by the engineers of the company; the total amount of cable payed out being 749 miles. Everything throughout this trip appears to have gone on in the most satisfactory manner, the paying out being easy and uninterrupted—no faults, the insulation being throughout perfect.

The satisfactory state of the whole cable may be shown from the fact that on Sunday last the two sections of the cable were joined together at St. Pierre, and direct communication established between Brest and Duxbury, a distance of over 3,330 nautical miles. Sir William Thomson telegraphs: "During five hours to-day we have made experiments, in the course of which minute directions given from one end have been instantaneously executed at the other."

The following extract from a private communication is full of interest, as conveying a notion of some of the risks of submarine telegraphy:—

The end of the cable is hanging to a buoy somewhere near here. We have successfully laid our section. There have been four faults found, and cut out. All but one were quietly hauled in astern. One occurred when it was blowing a gale of wind. As the sea heaved the ship about, of course a greater strain was put on the cable. Three seas struck her in succession, each one breaking over the stern, deluging the decks with water, carrying several men off their feet into the scuppers. Some of the staging and bulwarks astern were smashed, and the cable parted. The end, fortunately, fouled in the paying-out-drum, and thus they had time to put on the "stoppers," which are ropes held round the cable, and always ready to be pulled tight in case of need. It was useless trying to haul in again, so we made the buoy rope fast and let go. Then, to mark the

spot, we let another buoy go, anchored to a "mushroom," with 2,030 fathoms of rope. The "Scandaria" did the same. All day and night and the next day we dodged about these buoys. When the sea went down we got the buoys in, hauled the cable up, cut out the fault, joined up, and went ahead again. The sea was most magnificent, and our ship behaved splendidly. The other two were deluged fore and aft, and tossed about like corks, while we simply rolled in a slow, deliberate, magnificent manner, though we sometimes made a tremendous angle and pitched a little. Yesterday was a miserable Sunday—thick fog, which soaks everything and drips from every rope and spar. No service, and everyone anxious and uncomfortable generally. While we were at dinner it was calculated that we ought to have reached the spot where we should meet the "Cory," so guns were fired. Suddenly the fog lifted, and there she was right ahead. She and a surveying boat had come out to pilot us between the banks. The fog was so thick that you would scarcely have found your way on land, and here we had come across the Atlantic and found exactly the right place.

In an early number, on receipt of accurate details, we trust to bring the history of the submersion of the French Atlantic cable to a conclusion.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW AT MANCHESTER.

SECOND NOTICE.

IN resuming our notice of the very successful exhibition at Manchester which closed on Saturday last, we will first take the stand of Messrs. Amies, Barford, and Co., of Peterborough. Here we found a very large number of exhibits of the class usually shown by this firm. There was no great feature of novelty, but there was the special recommendation of sound principle and construction throughout. We were especially pleased with their combined hay, corn, and straw elevator, which delivers to a height of 30ft. It is worked from the steam thrashing machine, but, in hay time and harvest, the body is raised so that a horse can be worked underneath within its own length. We would also call attention to the Peterborough Gas Boiler, as patented and manufactured by this firm. It is designed to meet the requirements of all who use gas for heating purposes. The boiler is constructed upon an entirely new principle, the body being made wholly of copper, enclosed in an ornamental iron casing, and the water spaces are so arranged that a complete and perfect combustion of gas is secured, and no danger whatever can arise either to health or to plants. Experiments show that a saving of at least 40 per cent. over any similar apparatus is effected. The boilers can be placed either inside or outside a greenhouse, or in a hall or similar situation, without danger, and require no brickwork for fixing. This firm have also an excellent annular boiler of novel construction for agricultural and other purposes. The firebox being entirely surrounded by water, a saving of 50 per cent. in the consumption of fuel is effected; and, being complete in itself, can be removed at pleasure to any building where it may be required. It is valuable to the farmer for the purpose of boiling water, steeping linseed, corn, &c.; and, in a steamer which fits on the top, potatoes and other roots may be expeditiously and cheaply cooked.

Mr. Edward Gray, of the Moscow Works, Mowbray-street, Sheffield, made a splendid show of agricultural cutlery of every kind, into which he has introduced several notable improvements. To individualize the items at this stand would be to write a decent sized catalogue, whilst a classified description would occupy about three columns of our space. We, therefore, take the leading features of Mr. Gray's exhibits, foremost amongst which and perhaps most generally attractive were his steel-faced grooved horse shoes. The under side or face of the shoe is made with serrations, the shoe being made from steel or steel-faced bars manufactured by Mr. Gray for this special purpose. This is a very important invention, and one that has long been wanted, as it will enable horses to obtain a firm foothold, and prevent them slipping or falling, which is of daily occurence in London and other large cities and towns. Shoes made from this material will not require sharpening in winter, and will be found of universal advantage on the road or in the field; they are one-third lighter, and from the nature of the material will last longer than any other shoes. Crucible cast steel appears to be Mr. Gray's great material, and of this were made most of the implements exhibited. For instance, there were cast-steel fingers for mowing and reaping machines, which will keep sharp at the points and cutting part much longer than any other kinds. Then there were a variety of crucible cast-steel plough shares, coulters, and breasts, as well as a variety of machine knives, cutters, and blades of every kind. Mr. Gray had also some samples of steel-faced rails, which appeared to meet the requirements of the times as regards economy and durability. We likewise noticed a splendid pair of rag engine plates and a roller bar, as well as some steel beating bars for thrashing machines. On the whole, we were very pleased with this exhibition of Sheffield ware, which was highly creditable to the exhibitor, and well worthy of the occasion.

Messrs. Hayward, Tyler, and Co., of Upper Whitecross-street, London, had a variety of interesting exhibits. First, there was Mortlock's millstone dressing and levelling machine, of which Mr. J. L. Norton, of Abyssinian pump notoriety, is sole licensee. This apparatus is very simple in construction, the diamond being the cutting agent. One of its recommendations is the rapidity and cheapness with which a stone can be dressed, as one man can dress a stone in about an hour; only one hand is required to work it, no gearing or motive power of any kind being necessary. It is also very portable, and no fixing is required, so that the dressing may be commenced immediately the machine is placed upon the millstone. A novelty at this stand was Redup and Brigg's shive cutting machine for brewers. It cuts and finishes the shives at one operation, and makes them more rapidly than any other method. It uses up every waste piece of wood, and can be managed by a boy. This firm also exhibited their universal steam pump, which was recently described and illustrated by us. They had also a well-arranged portable pump for irrigation purposes, to be worked either by horses or bullocks. This pump is very compact, and insures the greatest amount of water thrown. The gearing is about 20 to 1; and, as the bullocks travel at the rate of about two and a-half turns per minute, the pump will work at 50 strokes a minute. The pump is the well-known 6-inch California double-acting pump—one of the simplest, or perhaps the simplest and best, of its kind, and well suited for places where no skilled labour can be had, as the valves are very easily got at, are of the plainest construction, and most effective. The pump and its gearing are fixed to a light but strong cast-iron bedplate, which again is bolted to a wooden frame, which carries the front axle (with a simple locking gear and drag handle), and the hind axle with their cast-iron travelling wheels. This pump, worked by a pair of bullocks, will draw water 30ft., and force it 20ft. at the rate of upwards of 4,000 gallons per hour. In steam engines, this firm were well represented; especially so by a 2-horse power horizontal high pressure engine, which was priced at a remarkably low figure considering the completeness of the equipment and the character of the work.

At the stand of Messrs. Burney and Co., of Millwall, we found a variety of cisterns, cattle troughs, corn bins, &c., in wrought iron, and a very good petroleum store. The cattle troughs have a patent safety undamageable edge, which is produced by riveting a rolled iron moulding around the edges of the utensils. The petroleum store is made with a magazine of sand on the top to ensure safety.

In water filters, we have first the well-known pure charcoal block cistern filter of Messrs. Atkins and Co., of Fleet-street, London. The peculiar property possessed by block carbon renders it superior to any other substance with which we are acquainted as a filtering medium. The mode by which it acts is to induce a chemical change in the noxious compounds given off by decomposing organic matter, with which water is more or less contaminated, as well as to destroy any injurious gases that may have been absorbed from the atmosphere. It is an established fact in science that there can be no motion without an active principle; hence the absorption of oxygen into the pores of the carbon necessarily involves the evolution of hydrogen, changing the polarity of the constituent particles of vapour held in solution by the water during its gravitating process, and giving off carbonic acid gas. Whenever, therefore, the impurities in water pass within the pores of the carbon, they are neutralized by oxidizing action, the change in the carbon disinfecting the water, not by mere mechanical separation, but by actual nascent combustion.

A very rapid and effective form of filter was exhibited by Mr. George Cheavin, of Boston, Lincolnshire. It is composed of charcoal and sponge, the latter material acting as a mechanical strainer. The filter can be cleaned by the user without being taken apart, a tube being provided, on blowing through which the charcoal is cleansed. These filters purify any kind of water with rapidity and certainty, effectually removing lead, lime, sewage, and animalculæ. Their especial advantages are rapidity of action, durability, and their self-cleansing properties.

Messrs. H. R. Marsden and Co., of Meadow-lane, Leeds, were busily at work with Blake's stone-breaking machine for road making purposes, and an improved stone or ore crushing machine. The rate at which Mr. Marsden was breaking up granite rendered it very probable that the Corporation of Manchester would find a large quantity of material ready to hand for road mending purposes at the close of the Show. It is unnecessary to state that these machines worked most efficiently.

Archer's stone breaker was also in full operation, doing very good work. In this machine a revolving motion is imparted to the grinding or pulverizing roller, and at the same time a short and powerful reciprocating motion is imparted to the lever with the squeezer on its end, thereby operating with a crushing action on the material between the roller and the squeezer as they are carried round by the turning of the roller. The relative distances of the operating faces from the roller are adjusted as required by varying the thickness of the liner in the connecting link. The periphery of the roller is fluted horizontally, and the faces of the operating lever are fluted vertically. The sizes of these flutes vary according to the material to be operated on, and the size required to be broken. This machine is manufactured and was exhibited by the Dunston Engine Works Company, Gateshead-upon-Tyne.

Messrs. J. and H. Gwynne, of the Hammersmith Iron Works, London, exhibited an excellent selection of centrifugal pumping engines upon their well known principle. We specially noticed their pumps, No. 2 and No. 8. No. 2 is fixed on a deep and strong bedplate, which dispenses almost entirely with foundation. The pump is capable of discharging 80 gallons per minute 80ft. high; the whole of the working parts are in steel, tempered in oil, and of the best material and workmanship. Pump No. 8 is capable of discharging 800 gallons per minute, 25ft high, or 1,500 gallons 15ft. high per minute; the engine works direct on to the pump shaft, dispensing with all gearing or belts; the working

parts are all in steel. The pump is suitable for irrigation, drainage, &c. This firm have recently introduced a new feature in their manufacture—that of Schiele's turbine, which gives a very high useful effect, and is exceedingly simple in construction.

An excellent show of wood-working machinery was made by Messrs. Charles Powis and Co., of the Cyclops Works, Millwall, London. First, there was a general joiner, which has been improved in several respects by Messrs. Powis. It has a self-acting feed for moulding, planing, &c., and will plane stuff up to 10in. in width and 4in. in thickness. The drunken saw here is also very effectively arranged. The trying-up machine is remarkably solid in construction, the frame, which is 18ft. in length, being cast in one piece. This machine will plane warped or twisted timber up to 21in. wide by 12in. deep, and 12ft. long. The cutter block and spindle are forged in one, the block being of an improved form. The self-acting saw bench exhibited by this firm was also worthy of notice. It is adapted for cutting planks, deals, and battens, at speeds varying from 15ft. to 20ft. per minute. The saw spindle is made of the best scrap iron, and runs in long gun metal bearings, the outer end of which is supported by an outside standard. A self-acting feed motion is attached, specially designed with a view to economy in space and efficiency in working. The fence can be set at an angle for cutting feather-edge boards, and always maintains a parallel position with the saw, whatever be the angle at which it may be placed. If the bench be required for cross cutting, the fence can be removed with very little trouble. The framing and table top being cast in one piece, great strength, combined with portability, is obtained. No brickwork foundation is required, its own weight being sufficient to keep it steady while working. Various other machines of this class were exhibited by Messrs. Powis and Co., all of them of the most improved design and the best manufacture.

Considerable interest was taken by the public in the Abyssinian tube well, various examples of which were exhibited by Mr. J. L. Norton, of Belle Sauvage-yard, Ludgate-hill, London. At various periods throughout each day these wells were sunk, water pumped, and the tube withdrawn in a very brief period. One of these tube wells—the true Abyssinian, 1¼in. diameter—was driven down 9ft., water was pumped, and the pump withdrawn in ten minutes. These operations were superintended by Mr. C. S. Taylor, City-buildings, Corporation-street, Manchester, the sole licensee for Cheshire, and Mr. G. F. Cox, of the same address, and who is sole licensee for Lancashire. These wells have taken silver medals at all the agricultural shows where they have been shown, including the Royal at Leicester, 1868; Middleton, 1867; Ulverston, 1868; and Southport, 1868. They can now be fixed in any strata, or almost at any depth, by a new system of boring, along with deep well pumps.

No small attraction to visitors was what the inventor terms "the biggest sewing machine out." This was a multiple needle sewing machine for making thatching, by Mr. G. O. Gooday, of Great Leighs, Chelmsford. The principal novelty in this machine, which is applicable to many purposes besides the manufacture of thatch, consists in the arrangement for working two or more needles simultaneously. In making thatch, the straw is placed upon an inclined feed-board, whence it is drawn continuously through the machine, which converts it into a dense woof impervious to rain. The needles are supplied with string, and may be adjusted to produce straight, curved, or zig-zag lines of stitching. As every stitch is perfectly secured, the thatch does not become loose when it is cut into lengths. The machine is adapted for a thatch 5ft. wide, and of any required length, or of any thickness from ¾in. to 2in. It may be worked by ordinary labourers in the winter or during wet weather, and the thatch produced kept rolled up for future use.

Messrs. Headly and Sons, of the Exchange Iron Works, Cambridge, had several novelties. Amongst others, was their hydraulic apparatus for watering streets, lawns, &c., and for extinguishing fires. This useful implement consists of a drum mounted on a pair of wheels, and on which is wound any length of flexible pipe, one end of the pipe being connected to the hydrant. The apparatus is propelled forward, the drum rotates on its axis, the water passes round and through it, and is distributed either by a rigid spreader in front or by a man. A compensating chain gearing is attached for winding up after the water is distributed as far as the pipe extends. We understand that the streets of Reading are now being watered with Messrs. Headly's apparatus. The Cambridge spring chairs at this stand were objects of great interest. The occupier, without leaving his seat, can adjust the chair to any angle at which he may wish to recline.

As a matter of course, Messrs. John Fowler and Co., of Leeds, were strongly represented in steam ploughing and cultivating machinery. They had a very fine 30-horse power traction and ploughing engine, which was kept on the move at the far end of the Show. This engine has been built for Mr. Campbell, of Buscot Park. It has cast steel bearings and weighs 22 tons, and will plough 3ft. 6in. deep. It is fitted with fast and slow speeds, runs well, and stops and reverses rapidly. There were two other engines of 20-horse power each, of this class and make, in the ploughing field. Another great feature at this stand was the Pirie plough, in which the front and back wheels run at an angle in the bottom of the furrow, and are so arranged that they take the whole of the thrust caused by turning over the furrow slice, thus dispensing with the land side and slade, and substituting a rolling for a sliding friction. The left side of the plough is carried by a wheel fixed to a lever. This wheel runs on the unploughed land, and may be arranged as a castor, thus giving great facility in turning the plough at the head-land. This lever also serves the purpose of disengaging the plough from its work at the end of the field, as by lifting it up till a catch on it comes into play, the shares are so raised that they draw themselves out of work and clear the plough from the furrow. The depth of the work is regulated by a T-handle on the lever. On the other end of the rod, connected with this handle, is a screw, by which the man can adjust the depth without stopping the plough. On this plough (unlike all other double furrow ones) the width of furrow may be adjusted from 7in. to 10in. This is done for the first furrow by shifting the front wheel on the bar to which it is attached much as an ordinary wheel plough, and for the back furrow the skief and mouldboard are all shifted on the bevel part of the frame.

We cannot pass the stand of Messrs. Hepburn and Sons, of Long-lane, Southwark, London, without referring to the extensive and varied assortment of leather goods exhibited by them. These consisted of single and double driving bands of every size and length for heavy and light work. This firm have introduced a composite band which is the strongest band made. It will not stretch in work, and the cost of a triple composite is not more than that of an ordinary double leather band. Amongst the other exhibits at this stand were leather hose pipe, fire buckets, laces, hydraulic leathers, &c., &c., all of excellent quality and workmanship—a combination especially desirable in this class of goods.

Mr. Reuben Hunt, of the Atlas Iron Works, Earl's Colne, Essex, had a very good collection of his stock-feeding implements, all of which have obtained a good name, and some of them prizes and medals. Besides these, Mr. Hunt exhibited an improved 1-horse gear about as strong and as compact as any we have seen. It has a driving wheel 3ft. diameter, a cast-iron frame, brass bearings, and is well suited for all purposes to which a horse gear can be applied. Mr. Hunt has effected an important improvement in horse rakes, which consists in almost entirely dispensing with manual labour, any boy old enough to drive a horse being the only attendant required. By simply touching a lever, the rake relieves itself of its load, and, at the same time, the teeth instantly fall to the ground. Its simplicity and certainty of action cannot fail to commend it.

Mr. Walter A. Wood, of 77, Upper Thames-street, London, was strong in mowing and reaping machines, for which he has become celebrated. His new jointed-bar mower attracted attention from the completeness of its details. Some special improvements have been made in these machines during the present year. The shifting lever, for throwing in and out of gear, has been changed from a line, which throws out and in gear by a horizontal side-wise movement, to one which turns in a vertical plane, acting upon a cam-shaped piece, which throws the clutch horizontally out and into gear. The axle on which the machine tilts is not bored to keep the draft iron in place, but is fastened by a separate piece of casting, which clamps the axle by a set screw, thus giving it more strength, as boring the holes tended to weaken the axle. The side pieces of the frame are made wider, which gives more strength to the frame and a wider support to the axle. The steel spring extension piece is fastened to the machine at the lower outer corner of the frame by three bolts, and extends across the joint formed by the front end and outside piece of the main frame, and one of these bolts takes through the end piece. As hitherto made, the extension piece was only fastened to the side piece of the frame, which arrangement afforded no support to the frame from twisting apart at the joint. It may be interesting to note that Mr. Wood commenced the manufacture of mowing and reaping machines in the village of Hoosick Falls, New York, fifteen years since. At that time the manufacture of harvesting machines was confined to a few establishments, and to a class of heavy, cumbersome machines which, although in themselves improvements over the old method of securing crops by hand, were difficult to manage, and trying to the patience of man and beast. Mr. Wood has developed these machines into their present perfect condition, and has stamped them as a class or type with which his name has become identified. The uniform success which has attended the efforts of Mr. Wood is due no less to the careful construction of the machines sent out than to the approved principle upon which they are made. None but the best material of its kind is used, and each machine is put together and tried before shipment. We are informed that the works at Hoosick Falls have facilities for turning out one complete machine every five minutes.

The Beverley Iron and Waggon Company, of Beverley, Yorkshire, had as fine a selection of carts and implements as they ever exhibited. The carts especially were objects of notice and admiration, many detail improvements having been introduced into them by Mr. Norfolk, the Company's managing director. Amongst the new implements was an open cart with a low body for moving stock, &c. The stock can be put in at one end and can walk out at the other on the cart arriving at its destination, thus obviating the difficulty of backing stock out. The cart has a cranked axle, machine-made wheels and springs, and the shafts are easily attached to or removed

from either end. The Beverley Company's wrought-iron wheel —Norfolk's patent—is a valuable invention for hot climates. In these wheels the naves are of cast iron, chilled so hard inside the box or bush part as to resist the file, and fitted with patent wrought-iron oil boxes, bevelled spokes, and convex tires. The axles are forged at the Beverley Iron Works from the best scrap iron, turned and case-hardened. Mr. Norfolk has also introduced some improvements in reaping machines which will be found fully described and illustrated on another page

Messrs. Kinsey, Norton, Hill, and Co., of the Robin Hood Works, Nottingham, had their usual show of engines, in the forefront of which was Mr. Kinsey's horizontal tank and foundation engine, which has met with approval wherever it has been used. These engines are very strong, and entirely self-contained ; the base or bedplate serves as a foundation, and also as a tank and water heater. This firm also exhibited a patent universal suspension steam plough, invented by Mr. Thomas Beards, of Stowe Park, Bucks, and manufactured by the exhibitors. The arrangements are worthy of the attention of agriculturists ; they prevent the sudden strain which causes so many breakages of the haulage-rope on starting. Messrs. Kinsey and Co. are perfecting a new wrought-iron corrugated boiler, which they purpose bringing out ; when the design has been completed, we intend giving particulars.

Messrs. B. and S. Massey, of Openshaw Canal Iron Works, Manchester, exhibited four of their well-known patent steam hammers of small sizes, suitable for the use of agricultural and other machinists. They are very carefully designed and constructed, and are fitted with an exceedingly simple and convenient valve motion, which allows them to be worked either by hand or self-acting at any speed up to about 600 blows per minute.

Although our notice has extended to a considerable length—in fact, as far as we can allow it to extend this week—we find we have not yet used all our notes, several exhibitors still remaining for notice. We shall, therefore, conclude our remarks next week.

We append a list of the prizes awarded at the Manchester Show, which is compiled from the official statement. This statement, we may add, was printed at the Show by Messrs. Gadsby and Arnold, of Crane-court, Fleet-street, London. This firm had a stand at the Show—a regular printing establishment—from whence was issued during the Show a daily paper, and at which the Royal Agricultural Society's printing for the time being was done. Messrs. Gadsby and Arnold were also exhibitors of a double-demy Wharfdale cylinder printing machine, at which their printing was done. They also showed a very good paper-cutting machine and a card machine for printing without ink, the invention of M. Leboyer, of Riom. This temporary printing establishment proved of great use, not only to the Agricultural Society, but to the exhibitors at large, who were not slow to avail themselves of the convenience. A considerable staff found employment both day and night, and turned out their work in a very satisfactory manner.

JUDGES.

F. J. Bramwell, C.E., 37, Great George-street, London, S.W. (engineer judge).

Mowing and Haymaking Machines and Horse Rakes.—John Hemsley, Shelton, Newark, Notts; J. W. Kimber, Tubney Warren, Abingdon; Matthew Savidge, Sarsden Lodge Farm, Chipping Norton.

Reaping, Sheaf-Binding, and Corn-Drying Machines.—John Hicken, Dunchurch, Rugby; W. Sanday, Radcliffe-on-Trent, Nottingham; W. Sadler, Ferrygate, Drem, N.B.

Manure Distributors, Potato Getters, Waggons, and Carts.—John Wheatley, Neswick, Driffield; Henry Cantrell, Baylis Court, Slough, Bucks; John Gibson, Woolmet, by Dalkeith, N.B.

Miscellaneous and Dairy Utensils.—H. B. Caldwell, Monkton Farleigh, Bradford-on-Avon; F. Sherborn, Bedfont, Middlesex; J. K. Fowler, Willowbank, Aylesbury.

Plans and Models.—J. Coleman, Escrick Park Office, York; J. Bailey Denton, 22, Whitehall-place, London; J. E. Watson, Newcastle-on-Tyne.

PRIZES.

SECTION I.

New patent Paragon mower, Richard Hornsby and Sons, 636, £20.

Grass mowing machine, Walter A. Wood, 478, £17.

Two horse grass mower, Burgess and Key, 174, £13.

The judges are of opinion that all the machines exhibited under the title of "one-horse mowers" are far too heavy in draft to be worked by one horse, and, therefore (under clause 3 of their instructions), withhold the sum assigned for prizes in this class.

SECTION II.

Haymaker, W. N. Nicholson, 5636, £16.

Haymaker, J. and F. Howard, 3711, £14.

SECTION III.

The prize for hay collectors is withheld for want of merit.

SECTION IV. CLASS I.

Reaping machine with self-delivery in sheaf, clear of the horse track, Richard Hornsby and Son, 644, £25.

Reaping machine with self-delivery in sheaf, clear of the horse track, Richard Hornsby and Son, 642, £20.

Reaping machine with self-delivery in sheaf, clear of the horse track, Samuelson and Co., 3938, £15.

SECTION IV. CLASS II.

Reaping machine, with self-delivery in swathe, clear of the horse track, A. C. Bamlett, 3975, £25.

Reaping machine, with self-delivery in swathe, clear of the horse track, Burgess and Key, 178, £20.

Reaping machine, with self-delivery in swathe, clear of the horse track, Hornsby, 646, £15.

Reaping machine with self delivery, Richard Hornsby and Son, 648, £12.

Reaping machine with self delivery, A. C. Bamlett, 3981, £10.

Reaping machine with self delivery, Samuelson and Co., 3989, £8.

SECTION IV. CLASS IV.

Combined self-raking, reaping, and mowing machine, Samuelson and Co., 3940, £20.

New patent paragon combined mower and reaper, Richard Hornsby and Sons, 649, £10.

SECTION IV. CLASS V.

Reaping machine with one horse, A. C. Bamlett, 3980, £12.

Reaping machine with one horse, Richard Hornsby and Son, 653, £10.

Reaping machine with one horse, R. Cuthbert and Co., 45, £3.

SECTION V.

Horse rake, Ransomes, Sims, and Head, 766, £20.

Horse rake, J. and F. Howard, 3714, £10.

SECTION VI. CLASS I.

Pair horse waggon, William Crosskill and Son, 1403, £15.

Pair horse waggon, Henry Hayes and Son, 733, £10.

Pair horse waggon, Thomas Milford and Sons, 356, £5.

SECTION VI. CLASS II.

Other waggons, Henry Hayes and Son, 732, £10.

Other waggons, Beverley Iron and Waggon Company, 1716, £5.

Other waggons, Beverley Iron and Waggon Company, 1804, £5.

SECTION VII. CLASS I.

Single horse cart, Henry Hayes and Son, 739, £8.

Single horse cart, Thomas Corbett, 3839, £7

Single horse cart, William Crosskill and Son, 1405, £5.

SECTION VII. CLASS II.

Two horse carts, Henry Hayes and Son, 741, £8.

Two horse carts, William Ball and Son, 1005, £7.

Two horse carts, Beverley Iron and Waggon Company, 1724, £5.

SECTION VII. CLASS III.

Harvest cart, Henry Hayes and Son, 744, £10.

Harvest cart, Frank Milford, 27, £5.

SECTION VII. CLASS IV.

Market cart on springs, Beverley Iron and Waggon Company, 1730, £6.

Market cart on springs, Thomas Corbett, 3841, £4.

SECTION VII. CLASS V.

Liquid manure cart, Isaac James, 392, £6.

Liquid manure cart, Thomas Baker, 351, £4.

SECTION VIII.

Carriage for removing stock, implements, &c., Thomas Corbett, 3842, £15.

Carriage for removing stock, implements, &c., Beverley Iron and Waggon Company, 1740, £5.

HIGHLY COMMENDED.

SECTION I.

Patent grass mowing machine, Samuelson and Co., 3934.

SECTION IV. CLASS I.

Reaping machine, with self delivery in sheaf, clear of the horse track, Richard Hornsby and Son, 643.

Reaping machine, with self delivery in sheaf, clear of the horse track, Richard Hornsby and Son, 645.

SECTION IV. CLASS V.

One horse reaper, Samuelson and Co., 3948

SECTION V. CLASS V.

Liquid manure cart, Robert and John Reeves, 528.

Liquid manure cart, Coleman and Morton, 569.

SECTION VI. CLASS I.

Pair horse waggon, Beverley Iron and Waggon Company, 1714.

SECTION VI. CLASS II.

Other waggon, George Ball, 4089.

Other waggon, Humphrey Bracewell, 4058.

SECTION VII. CLASS I.

Single horse cart, William Chapman, 81.

Single horse cart, Beverley Iron and Waggon Company, 1718.

SECTION VII. CLASS II.

Two horse cart, Thomas Corbett, 3840.

Two horse cart, F. P. Milford, 26.

COMMENDED.

SECTION I.

Two horse mower, A. C. Bamlett, 3968

SECTION IV. CLASS II.

Reaping machine, with self delivery in swathe, clear of the horse track, Beverley Iron Company, 1707.

Reaping machine, with self delivery in swathe, clear of the horse track, Beverley Iron Company, 1709.

SECTION VI. CLASS I.

Pair horse waggon, William Chapman, 28

Pair horse waggon, William Ball and Son, 1002

SECTION VI. CLASS II.

Other waggon, Thomas Corbett, 3838.

Other waggon, Henry Hayes and Son, 737

SECTION VII. CLASS I.

Single horse cart, Thomas Milford and Sons, 359

Single horse cart, William Ball and Son, 1004

SECTION VII. CLASS II.

Two horse cart, Woods Cocksedge and Warner 141.

Two horse cart, Samuel Harrison, 171

SECTION VII. CLASS III.

Harvest cart, Beverley Iron and Waggon Company, 1729.

SECTION VIII.

Carriage for removing stock, implements, &c., Beverley Iron and Waggon Company, 1739.

GOLD MEDAL.

Smut and separating machine, called "Eureka," Nell, Harrison, and Co., 6514.

SILVER MEDALS.

One horse gear, Richmond and Chandler, 885.

Machine for net folding of sheep, R. Winder, 2186.

Patent two-row turnip and mangold sower, T. M'Kenzie and Sons, 2400.

Improved steam road roller, Aveling and Porter, 4301

Weighing machine, Pooley and Son, 6166

Machine for boring in the earth, Mather and Platt, 7608.

Machine for drying corn by steam heater cylinders, Davey, Paxman, and Davey, 6185.

THE ROYAL INSTITUTION.

OWING to the pressure caused by the proceedings of the Agricultural Society, and other business our notice of the closing proceedings of the Royal Institution session has been considerably delayed. Since the last summary, the principal features of interest at the Royal Institution were a lecture by Dr. William Odling, F.R.S., on "The Simplest Organic Compounds," and another by Dr. John Tyndall, M.R.I., on "The Constitution of the Interstellar Ether." At Dr. Odling's lecture, the Prince of Wales presided, and the speaker explained the difficulties which prevent chemists from knowing much of the actual grouping of the atoms in compound chemical substances. Professor Tyndall, in his lecture, spoke of the difficulty of ascribing the phenomena of light to anything but the wave motion of a fluid of definite mechanical properties. We only know of things, he said, by their effects, and the first question relating to light is "What can it do?" It can do mechanical work, and be made to raise weights, and to turn wheels. The human mind cannot conceive of motion being thus produced without motion in the thing causing the movement. Light takes eight minutes to travel from the sun to the earth, and separating in idea a cubic mile of the space between the sun and the earth from the surrounding space, it will be found most difficult to form any other theory than that

of wave motion to explain the phenomena taking place within the said cubic mile. By the wave theory, Sir William Hamilton came to the conclusion that conical refraction ought to take place in certain crystals, such is arragonite. After theory pointed to this conclusion, the crystals were examined, and found to present the expected phenomena, which had never before been seen by human eyes. The wave theory, therefore, is as much strengthened by the foregoing facts, as was the theory of gravitation by the discovery of the planet Neptune, in consequence of the mathematical calculations of Leverrier.

ELECTRICITY AND TELEGRAPHY.

WE regret to have to announce that a fault was discovered on Saturday last in the 1866 Atlantic cable, the distance being estimated at about 130 miles from the Irish coast. The fault is not of so serious a nature but that communication can be carried on; it has been, however, determined to take steps to immediately repair it. This is the fourth interruption in this cable, which may be looked upon as excessively unfortunate; the 1865 cable, however, is, and always has been, in perfect condition.

The manufacture of the British Indian Submarine cable, at the Telegraph Construction and Maintenance Company's works at East Greenwich, is making rapid progress, over 500 miles of the deep-sea section between Aden and Bombay being completed. The "Great Eastern" having arrived at Sheerness from the successful laying of the French Atlantic cable, will be at once put in order to receive the British Indian cable, the major portion of which she will carry out in the winter.

The main Black Sea cable, of about 200 miles in length, has been successfully submerged by Mr. Siemens.

The Norwegian cable from Peterhead to Norway has also just been laid by Mr. Henley.

Mr. Henley is now manufacturing at his works a length of cable for the Mediterranean Extension Telegraph Company, to form a duplicate line between Malta and Sicily.

The various arbitrations between the Post Office and the telegraph companies having been brought to a satisfactory conclusion, the Money Bill has been brought in, and is now passing through its various phases. It will before the close of the session have completed its parliamentary stages, and shortly we hope to place the subject before our readers. The total amount required for the purchase of the various telegraphs is estimated at £7,000,000.

NOTES ON RECENT SCIENTIFIC DISCOVERIES, AND THEIR PRACTICAL APPLICATIONS.

NITRO-GLYCERINE—CHLORIDE OF NITROGEN—SIEMENS' FURNACE IN THE MANUFACTURE OF IRON.

NITRO-GLYCERINE is not a very recent discovery, nor are the dangers of it exactly a novelty. We only allude to it here to point out that if its use in the liquid form must be continued, it can be easily prepared on the spot where it is required, and at the time it is wanted. Such a plan is followed, on the suggestion of M. Kopp, in some French quarries, and might easily be adopted in Wales. Nitro-glycerine is made by submitting glycerine to the action of a mixture of two parts of sulphuric acid and one part of nitric acid, the use of the sulphuric acid being to concentrate the nitric acid which is alone concerned in the re-action. In the apparatus ordinarily used, the glycerine and the acids are allowed to mix in thin streams, and are afterwards agitated together for a short time in the receptacle into which they flow. The nitro-glycerine is then allowed to settle at the bottom, the acids are drawn off, and after a single washing with water the explosive is ready for use. There is nothing in this process which could not be managed by any intelligent labourer, and we do not see why it should not be generally adopted, in place of incurring the risks unavoidable in transporting and storing the article.

While writing of explosives, we may mention the curious circumstance recently discovered by Mr. Abel, that the explosion of perfectly dry chloride of nitrogen in an open vessel produces comparatively slight destructive effects. A drop exploded on a watch glass, for example, only breaks the glass into two or three fragments, while the same quantity of chloride of nitrogen, if wet, shatters the glass to atoms. The thin layer of water, in fact, acts like the water tamping used with nitro-glycerine in a drill hole. Chloride of nitrogen has only been the subject of some researches by MM. Deville and Hautefeuille. As is well known, it is exploded by friction, by percussion, by contact with grease, and by heat, and, in our experience, sometimes goes off without any obvious cause at all. Owing to the extreme danger attending experiments with it, the exact degree of heat at which it explodes has never been ascertained, but the chemists named above have determined that it can be made to boil without exploding. As regards the force exerted by the explosion of chloride of nitrogen, the same gentlemen have ascertained that when exploded in confinement, the pressure of the gas liberated cannot be less than 3500 atmospheres. This is an interesting scientific fact; but chloride of nitrogen appears to be so capricious and unstable a body that no profitable use is likely to be made of the tremendous energy it is able to develope.

We may mention that some experiments on the application of Siemens' furnace to the manufacture of iron in France appear to have yielded extraordinarily successful results. We may give an account of the mode in which the furnace is applied, when fuller details come to hand. At present, we need only say that with the apparently small scale on which it has been tried, a ton of cast iron is produced with the expenditure of an equal weight of coal. This result, if established, would, no doubt lead to a very general adoption of the furnaces.

THE PALLISER GUN.

SOME particulars are to hand relating to the practical working of a number of guns converted upon Major Palliser's system, and which will prove interesting to our readers. In 1866 eight cast-iron 24-pounder and 32-pounder smoothbore guns were converted by Major Palliser into 56-pounder and 64-pounder rifled guns, with a view of ascertaining whether our large stock of cast-iron guns could be advantageously converted into rifled cannon. Of these eight experimental guns one was tested for endurance, by firing continuously, with shot of 64lb. weight, until it had completed 2,285 rounds, of which 2,170 were with 8lb. charge, eighty-eight with 14lb., two with 12lb., one with 10lb., and twenty-four with 16lb. and 86lb. shot. The power of endurance of the converted guns was thus thoroughly proven. Six of the remaining guns were issued for service to home and foreign stations, in order that the Royal Artillery might have an opportunity of practising with them. The preliminary reports from these stations have now arrived, and are, on the whole, very satisfactory. The 64-pounder issued to Devonport has fired over 300 rounds, the gun is reported to be perfectly serviceable, and no complaints have been made of any difficulty in working. The Sheerness 56-pounder gun has fired 200 rounds, and the practice is reported as excessively accurate. The report from Gibraltar speaks in high terms of the accuracy of the 56-pounder issued to that station. The gun has fired 400 rounds, and is perfectly serviceable. The 56-pounder issued to Malta has fired 250 rounds. At Dover a 64-pounder has fired over 180 rounds with remarkable accuracy. The gun is spoken of as being, for handiness and fitness for rough work and exposure, in every way equal to the old 32-pounder. The 64-pounder on board the "Excellent" has fired over 480 rounds with great accuracy, the working of the gun carriage, &c., being in every way satisfactory. These reports are of much interest, proving, as they do, that the converted 64-pounder gun is fully equal to the more expensive wrought-iron gun of the same calibre.

THE plans of Mr. Kneass have been adopted for an iron bridge over the Schuylkill, at South-street, Philadelphia. The centre and river piles will be of iron, sunk by the pneumatic process; the length of the bridge will be 2,488ft., and the clear height 32ft. above high water.

ROGERS' PROJECTILE ANCHOR BLOCK AND LIFE-SAVING APPARATUS.

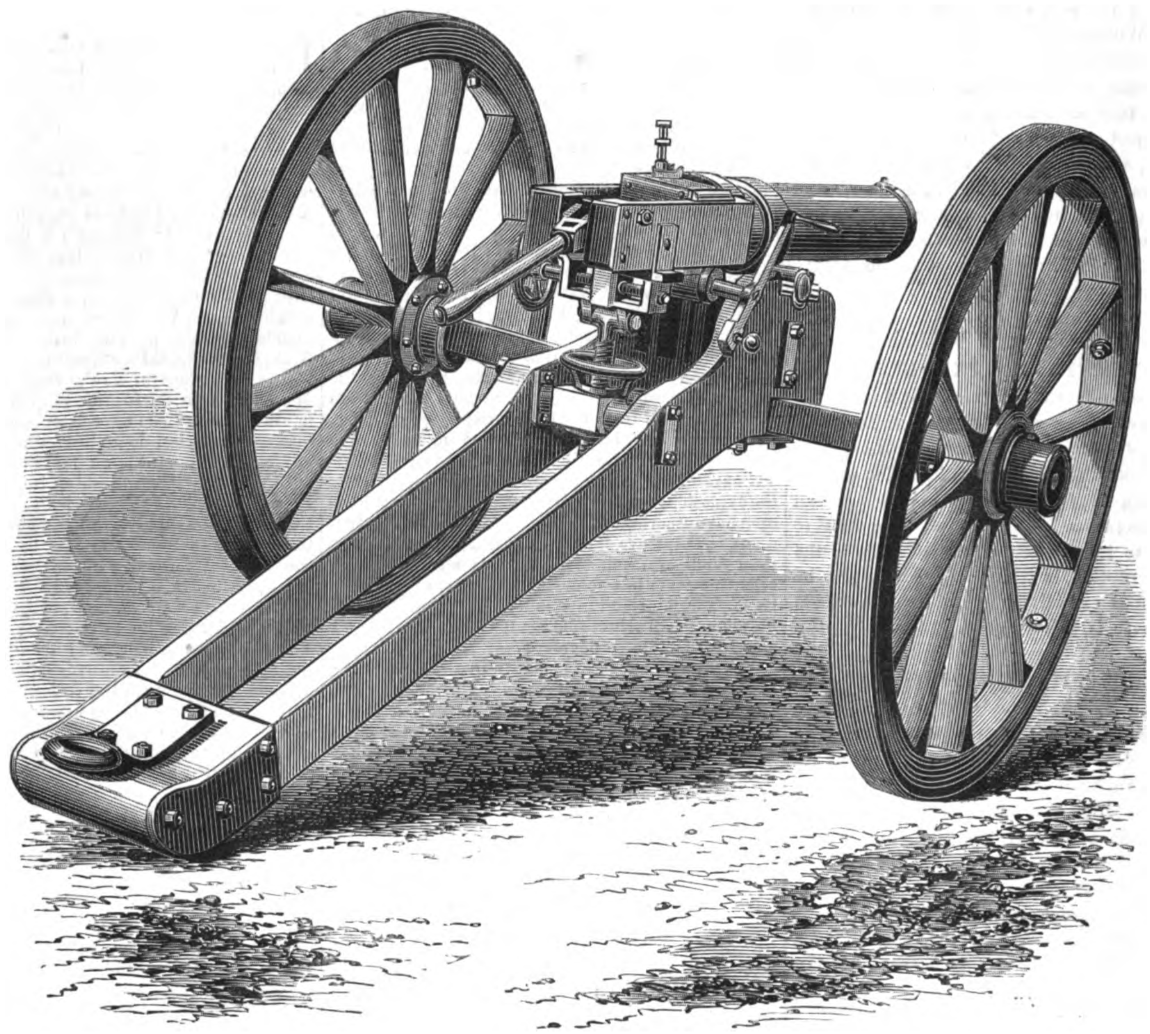
IT is with pleasure we observe that this useful and humane invention is now in a fair way of becoming an established fact, and acknowledged as a requirement. We have commented upon this invention several times, and are satisfied that it deserves the fullest attention of the public as a means of life-saving on seaboard. Mr. Rogers was requested by the Lords Commissioners of the Admiralty to demonstrate his principle before the authorities at her Majesty's dockyard, Sheerness, on Tuesday and Wednesday, the 20th and 21st inst. The trials took place on the above dates with model anchor blocks, cones, &c., to the entire satisfaction of Vice-Admiral R. L. Warren, Commander-in-Chief at the Nore; Captain the Hon. A. A. Cochrane, C.B., superintendent of Sheerness Dockyard; Captain Paul, staff superintendent; Mr. A. B. Sturdee, master shipwright, and other nautical men. The experiments embraced a very interesting series, including, amongst others, the use of the apparatus in making communication with the shore from a ship, by the aid of Mr. Rogers' non-choking block; also from the shore to the sea for the purpose of launching boats through the surf by shore aid and not by the exertion of the crew. Its use as a life-saving means was fully demonstrated in the supposed case of a vessel being wrecked under a cliff, bluff, or headland, where it would be impossible to get boat communication. The anchor, with block and double line, was fired the height of a cliff, proving that it would be a means of escape from the wreck to the top, when no other method could be used. We trust we shall shortly be able to announce that this humane and efficient means of giving aid to seamen and ships in distress will be placed upon our coasts and on board our vessels to be used in case of need.

NEW IRONCLADS.

ANNEXED is a statement showing the armour-clad ships now in course of construction for the Admiralty, and the establishments at which they are being built:—The "Sultan," 12, 5,226 tons, 1,200-horse power, and the "Glatton," 2, 2,709 tons, 500-horse power, double screw turretship, building at Chatham dockyard; the "Iron Duke," 14, 3,774 tons, 800-horse power, double screw, building at Pembroke dockyard; the "Swiftsure," 14, 3,893 tons, 800-horse power, and the "Triumph," 14, 3,893 tons, 800-horse power, building by the Palmer Shipbuilding Company at Jarrow-upon-Tyne; the "Hotspur," 2, 2,637 tons, 600-horse power armour-plated ram, building at the yard of Messrs. Napier and Sons, Glasgow; and the "Vanguard, 14, 3,774 tons, 800-horse power, building by Messrs. Laird Brothers, Birkenhead. In addition to the above, the "Abyssinia," 4, 1,854 tons, 200-horse power, and the "Magdala," 4, 2,107 tons, 250-horse power, double-screw iron armour-plated turretships, are building for the defence of Bombay, the former by Messrs. Dudgeon, at Poplar, and the latter by the Thames Iron Shipbuilding Company at Blackwall. They are said to be in such a forward state that they will be completed during the present or early in the ensuing year. As soon as one of the building slips becomes vacant at Chatham dockyard, a new armour-plated ram, to be named the "Rupert," of 3,159 tons, and 700-horse power, is to be commenced at that establishment. A new armour-plated turretship, the "Devastation," of 4,406 tons and 800-horse power, from the designs of Mr. E. J. Reed, C.B., has been recently commenced at Portsmouth dockyard.

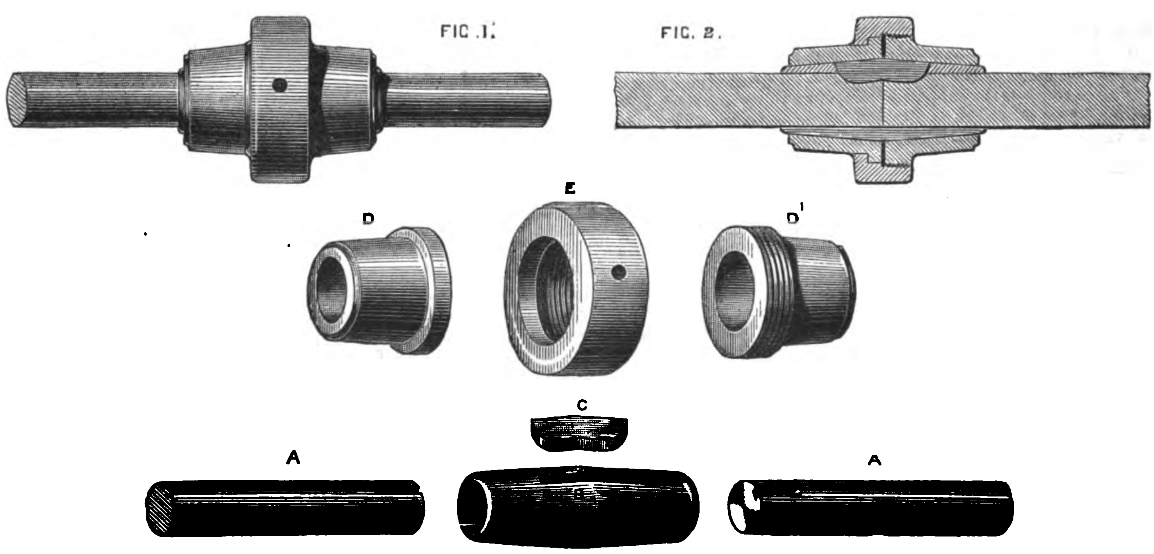
AN interesting discovery has been made near Corbridge within the last few days, by which the true site of the Roman bridge which crossed the Tyne there has been ascertained. Remains of the land pier were found on a rock, which only stands about 4ft. from the bank, beyond which the river bottom consists of mud and shingle. At a distance of 50ft. from the face of the land pier the foundations of the first pier were found by removing about 1ft. of mud. They are constructed in the very strongest possible manner, a strong oak framework enclosing stones 5ft. long by 12in. broad, the oak again inserted across at every five stones, secured to a centre piece, which traverses the whole. At the east end piles are driven in to secure the platform from moving. The most interesting remain is one of the oak beams of the bridge lying on this foundation, burried in mud and rubbish, clearly in the postiion as it fell when the bridge was destroyed a large place a few feet from the end being burnt nearly half through the beam, which, though much decayed, is yet quite in a sufficiently good state of preservation.

THE BELGIAN MITRAILLENSE.



SELF-CENTREING COMPRESSION COUPLING.

BY A. RANSOME AND CO.



THE BELGIAN MITRAILLEUSE.

WE have of late occasionally recorded the remarkable results of firing of a new multiple barrelled field gun in Belgium. It will doubtless interest our readers to know more of this deadly weapon. We therefore give a perspective view of the gun, which is taken from an official photograph. Although the latest weapon of its kind, it is in principle no novelty, having had several prototypes, the well known Gatling gun being one of them. The present gun is the invention of M. de Montigny, of Belgium, and is stated to be the machine gun with which the French military authorities experimented last year. It consists of thirty-seven steel rifled barrels, of about the usual small-bore calibre. These being hexagonal prisms externally, are packed together to constitute a sort of cylinder, which, being fixed within a bored and turned wrought-iron tubular casing, are all soldered to each other and into the tube. The rear end of the tube consists of a stirrup or U-shaped frame, within the vertical jaws or sides of which are the planed chases within which the breech blocks, holding the ammunition to be fired, are in succession placed. The tube (*i.e.*, the whole gun), is mounted on trunnions upon the hard wood cheeks of a light field gun carriage of double trail, and is provided with the usual arrangement of elevating screw, and with a horizontal screw for fine adjustment in azimuth. The sights at breech are movable, and elevate for range, &c., the line of aim being about 36in. in length. The breech block is a solid parallelopiped, bored out with thirty-seven chambers. Behind each of these is a lock—that is to say, a spiral spring and detent, which on the release of the latter drives forward a needle into the centre of the cartridge in the chamber before it, and so communicates a central ignition. One handle which projects in the rear in line with the piece, clamps forward firmly the compound breech

piece when dropped into place, or at once releases it, when it has to be replaced after its exhaustion by fire. At one side of the proper sight of the gun is seen a handle, by means of which each lock of each barrel is in succession released, and that barrel fired. The rate of firing is thus dependent simply upon that at which this handle or winch is manipulated.

It is stated that at least 350 shots per minute can be discharged from one piece, and by one man, but that stands in need of confirmation. The rapidity of fire is, no doubt, great, for Major G. V. Fosbery, V.C., B.S. Corps, who has been investigating this arm abroad, saw ten blocks exhausted in about three minutes, when aiming at a target screen, at the heath of Brascäat, the Belgian Artillery practice range. These experiments appear to have been made at ranges of 430 yards, and at extreme ones of 1,100 yards, the screen being nearly 100ft. long by 9ft. high, with a central portion of about one-fourth the whole length of 12ft. in height. At the short range nearly 85 per cent. of the projectiles struck, and had there been no missfires (there were no less than forty out of the 370) this percentage would, no doubt, have been higher. At the longest range the fire was much more wild, and from the constant divergence of the cone of dispersion, as well as from all other sources of inaccuracy or of divergence, the number struck was so much smaller in proportion that no exact trials seem to have been made. The cartridges are made up with their projectiles and priming, and are readily dropped simultaneously by mechanical means into their chambers, and by the aid of a perforated steel plate which is the cartridge holder, and grips the necks of the cartridge cases, these are easily and simultaneously extracted, so as to admit of the block being recharged. By a change in the nature of the breech blocks or steel plates, or both, this gun may be instantly converted into a strict volley gun, and all the thirty-seven barrels be discharged at once. The main military uses for these pieces will be special.

SELF-CENTREING COMPRESSION COUPLING.

In our notice last week of the Agricultural Show at Manchester, we referred to a very good coupling, which we found at the stand of Messrs. Allen Ransome and Co., of King's-road, Chelsea. The accompanying engraving represents this coupling, which possesses very striking advantages over those hitherto used. Fig. 1 shows the coupling in elevation when fixed upon a line of shafting, and fig. 2 is a longitudinal section of the same, while the various parts are shown below in detail. A A represent the ends of two lengths of shafting which are to be coupled together. B is a cast-iron split sleeve, bored parallel inside to suit the size of the shafting, and having its outer surface turned to the form of a double cone. C is a steel key fitted into corresponding slots in ends of the shafts A A and sleeve B. D D¹ are two outer compression shells, bored conical to fit the double cone of the sleeve B. E is a turned cast-iron collar or ring nut, having a strong thread formed upon its inner circumference on one side, to fit upon a corresponding screw cut on the collar of the compression shell D¹. By screwing up the ring nut E, the conical shells D D¹ are drawn together and compress the split sleeve B, so that it tightly grips the ends of the shafts, and holds them firmly together. The couplings can be supplied of any size, independently of the shafting, and do not require to be turned in their places on the shafting. The split sleeve, when drawn together by the action of the conical compression shells, closes on the centre, and thus necessarily brings the lengths of shafting into a perfectly straight line. A single length in a line of shafting united with the couplings can be readily taken out to shift a pulley without disturbing the other lengths. No bolts, nuts, or tight keys being used, these couplings are readily fixed, one minute being ample time to uncouple or couple up each joint. Although lighter than those in ordinary use, the couplings are much stronger, as from their peculiar construction, the strain is equally diffused throughout every part of them. Being free from any projections, the couplings are not only symmetrical in appearance, but they can be used as driving pulleys for slow speeds, without fear of injuring the belts.

The Keystone Bridge Company, of Pittsburg, has contracted to build a wrought-iron bridge on the Boston, Hartford, and Erie road at Middletown, Connecticut; the bridge will be 1,200ft. long.

PATENT LAW FOR THE DOMINION OF CANADA.

A NEW Patent Law Act for Canada was assented to by the Governor General on the 22nd of June last. We append a copy of a portion of this act, and purpose giving the remainder next week. We shall then enter upon a discussion of its merits, or rather demerits, for it is especially unsatisfactory, and involves matters of great importance to non-resident alien inventors, whom it excludes from the benefits of its provisions.

Her Majesty by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

PATENT OFFICE CONSTITUTED.

1. There shall be attached to the Department of Agriculture, as a branch thereof, an office to be named the Patent Office; and the Minister of Agriculture for the time being shall be the Commissioner of Patents of Invention; and it shall be the duty of said Commissioner to receive all applications, fees, papers, documents and models for patents, and to perform such acts and things respecting the granting and issuing of patents for new and useful inventions, discoveries, and improvements as are herein provided for; and he shall have the charge and custody of the books, records, papers, models, machines, and other things belonging to the said office.

2. The Commissioner shall cause a seal to be made for the purposes of this Act, and may cause to be sealed therewith letters patent and other instruments and copies proceeding from the Patent Office; and all courts, judges, and other persons whomsoever shall take notice of such seal, and receive impressions thereof in evidence, in like manner as impressions of the Great Seal are received in evidence, and shall also take notice of and receive in evidence, without further proof and without production of the originals, all copies or extracts certified under the seal of the said office to be copies or extracts from documents deposited in such office.

3. The Commissioner may, from time to time, subject to the approval of the Governor in Council, make such rules and regulations, and prescribe such forms, as may appear to him necesssary and expedient for the purposes of this Act; and notice thereof shall be given in the "Canada Gazette"; and all documents, executed after the same and accepted by the Commissioner, shall be held valid so far as relating to proceedings in the Patent Office.

4. The Deputy of the Minister of Agriculture shall be the Deputy Commissioner of Patents of Invention; and the Government may, from time to time, appoint such clerks and officers under him as may be necessary for the purpose of this Act, and such clerks and officers shall hold office during pleasure.

5. The Commissioner shall cause a report to be prepared annually and laid before Parliament of the proceedings under this Act, and shall, from time to time, and at least once a year, publish in the "Canada Gazette" a list of patents granted, and may, with the approval of the Governor in Council, cause such specifications and drawings as may be deemed of interest, or essential parts thereof, to be printed from time to time for distribution or sale.

WHO MAY OBTAIN PATENTS.

6. Any person having been a resident of Canada for at least one year next before his application, and having invented or discovered any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used by others before his invention or discovery thereof, or not being at the time of his application for a patent in public use or on sale in any of the provinces of the dominion, with the consent or allowance of inventor or discoverer thereof, may, on a petition to that effect presented to the Commissioner, and on compliance with the other requirements of this Act, obtain a patent granting to such person an exclusive property therein; and the said patent shall be under the seal of the Patent Office and the signature of the Commissioner, or the signature of another member of the Privy Council, and shall be good and avail to the guarantee, his heirs, assigns, or other legal representatives, for the period mentioned in such patent, but no patent shall issue for an invention or discovery having an illicit object in view, nor for any mere scientific principle or abstract theorem.

7. An original and true inventor or discoverer shall not be deprived of the right to a patent for his invention or discovery by reason of his having, previously to his application, taken out a patent therefor in any other country, at any time within six months next preceding the filing of his specification and drawing as required by this Act.

8. The patent may be granted to any person to whom the inventor or discoverer, entitled under the sixth section to obtain a patent, has assigned or bequeathed the right of obtaining the same, and the exclusive property in the invention or discovery in Canada, or in default of such assignment or bequest, to the executor or administrator of the deceased inventor or discoverer or other legal representative.

9. Any person having been a resident of Canada for at least one year next before his application, and who has invented or discovered any improvement on any patented invention or discovery, may obtain a patent for such improvement, but shall not thereby obtain the right of vending or using the original invention or discovery, nor shall the patent for the original invention or discovery confer the right of vending or using the patented improvement.

10. In cases of joint applications, patents shall be granted in the names of all the applicants; and in such cases, any assignment from one of the said applicants or patentees to the other shall be registered in the manner of other assignments.

CONDITIONS AND FORMALITIES.

11. Every applicant for a patent, before he can obtain the same, shall make oath, or when entitled by law, to make an affirmation instead of an oath, shall make an affirmation that he verily believes that he is, or that the person whose assignee or representative he is or was the true inventor or discoverer of the invention or discovery for which the patent is solicited, and that he, or the person whose assignee or representative he is, was a resident of Canada for one year next before the application, or in case of death of the inventor or discoverer, for one year next before such death. Such oath or affirmation may be made before any justice of the peace in Canada; but if the applicant is not at the time in Canada, the oath or affirmation may be made before any minister plenipotentiary, *chargé d'affaires*, consul or consular agent holding commission under the Government of the United Kingdom, or any judge of the country in which the applicant happens at the time to be.

12. The petitioner for a patent shall, for all the purposes of this Act, elect his domicile at some known and specified place in Canada, and mention the same in his petition for a patent, and he shall in the same petition state the place or places in Canada at which he, or, if his application be as assignee or representative of the person whose assignee or representative he is, was resident during the year of residence required by this Act, and the period of residence at each such place.

13. The applicant shall, in his petition for a patent, insert the title or name of his invention or discovery, its object, and a short description of the same, and shall distinctly allege all the facts which are necessary under this Act to entitle him to a patent therefor, and shall with the petition send in a written specification, in duplicate, of his invention or discovery, describing the same in such full, clear, and exact terms, as to distinguish it from all contrivances or processes for similar purposes.

14. The specification shall correctly and fully describe the mode or modes of operating contemplated by the applicant, and shall state clearly and distinctly the contrivances and things which he claims as new, and for the use of which he claims an exclusive property and privilege; it shall bear the name of the place where it is made, the date, and be signed by the applicant and two witnesses; in the case of a machine, the specification shall fully explain the principle and the several modes in which it is intended to apply and work out the same; in the case of a machine, or in any other case where the invention or discovery admits of illustration by means of drawings, the applicant shall also, with his application, send in drawings in duplicate, showing clearly all parts of the invention or discovery, and each drawing shall bear the name of the inventor or discoverer, and shall have written references corresponding with the specification, and a certificate of the applicant that it is the drawing referred to in the specification; but the Commissioner may require any greater number of drawings than those above mentioned, or dispense with any of them, as he may see fit; one duplicate of the specification and of the drawings, if any drawings, shall be annexed to the patent, of which it forms an essential part, and the other duplicate shall remain deposited in the Patent Office.

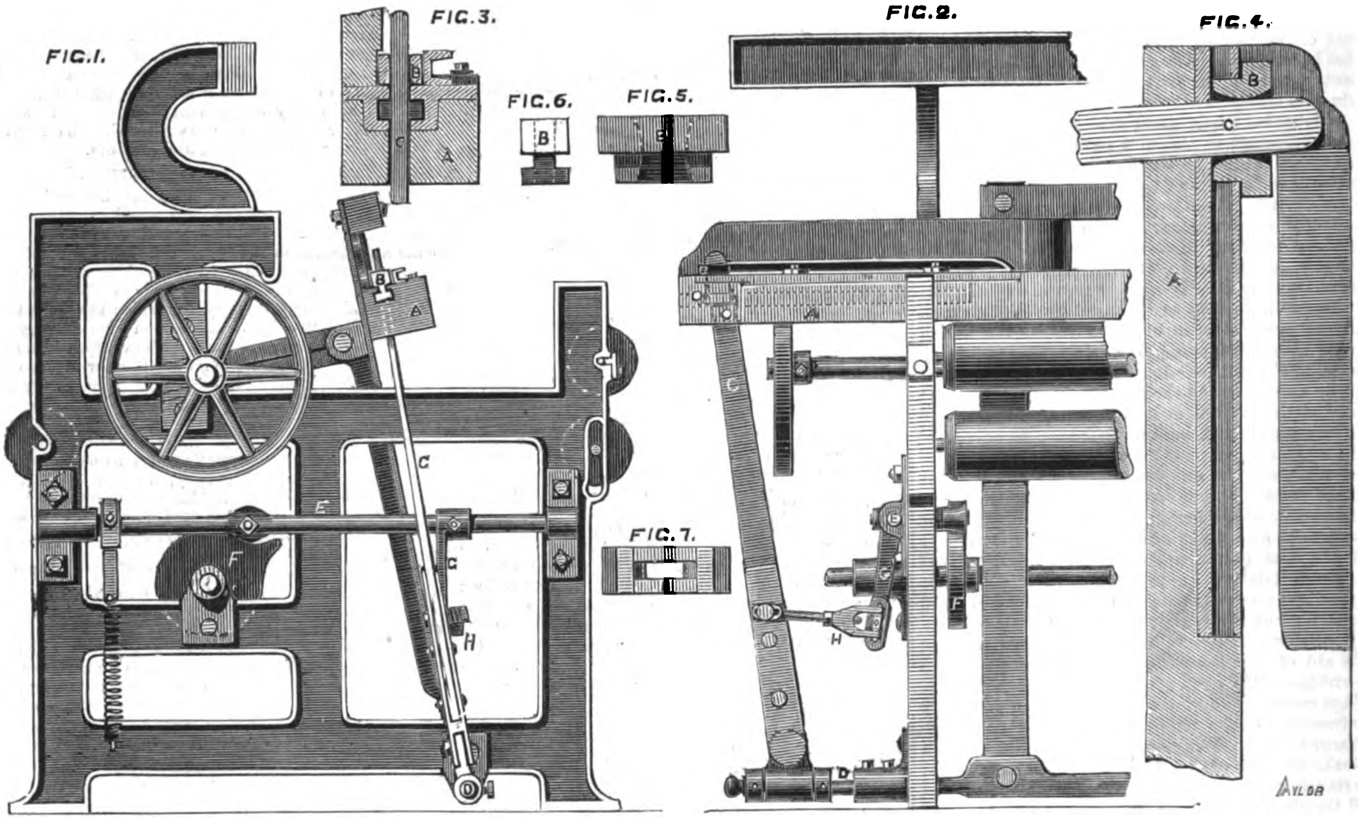
15. The applicant shall also deliver to the Commissioner, unless specially dispensed from so doing for some good reason, a neat working model of his invention or discovery on a convenient scale, exhibiting its several parts in due proportion, whenever the invention or discovery admits of such model; and shall deliver to the Commissioner specimens of the ingredients, and of the composition of matter sufficient in quantity for the purpose of experiment, whenever the invention is a composition of matter; provided such ingredients and composition are not of an explosive character, or otherwise dangerous, in which case they are to be furnished only when specially required by the Commissioner, and then with such precautions as shall be prescribed in the said requisition.

CONTENTS, DURATION, SURRENDER, RE-ISSUE OF PATENTS AND DISCLAIMERS.

16. Every patent granted under this Act shall recite briefly the substance of the petition on which it is granted, and shall contain the title or name of the invention or discovery, and a short description of the same, referring for a fuller detail to the specification; and shall grant to the patentee, his assigns and legal representatives, or in trust, as the case may be, for the period therein mentioned from the granting of the same, the exclusive right, privilege, and liberty of making, constructing, and using, and vending to others to be used, the said invention or

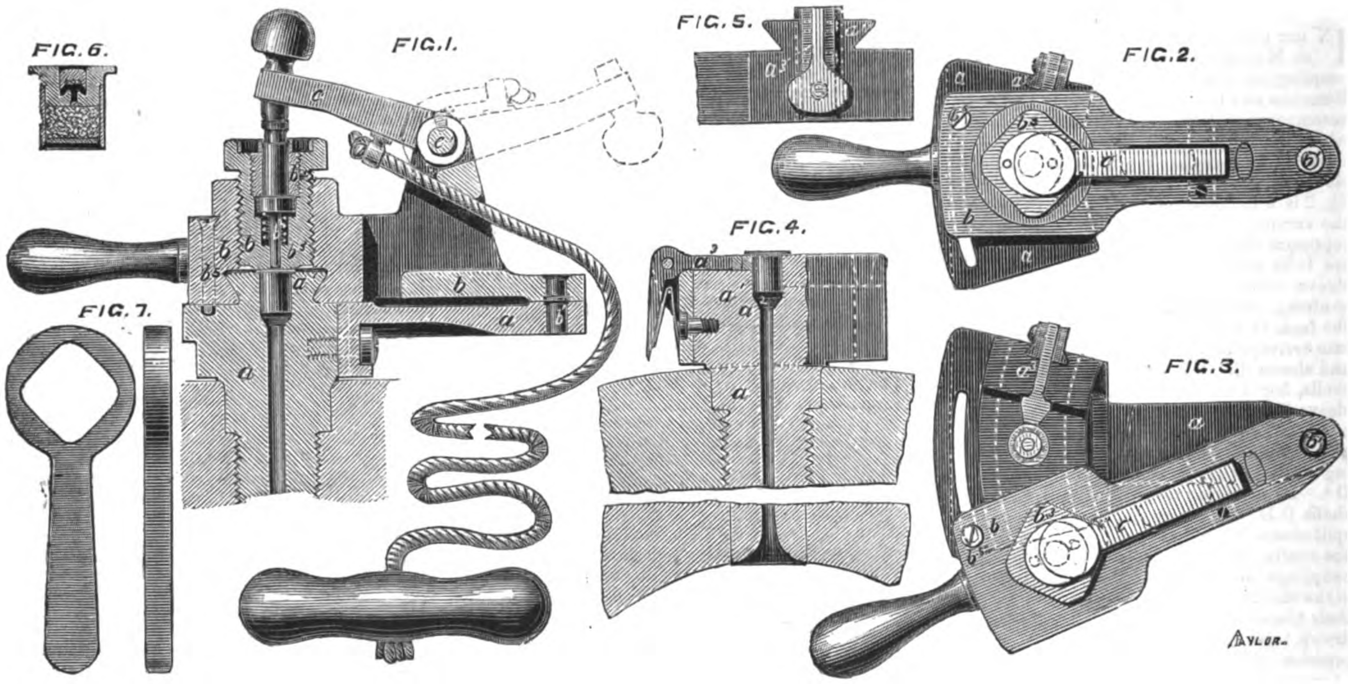
IMPROVEMENTS IN LOOMS.

BY MR. PRIESTLY AND MR. DEIGHTON.



APPARATUS FOR DISCHARGING ORDNANCE.

BY MR. J. VAVASSEUR.



discovery; and shall contain a condition that it is nevertheless subject to adjudication before any court of competent jurisdiction.

17. Patents of invention or discovery issued by the Patent Office shall be valid for a period of five years; but at or before the expiration of the said five years the holder thereof may obtain an extension of the patent for another period of five years, and after those second five years may again obtain a further extension for another period of five years; and the instrument delivered by the Patent Office for such extension of time shall be in the form which may be from time to time adopted, and shall be made in duplicate, one duplicate to remain of record and be duly registered, and the other to be attached, with a reference, to the patent, under the seal of the Patent Office, and signature of the Commissioner, or any other Privy Counsellor in case of absence of the Commissioner.

18. Every such patent and every instrument for granting a further extension of any patent shall, before it is signed by the Commissioner, or any other member of the Privy Council, and before the seal hereinbefore mentioned is affixed to it, be examined by the Minister of Justice, who, if he finds it conformable to law, shall certify accordingly; and such patent or instrument may be signed and the seal affixed thereto, and being duly registered shall avail to the grantee thereof, and be delivered to him.

19. Whenever any patent shall be deemed defective or in operative by reason of insufficient description or specification, or by reason of the patentee claiming more than he had a right to claim as new, but at the same time it appears that the error arose from inadvertence, accident, or mistake, without any fraudulent or deceptive intention, the Commissioner may, upon the surrender of such patent, and the payment of the further fee hereinafter provided, cause a new patent in accordance with an amended description and specification to be made by such patentee, to be issued to him for the same invention or discovery for any part or the whole of the then unexpired residue of the five years' period for which the original patent was or might have been, as hereinbefore directed, granted. In case of the death of the original patentee, or of his having assigned the patent, a like right shall vest in his assignee, or legal representative; the new patent, and the amended description and specification shall have the same effect in law, on the trial of any action thereafter commenced for any cause subsequently accruing, as if the same had been originally filed in such corrected form before the issue of the original patent.

(To be continued).

A statue of Goethe in Munich will be uncovered on August 20, the 120th anniversary of the poet's birth.

IMPROVEMENTS IN LOOMS FOR WEAVING.

THE invention illustrated in the annexed engraving relates to the picking motion or the means of picking the shuttles in plain looms for weaving. It has been patented by Mr. Priestly and Mr. Deighton, of Bradford, York, whose object is to dispense with the picker spindles now employed (and which require lubrication), and thereby avoid the grease spots which are so frequently produced on the fabric while being woven, by the action of the pickers throwing off the lubricant from the said spindles upon the fabric. To accomplish this object a slot hole is formed in the bottom of each shuttle box, and the shank of the picker is formed to slide freely in the slot with a T head or projection under the box to prevent the picker coming out of the slot when the loom is in action. Ordinary upright picking sticks are used, which are hinged in line with the axis of the lay or lathe swords, and they project upward through the slots of the boxes, and also through slots formed in the pickers. Motion is given to the picking sticks by horizontal shafts actuated by tappets fixed on the low shaft of the loom, the shafts having levers thereon connected by adjustable metallic rods, jointed to allow the required duplex motion of the picking sticks.

Fig. 1 of our engraving represents an end elevation, and fig. 2 part of the front elevation of one end or a portion of the loom. A is the shuttle box, B the picker, C the picking stick which is hinged on the axis D of the lathe, E the horizontal shaft which is operated by an ordinary tappet F fixed on the low shaft of the loom, G is a lever fixed on the shaft E, and is connected by universal joints to an adjustable link or rod H, which connects it to the picking stick, and by which motion is communicated thereto. The picking stick passes through a slot formed in the bottom of the shuttle box, and also through a slot made in the picker. These parts are shown in detail at fig. 3, which is a cross section, and fig. 4, which is a longitudinal section of the box and picker, with a portion of the picking stick drawn to a larger scale. Figs. 5, 6, and 7 are three views of the picker, showing its construction for this purpose, where it will be seen that the shank is formed with a T end, or flanged to fit under the box bottom to prevent the picker from being lifted out of place by the action of the picking stick. It will be also seen, on reference to fig. 4, that the box bottom is of varying thickness, or that the under side is inclined, and a parallel groove is formed underneath by a pair of flanges to guide and give the picker a slight lift off the box bottom in picking, which is found requisite for driving the shuttle properly across the loom.

APPARATUS FOR DISCHARGING ORDNANCE.

WHEN a piece of ordnance is discharged by means of a vent which is left open during the explosion, flame and gases resulting from the explosion rush from the bore of the gun into the vent passage; the vent thus becomes enlarged, and the bore of the gun close to where the vent enters becomes starred or cracked, and the gun often ultimately becomes unserviceable from this cause alone. To avoid this injury to the vent passage, Mr. J. Vavasseur, of the London Ordnance Works, Bear-lane, Southwark, has recently patented an invention which provides for the firing of the charge whilst the vent is closed, in the following manner:—He introduces into the outer end of the vent, which is chambered, a capsule like the case of a cartridge for a breech-loading rifle. This capsule is provided with a percussion priming, and is loaded with a charge of explosive material sufficient to produce the volume of flame required. The capsule is held in the chamber of the vent, so that it may not blow back on firing, by means of a cover to the vent strong enough to resist the pressure of the gas. This cover is also fitted with a striker for exploding the priming of the capsule. The cover slides from one side on to the head of the ventpiece so as to allow the capsule to be withdrawn.

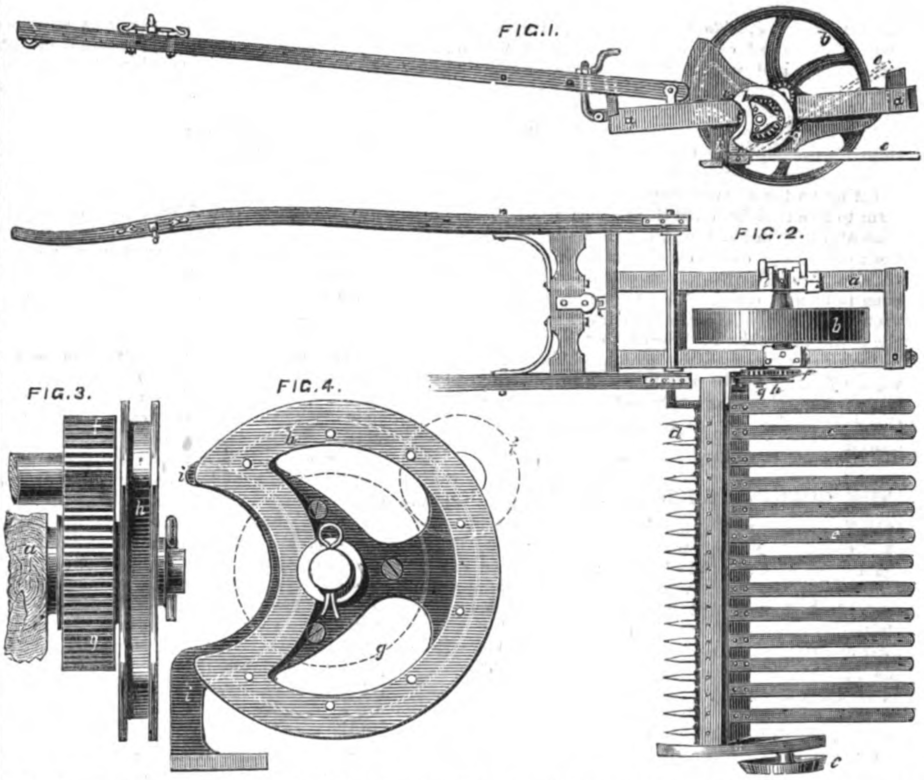
In our engraving, fig. 1 is a longitudinal section of the apparatus, together with a portion of the piece of ordnance to which it is fixed; the apparatus is also shown in plan at figs. 2 and 3. In fig. 2 the vent is covered, and in fig. 3 it is exposed. *a* is a ventpiece, which is screwed, as is shown, into a passage formed for it in the gun; it has a head a^1 of a dovetail form, in the centre of which is a cavity or chamber a^2 to receive a capsule. This chamber is formed somewhat like the cartridge chamber at the rear end of the barrel of a breech-loading rifle or fowling piece, and it is fitted with an extractor a^3. The extractor is more clearly shown in fig. 4, which is a transverse section of a part of the apparatus. The tail of the extractor is formed into a thumbpiece, as is shown at fig. 5. The chamber a^2 receives a metallic capsule charged with powder or other suitable explosive substance, and provided at its base with a percussion cap. The capsule is shown at fig. 6. *b* is a cover to secure the capsule in its chamber. This cover is able to turn on the centre pin b^1 carried by an arm fixed to the ventpiece *a*, and it fits to the dovetailed head of the ventpiece. By adapting the cover to the head of the ventpiece in this way, sufficient rigidity is attained to withstand the great strain which comes on the cover when the piece is fired. The cover is turned to one side, as is shown in fig. 3, to uncover the chamber a^2 for the introduction of the capsule, and, when the capsule has been inserted and the cover is replaced, the striker b^2 which the cover carries stands vertically over the capsule, so that, when forced down, it strikes it at the centre of its base, where the fulminator is situate. The striker is a pin with a flange upon it fitted into a cavity in a screw plug b^3 which the cover carries, and it is there secured by cap b^4. A spiral spring holds the striker up off the capsule until it is forced down by the hammer. Each time that a capsule is inserted and the cover is brought over it, the screw plug is set down so as to bind the capsule in its place.

Fig. 7 shows the spanner which is used to work the screw plug. The hammer *c* turns at c^1 on a pin carried by the cover *b*. A lanyard is attached to the hammer *c*, and when it is desired to fire the piece by a sudden pull on the lanyard, the hammer is made to descend on the striker and explode the capsule. b^5 is a stop screw fixed in the cover *b*; its end enters a groove in the ventpiece *a*, so as to limit the motion of the cover to the distance required. a^3 shows the extractor and the way in which it is applied; it consists of a bent lever fitted in a recess in the face of the head a^1, and turning on a centre. On one end of the lever, the flange of the capsule rests; the other is widened out to form a thumbpiece, and is pushed down when the capsule is to be extracted; a spring returns the extractor to its place. By the combination with the vent of the cannon of an extracting instrument such as we have described, the capsule after firing is readily withdrawn from the vent, an operation which otherwise would be difficult.

The capsule is shown to an enlarged scale at fig. 6. The tubular part of the capsule is made of copper; it is forced on to an iron disc containing a stout percussion cap, and having a projection on to which the cap is driven by the blow of the striker. The tube of the capsule contains a small charge of powder enclosed by a paper wad. By the use of this invention, not only is the rapid wear of the vent prevented, but the necessity of serving the vent or stopping with the thumb during loading is avoided, and all chances of accident arising from this operation being imperfectly performed are removed. In cast-iron guns it will not be necessary to have a vent tube passing through the metal of the gun; the vent for the greater part of its length may be simply drilled in the gun itself.

REAPING MACHINE.

BY MR. R. NORFOLK.



IMPROVED REAPING MACHINE.

IN reaping machines of the present construction, the platform on which the corn is collected has been raised and lowered by the attendant acting on a treadle. The invention illustrated in the annexed engraving consists in performing these operations by self-acting machinery actuated from the driving wheel of the machine, whereby not only is the labour reduced but the work is performed with more regularity than heretofore. This invention has been patented by Mr. Richard Norfolk, the managing director of the Beverley Iron Company, and was exhibited at the Manchester Show. To the driving wheel or its axle is fixed a toothed wheel gearing into another wheel, to which is attached a cam, which acts on a lever projecting from the platform. The cam is made with a long dwell to hold the platform up while the corn is accumulating upon it, and with a recess to allow the platform to drop suddenly when a sufficient quantity of corn for making a sheaf has been cut. The toothed wheels can be changed so as to vary the rotary speed of the cam, according to the state of the crop or to the size of the sheaf.

Fig. 1 in our engraving is an elevation and fig. 2 a plan of a reaping machine, to which Mr. Norfolk's improvements are applied, fig. 3 is an edge view, and fig. 4 an elevation of the machinery drawn to a larger scale. In figs. 1 and 2 *a* is the framework of the machine, *b* the driving wheel, and *c* the outer supporting wheel, revolving on a stud fixed to the frame of the cutters *d*. These parts of the machine are made in the usual manner. *e* is the platform on which the corn is collected; this platform is hinged to the framework, as usual, but instead of being raised and lowered by the attendant acting on a treadle, as heretofore, it is raised and lowered by self-acting

machinery in the following manner:—To the driving wheel b, or to its axle, is fixed the toothed wheel f (seen best in figs. 3 and 4), gearing into the wheel g, which is mounted on a stud fixed to the framework a. To the boss of the wheel g is fixed the grooved cam h, which is made with a long dwell, and with a recess corresponding in shape to the curved lever i, which is fixed to the rail of the platform e.

The engravings represent the parts in the positions they occupy when the platform is down, but as the machine progresses over the field the cam h, acting on the curved lever i, causes the platform to rise rapidly until it assumes the position shown in dots in fig. 1, and it will be held in this position by the dwell on the cam h, during the time required for the accumulation of sufficient corn to form a sheaf. The recess in the cam h then again comes opposite the curved lever i, and the platform is then at liberty to fall rapidly, to deposit the corn on to the ground. The toothed wheels f and g are or may be made to be changed so as to vary the rotary speed of the cam h to suit the state of the crop or the size of the sheaf required.

THE QUEKETT MICROSCOPICAL CLUB.

THE fourth annual general meeting of the above society was held, on Friday evening last, in the library of University College; Mr. Arthur E. Durham, president, in the chair. A report was read which showed that 142 members had been elected since the last annual meeting, making a total of 512. The treasurer's report showed that the finances were in a very satisfactory condition. In vacating the chair, which he had filled for two years, the President delivered a highly impressive address, which was listened to with marked attention throughout. The following gentlemen were elected to fill the offices named for the ensuing year:—For President—Mr. P. Le Neve Foster. For Vice-Presidents—Dr. R. Braithwaite, Mr. W. M. Bywater, Mr. A. E. Durham, Mr. H. F. Hailes. For Members of Committee—Mr. T. Crooke, Mr. B. T. Lowne, Mr. S. J. M'Intire, Dr. J. Matthews. For Treasurer—Mr. R. Hardwicke. For Hon. Secretary—Mr. T. Charters White. For Hon. Secretary for Foreign Correspondents—Mr. M. C. Cooke. A paper on the Ratio-micro-polariscope, by Mr. James J. Field, its inventor, was read, at the conclusion of which the instrument was exhibited. Ten new members were elected; after which the proceedings terminated.

A NEW ASTRONOMICAL SOCIETY.

MR. WILLIAM F. DENNING, of Ashley-road, Bristol, has succeeded in forming "a society of gentlemen possessing astronomical instruments, for securing concerted observation of interesting astronomical phenomena." Amongst the list of members are the names of six fellows of the Royal Astronomical Society, including Mr. W. R. Birt, one of our leading authorities on lunar matters; and Mr. A. Brothers, the author of a very excellent catalogue of binary stars, and numerous valuable papers on celestial photography. The affairs of the society are managed by a president, treasurer, and secretary, and a committee of five members. The Rev. R. E. Hoppell, M.A., LL.D., F.R.A.S., of South Shields, is the president; Mr. William F. Denning, of Ashley-road, Bristol, is the treasurer and secretary; while the committee consists of gentlemen whose names are well known in connection with science. The society now consists of twenty-six members, and, if energetically carried on, will be of great service in aiding the spread of practical astronomy.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

(Continued from page 64.)

I HAVE by me here some specimens of metallic foils; that of aluminium is so light and strong that a tubular boiler or generating apparatus made of it would weigh so little—I fear to say how little, lest it should be thought incredible, and there are several liquids, such as muriatic ether, ammonia, and carbonic acid that boil at so low a temperature as not to require any fuel to evaporate them; which evaporation may take place in thin vulcanized india-rubber tubes strengthened by external coils of thread or wire. All these fluids, in passing from the liquid into a gaseous form, produce an intense cold, which cold is capable of being utilized as a source of power just as so much heat in an air engine; and this is independent of the power obtained from their self-evaporation before alluded to. Excepting, however, for experiment, they are not so economical as steam or heated air, for in dealing with this latter we have only to take account of the weight of fuel to be carried; for steam is capable of being condensed, after doing its duty, and used over again, and the weight of fuel is less than a tithe of that of the water evaporated by it. I have on a former occasion described how very light engines could be constructed of india-rubber cloth on the bellows principle, but even these are not absolutely necessary. It is true, that to lift, say, 32,000lb. only 1ft. high in a minute, which is a horse's power, a heavy massive engine would be required; but to raise or drive 1lb. through a space of 32,000ft. in a minute, which is the same thing, only a very light engine of the ordinary kind is necessary, the weight being converted into velocity, and, fortunately, such a quick-acting engine is the only one adapted for aerial navigation.

But a word, in conclusion, on balloons. The question is often asked why they cannot be steered. The reply is, they can be both propelled and steered in a calm, like a steam ship, the only difference being that the balloon is supported by a fluid which generally moves more than 20 miles an hour, whilst the ship rests on a fluid that rarely moves more than three miles an hour. It is needless to say that if the circumstances were reversed, the steam ship would be as much at the mercy of the tides as the balloon is now at that of the wind; and so would a ship be at the mercy of the wind, were it not for its greater specific gravity; and a bird, too, if buoyed up by air cells, which, I regret to say, is the all but general opinion. I have scarcely ever had occasion to allude to the possibility of flying without receiving in reply the stereotyped remark. "Ah, but you forget that a bird has air cells," as if air cells were not the easiest things in the world to make. And what is the balloon itself but a huge air cell? Something practical, however, in the way of locomotion, I think, may even be accomplished with balloons. Although we cannot by mere drift proceed from point to point, we can from line to line. Taking advantage, therefore, of the trade winds, I do not see why a balloon could not be easily wafted from the west coast of Africa across the Atlantic to South America, and the voyage afterwards continued to the East Indies. As steam navigation and railways become extended over the world, a person may make the greater part of a long journey in a balloon, thus securing an agreeable temperature, even in a burning zone, and correct or complete the journey by some more certain means of conveyance. But with very little motive power a considerable deviation in its course could be effected—probably as much as 90deg.; and if a drag were employed to retard the motion of the balloon when passing over the sea, the wind itself would then be available for creating a diversion, either by acting directly on a sail, or turning a wind-wheel to drive a propeller.

Mr. Glaisher said that, as Mr. Brown had made reference to several materials for boilers so light that he would not like to say, he would ask Mr. Brown to state approximately the weight and the pressure per square inch.

Mr. Brown produced a slip of aluminium beaten to the thinness of tinfoil.

Mr. Glaisher suggested that Mr. Brown should take steps to find out the weight of boiler with the pressure per square inch in one atmosphere or two atmospheres. He made this remark because, when he occupied the chair at the last meeting, he heard a gentlemen talking of two or three hundred miles an hour, when they could not even rise from the ground. He had, therefore, called attention to the necessity of taking the first step rather than to what might be done afterwards. Mr. Brown had referred to the very thing wanted—a light engine with very great power. This was what they wanted in their present state of, he was going to say, knowledge, but he would rather say want of knowledge.

Mr. Moy said he had constructed a boiler of 6½lb. weight, which would give him half-a-horse power, and he thought that he could make a boiler one-third of that weight with the same power. The present boiler was not quite sufficient for his flying machine to go up with, and he wanted to make a machine which would prove a success. The breaking power of a piece of brass one-eighth of an inch wide is eight tons, and he was sure that was ample for anything wanted.

Mr. Glaisher: Mr. Brown speaks of a boiler which would not even weigh a pound.

Mr. Brown: Yes, it would weigh within the pound. I must say I have not tested the strength by experiment, but I have no hesitation in saying that it would be far lighter than any other boiler ever dreamt of.

The Chairman: I should like to ask Mr. Brown if he has taken into consideration the extreme difficulty of working aluminium. It is almost impossible to solder it.

Mr. Brown acknowledged the difficulty.

Mr. Olrick, C.E., remarked that there were several points on which he could not agree with the writer of the paper, and if he happened to know that those points were not correct, he would not be doing his duty to the Society if he did not point them out. His first objection was that the power was underneath, and he doubted whether the machine and the carriages which it was to push would take the same direction. The one might aim for the south-east and the other for the north-west. Mr. Brown had proposed to make a boiler from tinfoil. If any engineer proposed to make a boiler from that stuff, he would never get a boiler maker in England to entertain any scheme of the kind. He had made 200 boilers of light construction, but Mr. Brown would not be able to rivet his material together, or to get it caulked. He was afraid it was impossible to do it; and, as to strength, it would be equally deceptive, for although you might reduce the thickness of your plates to a minimum with the best steel that could be made, he could not go so far as to use tinfoil, with neither strength nor toughness. (Mr. Brearey here reminded the speaker that the specimen submitted by Mr. Brown was aluminium and not tinfoil). He had great objection to the use of steel for boilers, for he knew how treacherous it was, and how much he might be on the wrong side in his profit and loss account. He knew of about 50 steam boilers working at a pressure of about 150lb. or 180lb., which appeared to him was sufficient for practical purposes. Some of these he had tested to 250lb. per square inch. He ought to mention particularly the Bolton Steel and Iron Company, who had taken immense pains to produce a kind of steel that can be used with safety. Mr. Moy had remarked ⅛in. thickness of brass would stand a pressure of eight tons. Eight times that would make one inch of brass stand a tensile strain of 64 tons. He was afraid that must be divided by four for actual fact. The best steel used for boiler making would only stand a tensile strain of 34 tons per square inch. As to Mr. Brown's theory, and the wafting of a balloon from Africa to America, he was of opinion that most of them would hold their lives too dear to make the experiment. No doubt it would be better to have a flying machine than a balloon, and he could assure them that whenever such is invented light engines will be forthcoming.

Mr. Moy said that he spoke of the breaking strain of brass. As to constructing a flying machine, they ought first to make a model that would sustain itself for five minutes, in order to then show engineers what they could do.

Mr. Brown observed that the material he had brought was hard and light, and not like tinfoil. It did not break nor crack, and it was, to his mind, the best thing they could have. The chief objection to it was that suggested to it by the chairman, namely, that it was not easily fastened.

Mr. Olrick: It is perfectly impossible to make a boiler of that stuff, which you could rivet or caulk, or which would sustain any steam pressure for practical purposes.

Mr. Wenham stated that there had been an aluminium boiler made with the top and bottom screwed on. It was very light indeed. It was not exactly a tubular boiler. Steam was generated by charcoal, and it was said to be able to stand a pressure of between 200lb. and 300lb. per square inch.

Mr. R. Sheward, engineer, read the next paper upon the construction of an aerial machine. The author proposed to construct this machine in the following manner:—An oval slab, 60ft. in length by 40ft. in breadth, is to be made airtight and sufficiently rigid to sustain the required weight. Above and below this is to be attached a fabric strong enough to bear a moderate degree of external and internal pressure. This fabric, both on the upper and lower side of the slab, is to be porous, or perforated with a number of small apertures. By means of a steam engine in a car suspended beneath the slab, and a suitable exhausting and blowing arrangement, air is withdrawn from beneath the fabric above the slab, and, entering through the upper pores, gives a rising tendency. Air exhausted from above is forced into a compartment below, and, being injected downwards through the pores with some velocity,

by its reaction forces the machine upwards. By the combined action of these two forces, the author expects to gain an ascending power equal to about two ounces per square inch. The propulsion is proposed to be effected by the ejection of air in a backward direction, and the steering to be performed by means of a rudder.

In a conversation with Mr. Quartermain, Mr. Sheward said he anticipated getting a sustaining power of 7 tons from a surface of 60ft. by 40ft.

The Chairman expressed his belief of the entire impossibility of working the machine in the manner proposed, and he suggested that a trial with a few sheets of paper would convince Mr. Sheward of the impracticability of his scheme.

Mr. Wenham and Mr. Olrick took the same view, the latter suggesting, if the writer of the paper had more experience, he would not stumble over the first elementary steps.

(To be continued.)

CAST-IRON ARCHES.

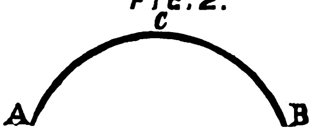
ANYONE who attentively takes into consideration the fact that the existing Southwark Bridge has the largest span of all similar structures crossing the river, cannot but be surprised that the principle of construction embodied in its erection should not have been more extensively developed. It is not to be understood that it is a matter of astonishment that all the bridges over the Thames are not like unto Southwark Bridge, but that the use of cast-iron arches is comparatively so restricted. The excessive rise demanded by an arch having a span of 260ft., which is the dimension of the centre span of Southwark Bridge, would altogether preclude the idea of employing a similar example for a new bridge over the river. Besides, although it has the merit, so far as size is concerned, of being the largest arched bridge in the world, yet it is by no means a favourable specimen of either engineering or architectural construction. It has not the slightest pretence to architectural beauty. The material is not only greatly in excess of the quantity necessary, but is moreover unscientifically and unskilfully distributed. Nothwithstanding that all this constitutes an unanswerable objection against the erection of another Southwark Bridge, it does not in any sense form a tenable argument against the adoption of the principle of cast-iron arches in the abstract. It is idle to talk of their not being safe. Take the South-Western Railway, for instance; nearly all the bridges carrying it over the main thoroughfares in the southern parts of London are composed of cast-iron arches. Westminster Bridge-road, Lambeth-road, South Lambeth-road, and numerous others have been traversed for years by trains running over bridges of cast-iron arches, some of which reach a span of 70ft., and they are to all appearance as safe as when they were originally erected. The true cause for the partial abandonment of the cast-iron arch type of erection is to be found in two circumstances. One is that some examples, not so much of the actual arch systems of the cast-iron girder, failed very conclusively—and, in fact, disastrously—years ago. The other is that most of the early engineers contemplated building bridges of enormous spans, for which a material such as cast iron is not well adapted. It was never for a moment considered that the failure of some of the cast-iron girders was due to ignorance on the part of the designer, and a complete want of scientific knowledge respecting the manner in which the strains act, and the proper proportions that ought to be given to the various parts. Not at all. Cast iron was at once voted by the profession as insecure, fickle, and treacherous material on something of the same ground that dictates the adage, "Give a dog a bad name and hang him."

It must not be supposed from the foregoing observations that we are about to advocate the wholesale adoption of cast-iron arches and girders, and that we regard them as suitable to every condition of span and rate of loading. Quite the contrary. But we do maintain that cast iron, like all other materials, has its legitimate, useful, and economical use, from which the idle fears of many professional men have endeavoured to exclude it. That it is not suitable for large railway bridges, with spans of 300ft. or 400ft., we readily acknowledge, but at the present time long span bridges are regarded in the light of an occasional necessity, but never of a desirable result. The mania for bridges of enormous span has completely died out, it having been long since demonstrated that a multiplicity of spans of average dimensions is by far the most economical method in the long run of bridging over an intervening space. Colonel Kennedy was the first engineer who broached the theory of the economy of small spans, and practically carried it out over 250 miles of line in the north-western part of India. He assumed 60ft. as the maximum span, which no doubt is too small, and might be safely increased to 80ft. without any risk of entrenching upon the principle of economy. Bridges of small span having, to speak fashionably, "come in again," it is a subject deserving serious consideration whether cast iron may not be employed instead of wrought, with great advantage on the score of economy and simplicity. A glance at the recent bridges thrown across the Thames, whether for railway or road traffic, demonstrates beyond a doubt that spans of moderate dimension are more in accordance with the ideas of the present race of engineers than they were in the days of Brunel and Stephenson. It has been shown that a few piers of moderate proportions produce no injurious effect upon the navigation of the river, and their expense is very much less than a long unsupported superstructure. The cost of a bridge increases in a far higher ratio than that of the mere span, which is the real reason that renders all long span bridges of so expensive a character. All engineers agree that the most economical manner in which to employ cast iron is that which allows of its compressive resistance only to be called into play. Practically, the ultimate resistance of good sound cast iron to compression may be taken at 50 tons per square inch, while that of wrought iron cannot safely be assumed to exceed 18 tons per square inch of sectional area. On the other hand, the tensile strength of wrought iron is rarely beyond 22 tons, and that of cast iron cannot be estimated at more than 8 tons per same unit of area. It is for this reason that cast iron is so very unsuitable a material for constructive purposes where heavy strains of a tensile nature are brought upon the design. On the other hand, owing to its very high resisting power to a strain of compression, it is admirably adapted for situations where those strains are likely to occur. It is, therefore, peculiarly well suited for the arch type of construction, where compressive strains prevail. Not only is it well adapted for erections of this character, by reason of its great compressive strength, but the large masses in which the various parts can be obtained, the fewness of their number, and the ease and simplicity with which they can be put together, render it an exceedingly convenient material for the purpose. Instead of the almost infinite number of rivets that are required to put together even the smallest specimen of a wrought-iron girder, a few bolts suffice to make the necessary joints, and a vast amount of time and labour is therefore saved. Moreover, in consequence of its greater inherent weight, it is better able to resist vibration, and can dispense with the large quantity of extra stiffening material which is a *sine quâ non* with wrought-iron structures, whether they be roofs or bridges.

The theoretrical distribution of the strains upon the arch is also more favourable to the employment of cast iron in that than in any other form of construction. In the flanges of a horizontal girder, whether lattice or solid-sided, the strains accumulate gradually from the abutments or supports A B to the centre C, so that the sectional area of the flanges must be increased in the same direction. This increase of area is obtained in the manner represented in fig. 1, where additional plates are riveted

FIG. 1.

FIG. 2.



together according as the centre of the flange is reached. In the arched form, on the contrary, the strains, which are all of a compressive nature, increase from the centre C towards the abutments A B, but the difference is not so considerable as in the horizontal girder. The gradual increase of the strain in the arch is shown in fig. 2 by the uneven thickness of the black line. Practically, the advantage arising from this theoretical distribution of strain in the arch, so far as cast iron is concerned, is that the only difference that need be made in the sectional area of the girder or rib can be effected by increasing the depth towards the springing. Those who are aware how important it is that large castings should not depart from a symmetrical form will at once recognize the merits of the arch. Girders for cast-iron arches are generally termed ribs, as they are placed much closer together than is the practice in ordinary bridge construction. They are usually of the section represented in fig. 3, their depth being increased, as already mentioned, from the crown towards the springings. Owing to the greater thickness of their web, they are much stiffer than a plate or lattice girder, and require no absolute stiffening, although they must be braced together in order to give the whole structure the requisite amount of rigidity. A distinction should always be observed between stiffening and bracing. The former has reference, strictly speaking, to only particular parts of a structure; the latter to the whole. There are two simple equations which will suffice for determining the strains upon a cast-iron arch, and the quantity of metal required at the crown and the springing. To consider the crown first. Suppose we have to ascertain the quantity of material, or the sectional area required at the crown for the rib of a cast-iron arch which has a span of 80ft., and a rise of 8ft. Let the share of the whole weight upon the bridge, which is carried upon one girder, be equal to W, equal to 20 tons. Putting L for the span, R for the rise, and S for the strain at the crown, we have

FIG. 3.

$$S = \frac{W \times L}{8 \times R} = \frac{20 \times 80}{8 \times 8} = 25 \text{ tons.}$$

As cast iron will safely stand 6 tons of compressive strain per square inch, we obtain the number of square inches in the rib at the crown by dividing the strain by that number. Consequently, the number of inches of metal equals $\frac{25}{6} = 4{\cdot}166$. Calling S^1 the strain at the abutments, or springing of the arch, we have

$$S^1 = \frac{W}{2}\sqrt{1 + \frac{L^2}{16 \times R^2}}$$

Substituting in the equation the values of the letters, we have

$$S^1 = 10\sqrt{1 + \frac{80 \times 80}{16 \times 8 \times 8}} = 10\sqrt{1 + 6{\cdot}166}$$

= 27 tons in round numbers. It is thus seen that in a small example there is very little difference in the amount of the strain at the crown and the springing. In this present case, the practical method of proceeding would be to make the area of the rib equal to five square inches, and the section and depth will thus be constant throughout the whole arch. Where the bridge is of large dimensions, the depth will have to be increased, as may be seen by a glance at either the Victoria Bridge carrying the London, Chatham and Dover Railway over the Thames at Battersea, or at the new Blackfriars Bridge, which is rapidly approaching completion. The erection of one new bridge over our metropolitan river draws attention to the fact that many others are wanted, and there is not the slightest doubt but that with spans of about 150ft. they could be more economically constructed of cast iron than of other material. The foundations also might be "got in" in a less troublesome and costly manner than what appears to be the organized method for road and street bridges. In fact, there is no reason why we should not have a road bridge over the Thames, handsomely, solidly, and securely built, altogether of cast iron, both piers and superstructure.—"Building News."

Legal Intelligence.

ROLLS COURT.

JULY 22.

CROSSLEY *v.* DIXON.

THIS was a suit instituted by the plaintiff, the well-known carpet manufacturer, to obtain certain royalties from the defendant in respect of a loom for the manufacture of carpets used by him, and which loom the plaintiffs alleged infringed four patents held by the plaintiffs for distinct portions of looms used in the manufacture of carpets. A large model had been constructed and placed in the yard of the Rolls Court for the purpose of enabling the Master of the Rolls to understand the points at issue between the parties.

His Lordship now decided that none of the details of the defendant's loom which the plaintiffs alleged to be an infringement of their patents were in fact so; but that, in his lordship's judgment, they were mechanical results which, although similar to the plaintiffs', had been arrived at by different processes. He therefore dismissed the plaintiffs' bill with costs, except certain costs occasioned by an improper contention on the part of the defendants.

Sir R. Bagallay, Mr. Jessel, Q.C., Mr. Grove, Q.C., Mr. Cracknall, and Mr. Aston appeared.

COURT OF CHANCERY.

JULY 26.

(Before Lord Justice GIFFARD.)

IN RE HORSLEY AND KNIGHTON'S PATENT.

IN this case, the Master of the Rolls a few days ago made an order to expunge an entry from the register of patents. An appeal was presented. The counsel for the respondents took the objection that the Patent Law Amendment Act of 1852, the 38th section of which gave the Master of the Rolls the jurisdiction to expunge the entry, gave no right of appeal from his decision.

Lord Justice Giffard held this to be a fatal objection, and dismissed the appeal with costs.

Sir R. Baggallay, Q.C., and Mr. Cracknall were for the appellant; Mr. Jessell, Q.C., Mr. E. Rodwell, and Mr. T. Aston, were for the respondent.

VICE-CHANCELLOR'S COURT.

JULY 27.

(Before Sir R. MALINS.)

PULVERMACHER *v.* HAMMOND AND ANOTHER.

This bill, filed some time ago for an injunction to restrain the defendants from advertising in a manner which might in any way interfere with the plaintiff's business, now came on to be heard as a short cause, the principal defendant (Barrow) having consented to a decree (not to contain the words "curative belts") for a perpetual injunction. The plaintiff not pressing for them, no order was made as to costs.

Mr. T. A. Roberts appeared for the plaintiff, and Mr. Graham Hastings for the defendants.

Correspondence.

STEERING GEAR.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—At the opening of the New Alexandra Dock, at King's Lynn, a notice of which appeared in your journal of the 9th instant, there was some delay experienced in getting the steamer "Mary" alongside the middle starth, owing to her steering, which was not of the best. This is a state of things that should not exist, and a disgrace to a maritime nation, in an age of improvements. Yet, it is very remarkable what little importance seems to be attached to the steering gear in general use in the mercantile marine of this country. Lloyd's specification for classing ships enters into every detail requisite for a first-class vessel, such as spars, cordage, anchors, cables, &c., but no allusion whatever is made to steering gear, leaving this most important matter entirely to the fancy of owners or builders. It may be supposed that when the lives and safety of thousands of human beings, sent daily adrift between a few boards, to buffet the winds and battle with the wild waves of the mighty deep, that great care and precaution would be taken to keep the helm of our ships under quick and proper control, and that the best appliances would be adopted for such a purpose. This, however, is not the case, and nine-tenths of the collisions and accidents that happen at sea is owing to bad steering from the slow action of the apparatus used, and the vessel not answering her helm as readily as she may be made to do if more care is taken in so vital a matter as the steering gear. Take the "Mary" as an instance; she is a splendid twin-screw steamer, of the best construction, and being a first-class boat, was engaged for the express purpose of carrying Royalty, yet it would appear that this vessel, so superior in every thing, seemed defective in the most essential matter—her steering; and it is frightful to think what the result may have been had a sudden squall overtaken her at that particular moment, when her steering was found defective.

It cannot be for want of inventive genius in this country that such a state of things exists; there are plenty of inventors, but as genius and poverty go together, no encouragement seems to be given to them, and it would appear that it is nobody's duty to test the inventions and improvements that are brought out, and to pronounce a judgment on the best and safest. At a recent conference of the Institution of Naval Architects, held at the rooms of the Society of Arts, there were exhibited plans, diagrams, and models of three patented inventions of steering gear; one was hydraulic, one steam, and the other Skinner's vertical screw. The two former were good, and lost nothing in power, but seemed rather complicated and expensive machinery, and more fit for large vessels of war than for merchant ships. The vertical screw, however, seemed compact, and well adapted for any size of vessel, from a yacht to the "Great Eastern" herself. It was said to be powerful and quick in action, and suitable for steam as well as sailing vessels. These inventions, which may be considered the latest and best improvements in steering, do not seem even known to builders. They have been fitted by Government on some of H.M. ships, and nothing further is heard of them, because the Admiralty don't publish reports of their tests for the benefit of the public. Messrs. Miller and Co., it would appear, are fitting Skinner's vertical screw to a 3,000 tons steam ship, of 400ft. long, just launched by them at Liverpool. This, it is true, will be a good test of this particular apparatus; but why don't H.M.'s Government or Lloyd's give every invention of this kind a fair and good trial, and report the result to the world at large, as a guide to shipowners of the safest gear to adopt for their vessels? At present it would appear that shipowners leave the matter in the hands of shipbuilders, and these latter use whatever gear is cheapest and most profitable to themselves; in the meantime, collisions will happen, and accidents take place, and while owners get compensation from insurance companies, no notice is taken of the sacrifice of human life. This is a serious subject, and demands much consideration from the Government, the merchants, and the shipbuilders of one of the first maritime nations in the world.—I am, Sir, yours, &c., M.

THE GUNPOWDER PILE DRIVER.

SIR,—Frequently finding valuable information in your magazine, which appears regularly at the reading room of our Franklin Institute, Philadelphia, I send you a few lines descriptive of a new pile driver lately invented by our townsman, Mr. Thomas Shaw. The machine consists of a scaffold and ladder mounted on rollers for change of position, and the top stayed at the cardinal points by ropes similar to most other perpendicular rams. The hammer is a cylindrical mass of iron, having a projecting tongue or plunger in its lower end, moving in a perpendicular frame of the same metal, which frame may be widened or narrowed by a lever in the hands of the operator, in order either to grasp or let fall the hammer. The head of the pile is covered with a heavy cast-iron cap, which sits firmly in its place without fastening upon the log, having in its centre a carefully bored chamber, into which the plunger of the hammer fits airtight. A very small charge of gunpowder, made up in a cartridge, is thrown into the chamber, and is exploded by the compressed air acted on by the plunger at the moment when the hammer strikes the upper surface of the cap; which explosion greatly promotes the driving of the pile, and also throws up the hammer preparatory for the next blow.

The following report of a recent experiment will give a more definite idea of the invention. The spot selected was on the premises of Mr. J. W. Lynn, the celebrated shipbuilder, adjoining the United States Navy Yard. The soil consists of layers of foundry slag, waste bricks, coal ashes, and live oak and yellow pine chips, some 12ft. or 15ft. thick, resting on the tough clay of the original Delaware Marsh. The operations were conducted by the inventor (Mr. Shaw), with a skilled assistant to supply the cartridges, in the presence of Chief Engineer Wood, United States Navy, and other officers of the Service, Mr. Lynn, and other builders and machinists.

Height of scaffold, 48ft.; length of pile, 32ft.; diameter of pile, 1ft.; weight of hammer, 675lb.; weight of cap, 1,200lb.; size of plunger, 4½in. by 18in.; average drop of hammer, 9ft.; charge of gunpowder, ½oz.

A speed of twenty strokes per minute was soon attained, the pile sinking perceptibly with varying progress from 3in. to 8in. at a blow. The following comparisons were next made:—1. With the hammer falling 8ft., no gunpowder used, and the plunger not allowed to enter the air chamber, the pile sank 13-16ths of an inch. 2. With same fall of hammer, no gunpowder, but the plunger going home in the air chamber, the pile sank 1 10-16ths inch. 3. With same fall of hammer, and a cartridge of ½oz. of gunpowder exploded by the plunger, the pile sank 4 5-8ths inches.

No. 1 exhibits the full effect of a common ram of similar weight. No. 2, by the compressed air shows just double the former result. While No. 3, showing explosion combined with the former forces, gives nearly six times the effect of No. 1.

Under a quite moderate speed of strokes, the pile sunk 10½ft. in 1¼ minute. The speed was next raised to that of forty-eight strokes per minute, a part of which time the controlling lever was not used, the hammer slipping up and down between the guides, timing itself by the supply of cartridges alone. After the pile had been driven down some 30ft., the cap was lifted, and the head of the log was found uninjured and almost without an indentation. Without stoppages for measurement and conference, the pile could have been driven home in three minutes.

This trial had been preceded by various others, each producing a similar general result. All parties present expressed high gratification at the performance of the machine, and full confidence in the value of the invention, the rapidity and perfectness of its execution being pronounced unprecedented.

It exhibits explosive force, hitherto almost intractable, so completely under control that the inventor has determined to apply the principle to the heaviest metal forging, a practical test of which may be expected soon.—I am, Sir, yours, &c.,

Philadelphia, July 10. HECTOR ORR.

WHEEL-MOULDING MACHINE.

SIR,—Referring to the description of Scott's moulding machine for toothed wheels, in the number of the MECHANICS' MAGAZINE for July 9, I beg to inform you that such a machine as that described was patented thirty years ago, the patent being dated October 11, 1839, and granted by the Prussian Government to the inventor, Mr. T. G. Hofman, the leading engineer of Ruffer's large machine manufactory at Breslau. Since that time up to the present, this machine has been in practical use in the foundry of the above-named establishment, where it may be seen at work every day.—I am, Sir, yours, &c., KAYSER,

Breslau, July 20. Civil Engineer.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscriber of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

RECEIVED.—W. L.—B. and S. M.—H. T. and Co.—H. O—F. C. S.—J. H.—R. T.—H. B. M.—E. G.—A. H.—G. W. H.—R. B.—J. T.—R. E.—O. and Co.—E. and G. T.—H. R. and Co.—B. J.—W. E.—R. M.—W. T. H.—J. K.—H. B. S.—B. D.—H. W.—J. T. and Co.—A. and F.—C. B. N.—F. W. B.—G. and A.—R. P.—G. W. H.—R. T.—E. G.—J. P.—M. B. W.—J. T.—R. S. F.—J. F.—M. G.—R. E.

Naval, Military, and Gunnery Items.

THE daring attempt which was made early in the morning of the 19th inst. to abstract an iron chest, containing upwards of £4,700, from the paymaster's office on board Her Majesty's ship "Octavia," at that time lying alongside the south jetty of the Portsmouth Dockyard, formed the subject of a lengthened investigation before the Portsmouth magistrates on Monday and Tuesday. The prisoners were committed for trial.

ACCORDING to "Punch," the following is something which requires to be overhauled:—The Naval School at New Cross has, according to the "Standard" (which appears to Mr. Punch to have made out its case), "succumbed to Bumbledom." A master who set himself against dirt, bullying, and, worse, who protected the young boys, and caused all to wash themselves, has been forced to resign. One defender of the Bumbles writes that "boys will be boys." We beg pardon, they are boys, and will be men, and it is to be wished that they should be humane and clean men, and not cruel and dirty men. But Bumble perhaps thinks that a naval cadet ought to be a naval cad.

WE have to announce the death of Vice-Admiral G. H. Seymour, C.B., and M.P. for the county Antrim, who died at Hampton Court Palace on Monday morning. He had only recently attained the rank of vice-admiral. The gallant officer prominently distinguished himself as commander of the "Wanderer" in the Yang-tse-Kiang in 1842; and after almost continuous employ was appointed captain of the "Cumberland," January 7, 1851. His commissions bore date as follows:—Lieutenant, June 27, 1838; commander, January 29, 1842; captain, May 27, 1844; rear-admiral, March 23, 1863; and by the recent death of Sir William Bowles he had been removed to the list of vice-admirals.

A MAN, who years ago was one of the notorieties of Europe, has just died at Brussels. His name is Cantillon. He was a serjeant in the Old Guard of Napoleon, and fought through the campaign of Waterloo, quitting the army after the capture of Paris. After the execution of Ney and Labedoyere thirty or forty of the non-commissioned officers of the Old Guard conceived the idea of assassinating Wellington, whom they regarded as the chief author of the evils that had befallen France. About the end of December, 1815, a pistol shot was fired at the duke in the streets of Paris, but missed him. Cantillon was suspected and tried, but the proof was not clear, and he was acquitted. It was to this man Napoleon left a legacy of £400, which was paid in 1823.

A SEVERE accident occurred to some Naval Reserve men last week on board Her Majesty's ship "Dauntless." It would seem that a party was practising at target exercise under the gunnery instructor, and, after some rounds had been fired, a gun went off just as the rammer was being withdrawn. One man had an arm broken, and was severely scorched; another was contused and slightly burnt, while a third was so much injured about the arms by the flame, that a fatal result is feared, although, strange enough, not a bone was broken. The man who served the vent had his thumb split, and it would from this circumstance seem that he must have done his duty too "tenderly."

UPON the subject of naval courts martial the "United Service Gazette" observes:—We have never felt or expressed any great confidence in the verdicts of these courts. Still, when their decisions are such as suit our purposes, we reserve to ourselves the right of quoting them. A court martial dismissed a young officer from his ship for nearly getting her on shore. He did not get her on shore, but saved her in the nick of time. Another officer got his ship on shore and did it completely, and was told not to do it again. We think that the punishment in the former case was extravagant, and cannot understand why the victim of it is thrust aside to half pay, while the hero of the other court martial is in active employment. The "Eclipse" scarcely touched the ground. The "Cadmus" stuck hard and fast. It may not have been the fault of anyone, but the lenient judgment which applies to one case may surely be applied to the other.

Miscellanea.

REPORTS from Lake Superior state that the production of iron in that district has been larger than ever this year.

FIFTY-THREE women clerks have just been placed on duty as copyists in the Patent Office, Washington—salary, 700 dols. per annum.

THE next annual congress of the Social Science Association is appointed to take place at Bristol, from September 29 to October 6 next.

ON Tuesday last the Royal Archæological Institute closed its summer meeting at Bury St. Edmunds, which has passed off successfully. Next year the institute will meet at Leicester.

THE Alabama and Chattanooga Railroad will, it is said, develope inexhaustible coal fields of a quality superior to any yet discovered south of the Ohio; it is also expected to open out vast deposits of hematite iron ore.

A CATALOGUE of the Royal Berlin Museums has just appeared in the English language under the title, "Special Catalogue of the Royal Museums at Berlin." It is divided into two parts, one for the old, the other for the new museum.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending July 24, was 3,809. Total number since the opening of the Museum, free daily (May 12, 1858), 1,608,693.

LARGE flocks of seagulls were off the estuary of the Tyne and the coast of Northumberland last week. A large number of them were young birds, and as they are now strictly preserved during the close time, they came quite in shore and were undisturbed, as no one dare fire a gun at them.

ABOUT 28 miles of the track of the New York and Newhaven Railroad were relaid last year with steel rails. About 2,800 tons of steel rails have been ordered for the renewal of the track during the present season; when these are all placed on the track, about one-half of the entire road will be laid with steel.

THE congress of directors of railways traversing Germany and Austria, or terminating in those countries, held its first sitting at Vienna last week. These companies possess 77 lines, the total length of which is about 18,750 miles, and the whole cost 250 millions of pounds sterling. Their rolling stock is composed of 6,000 locomotives, and more than 200,000 carriages, transporting annually 100 millions of individuals, and 1,500 tons of goods.

THE value of the exports of steam engines made from the United Kingdom has somewhat revived this year, having amounted to May 31 to £645,771 as compared with £569,953 in the corresponding period of 1868, and £778,038 in the corresponding period of 1867. The value of the steam engines—probably for the most part locomotives—sent to Russia has largely increased this year; on the other hand, there has been a rather material decrease in the case of British India.

A LARGE eagle, belonging to what is known in Scotland as the class Erne, was captured near Loch Tay last week. The bird, which measures 5ft. 4in. from top to tip of the wings, is a beautiful specimen of its class. It had been enjoying capital sport on the preserved waters of Loch Tay during a fortnight, and many unsuccessful attempts had been made to secure it. It was, however, ultimately taken in a trap skilfully set in a fallen tree at the western corner of the loch. No bait was used in the trap.

THE number of visitors to the South Kensington Museum during the week ending July 24, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,821; Meyrick and other galleries, 2,632; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,865; Meyrick and other galleries, 243; total, 16,561. Average of corresponding week in former, years, 11,881. Total from opening of Museum, 8,641,437.

A JOURNAL of Lyons says:—In the districts of Revermont and Bugey very great complaints are made of the multitude of foxes, and in the Cote-d'Or of wolves and boars. At Vievy three penetrated the other night into a stable and destroyed 25 sheep. Great ravages had also been committed by those animals in the neighbouring communes. The wild boars make their appearance in troops; in one place as many as 10 were found ravaging a field of wheat. The farmers have the greatest difficulty in driving them away.

WE understand that arrangements have been made to enable working men to visit the Amsterdam International Exhibition at a very small outlay, and that by giving a fortnight's notice they may obtain excellent accommodation for a shilling a day from the exhibition committee. Baron Mackay has been in correspondence with the "Working Men's Club and Institute Union" on the subject, and the secretaries of that Society will afford every information.

AT the closing ordinary general meeting of the Royal Institute of British Architects, held on Monday, June 21, 1869, Mr. William Tite, M.P., President, in the chair, the following recommendations for membership were read:—John Edward Cox (Associate), of Warblington, Havant; Herbert Williams (Associate), of 52, Old Broad-street, E.C., as Fellows. H. Joseph Williams, of 52, Old Broad-street, E.C., as Associate. The following gentlemen were then balloted for, and declared to be duly elected:—James Tollery (Associate), of 13, Angel-court, Bank, as Fellow. Benjamin Adkins, of Faversham; John S. Nightingale, of 21, Parliament-street, S.W. as Associate.

THE Royal Horticultural Great Show at Manchester was the third experiment made by the Society of holding an exhibition in the provinces, and has been most successful. On the high-priced days the ground was thronged, and when the payment was reduced to a shilling vast numbers of operatives might be seen poring over ferns and vegetables, which were represented by such a collection as has seldom been seen even in the metropolis. The bands of the 1st Life Guards and the 68th Regiment performed selections of operatic and other music.

WITH the means of locomotion at present in use a tour round the world may be made in 80 days. The itinerary is as follows:—Paris to New York, 11 days; to San Francisco (rail), 7; Yokohama (steamer), 21; Hong-Kong (steamer), 6; Calcutta (steamer), 12; Bombay (rail), 3; Cairo (steamer and rail) 14; Cairo to Paris (steamer and rail), 6; total, 80. Of that immense route, the only portion on which steam is not used is about 140 miles between Allahabad and Bombay, and that interruption will shortly cease, as the works for completing the railway are being carried on actively.

DURING the progress of the works at Suez, M. Lesseps despatched a number of engineers to the Desert of Sahara to ascertain the exact difference between the level of that tract of country and the surface of the Red Sea. The surveying party on their return reported a declivity of 27 metres, which is presumed to become still greater further inland. M. Lesseps now suggests the possibility of letting the waters of the Red Sea into the interior of Africa by means of a canal, and thus converting this hitherto almost unexplored desert into a large inland lake, which would afford easy access to the fertile countries surrounding it. We wonder how the natives will like this.

THE British Museum has been enriched by the purchase of a bronze, found at Foggia, in Southern Italy, which is as remarkable for its beauty as for its almost perfect preservation and unusual size. Its subject is a naked boy at play. His little body all life and excitement, he lifts up two fingers of his left hand, while the outspread right is idden behind his back. The game he is engaged in is that of mora (tocca), as played in Italy to this day, the selfsame game which the Romans called micatio, and which in mediæval Germany was popular under the name of "Fingerlein snellen." It is played in different ways, the most common being that the two partners suddenly and simultaneously open their clenched fists and stretch out a certain number of fingers to be guessed and called out at once by the adversary.

THE amended bill to prohibit for a limited period the importation and to restrict and regulate the carriage of nitro-glycerine has been printed. So long as the Act shall be in force, it shall not be lawful for any person to import into any part of the United Kingdom from any other country or place any nitro-glycerine for any purpose whatever, or to sell any nitro-glycerine for any purpose whatever, except to workmen in his employ, or to carry nitro-glycerine along any public highway, canal, river, or navigation, except with such licence and under such regulations as provided in the Act. The penalty is a fine not exceeding £100, or 12 months' imprisonment. It is proposed that the Act shall come into operation on October 1 next.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—6
BUILDINGS AND BUILDING MATERIALS—13, 33
CHEMISTRY AND PHOTOGRAPHY—3984, 9, 22, 33
CULTIVATION OF THE SOIL, including agricultural implements and machines.—None.
ELECTRICAL APPARATUS.—23
FIBROUS FABRICS, including machinery for treating fibre, pulp, paper, &c.—3968, 3979, 3980, 3991, 2, 10
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—3978
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—3969, 3972, 3986, 3990, 7, 15, 16, 18, 34
GENERAL MACHINERY—3982, 3985, 1, 12, 19, 27
LIGHTING, HEATING, AND VENTILATING—3974
METALS, including apparatus for their manufacture—3971, 3983, 4, 18
MISCELLANEOUS—3970, 3973, 3978, 3, 5, 8, 17, 21, 24, 26, 29, 32
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—3977, 3939, 11
SHIPS AND BOATS, including their fittings—3988, 25
STEAM ENGINES—None.
WARFARE—3981, 3987, 14

3968 J. H. JOHNSON, Lincoln's Inn-fields. *Paper tubes*. (A communication). Dated December 30, 1868.

This consists in making, and marking with the maker's name or trade mark, or other letters, figures or devices by mechanical means, and in a continuous succession the paper tubes employed in the spinning of wool and other fibrous substances. These tubes are also produced in duplicate simultaneously. The paper from which the tubes are manufactured is fed into the machine in the form of a continuous band or strip, wound on a reel, and the duplicate mechanism is disposed in reverse directions, in order to admit of the strip being severed or cut into portions or sections, of such shape as will form when rolled or coiled tapered tubes, with a minimum waste of material. The strip previously cut to the requisite width and wound on a reel or roller is first conducted between a pair of printing rollers, or beneath a stamper, from which it receives the manufacturer's or other name, trade mark, or other device. The strip passes thence between a pair of feed rollers, having an intermittent motion for enabling the subsequent operation of cutting or severing to be performed. This operation consists in cutting or severing a length from the strip, of the form of a parallelogram of equal sides, by means of a rectilinear knife. Each parallelogram serves for the manufacture of two tubes, for which purpose it is divided by a second knife, called a "guillotine," into two parts of the same size, and of a trapezoidal contour, the shortest sides of which subsequently form the narrower ends of the tapered tubes, the non-parallel sides corresponding to the length of the tubes. In order to obtain the geometric development of the tube or truncated cone, it is necessary to cut in the form of two concentric arcs the two parallel sides of the trapezium, which is accomplished either by a pair of curved shears or by a cutting punch.—Patent completed.

3969 W. WINTER, Leeds. *Sewing machines.* Dated December 30, 1868.

This consists, first, in constructing the needle bar or the spindle which carries the vertical needle hollow, and by preference cylindrical, with a slot hole for the insertion of the lever by which the required reciprocatory motion is given to it, and in applying within the said hollow spindle a spiral spring to press upon the lever, and thereby produce an elastic connection, and prevent undue wear by the action thereof. Second, in constructing the bushes or bearing for the said needle bar with a longitudinal slit, so that by a set screw applied externally, the said bush may be contracted, and thereby compensate for wear of the parts working in contact. Third, in the employment of a boss cam for working the feed motion, whether such motion be above or under the material to be sewn, and in the application to the side of said cam a stud with friction roller (by preference of steel) to operate a lever for lifting or working the foot or holder.—Patent completed.

3970 C. MONESTIER and J. BANG, Paris. *Impermeable paper*. Dated December 30, 1868.

This consists, first, in manufacturing imitation collars, cuffs, shirt fronts, petticoats, curtains, and other similar articles, of vegetable parchment, or of paper, or pasteboard, that has partially undergone the process of conversion into vegetable parchment, and which is called impervious paper; and, second, in the manufacture of lace paper and that kind of material usually composed of cotton cloth or

other similar fabric, placed between two layers of paper, pasteboard, or paper pulp. The inventors have also discovered that by treating sized paper by the same process, a slight layer of vegetable parchment is deposited on the surface of the paper, for as the acid cannot penetrate the whole thickness, the effect of the treatment is limited to the surface only. By this process, therefore, they obtain a paper only partially converted into vegetable parchment, a material less stiff, brittle, and transparent, but one which is perfectly waterproof, and can safely be washed in water with soap, alkalies, and other cleansing substances.—Patent abandoned.

3971 G. DAVIES, Manchester. *Separating ores.* Dated December 30, 1868.

This relates to a patent, dated April 4, 1868, No. 1146. The apparatus now comprises a long horizontal hutch or cistern, constructed of wood, bound with iron straps, and formed with a semi-cylindrical bottom. This hutch is divided into four jigging compartments by transverse ends and partitions, and there is also a similarly separated end compartment to receive what passes over the last jigging compartment. A vertical partition extends along the upper parts of the compartment, and on one side thereof there are a set of plungers or pistons to produce the jigging motion of the water, whilst a series of sieves are placed on the other side. On the tops of the partitions, there are fixed a number of standards to carry a longitudinal revolving shaft, provided with fast and loose pulleys for a driving belt, and with eccentrics, which, by means of connecting rods, actuate the plungers. The eccentrics are adjustable on their shaft, so that the stroke of each plunger may be adjusted separately to suit the materials it acts upon.—Patent completed.

3972 P. and R. GORNELL, Blackburn. *Long collars.* Dated December 30, 1868.

This consists in constructing such collars with a bush or ring of brass or other metal at the upper end of such collars, so that, when worn, the bush or ring may be removed and replaced by a new one, instead of having to replace the whole long collar by a new one, as heretofore.—Patent completed.

3973 H. H. BIGG, Wimpole-street. *Artificial legs.* Dated December 30, 1868.

The distinguishing features of this invention are, first, the construction of the ankle joint, and the mode of connecting the foot to the lower part of the leg. This improved mode of constructing the ankle joint admits both of antero-posterior and lateral or horizontal motion; second, the peculiar means of constructing, attaching, and moving the knee joints.—Patent abandoned.

3974 E. J. NONALHIER, Paris. *Ventilating.* Dated December 30, 1868.

This consists of a tube which is surrounded or surmounted by another tube extending round the whole or a portion of the length of the first tube, and provided with a number of vanes, deflectors, or curved or other plates, which, together with radial or other partitions or plates, form air ducts or passages into and through which air is drawn, and whence it passes away round the top or end of the inner tube. The parts may be fixed so that the apparatus may be conveniently used in all requisite aspects, positions, or places. To prevent counter currents, a spherical or otherwise shaped cowl or a dome-shaped cap may be pivoted or hung at the top of the outer tube, so as to take the required positions or inclinations for this purpose.—Patent completed.

3975 J. GEDGE, Kent. *Gas apparatus.* Dated December 30, 1868.

The inventor proposes to construct the gallery or support for the glass with jointed in lieu of rigid arms, as hitherto practised, that is to say, he makes the three or more arms which radiate from the ring movable simultaneously, in such a manner as to permit the glass to pass upwards on the pendent. This is done by jointing the arms either at their junction with the ring or in their centres, such joints being so formed as not to permit the outer portion of the arm to pass downwards lower than a horizontal position, and the globe or glass will be passed on to the pendent from below the pressure of its lower portion against the arms of the gallery will cause them to rise and assume an angular or even a vertical position, thereby permitting the glass to pass up the pendent shaft until its rim shall have passed above the ends of the arms, which will then fall into a horizontal position and form the gallery or support. The glass is then secured thereon at its rim in the ordinary manner; one or more jets may be used, the nipples being fastened on small elbow-shaped burners, projecting from the pendent, and the effect of heat or smoke on this pendent or shaft may be obviated by the use of one or more small reflecting plates, flat, curved, or of any suitable shape, fitted on to the said shaft a little above the burner or burners.—Patent abandoned.

3977 C. DE BERGUE, Strand. *Tramways.* Dated December 31, 1868.

In these tramways the sleepers are in cross section, and of a solid construction, presenting externally a T shape or H shape, or channelled or recessed shape, or corrugated shape, or a hollow construction, presenting externally a circular shape or elliptical shape, or D shape, or wedge shape, or triangular shape, or square shape, or a rectangular shape, or a shape in accordance with any geometrical regular or irregular figure, or whether solid or hollow, or a shape approaching any of those mentioned. The list also includes half or part sleepers of any approved form, that is to say, divided as to their length, but intended to be used in pairs or partsfastened together at their adjoining ends to form combination sleepers, so that although each rail may bear almost entirely on one such half or part, yet a partial support as to inclination or canting may be received from the other such half or part. The list also includes sleepers generally in accordance with any of the foregoing definitions, but having the ends varied or adapted to constitute a chair or seating for rail sometimes constructed with ribs or narrow bearing places in pairs at each position of support, and sometimes finished with provision for holding rails; and, lastly, it includes any combination of the said constructions and shapes.—Patent completed.

3978 W. E. GEDGE, Wellington-street. *Sweetmeats.* (A communication). Dated December 31, 1868.

The ingredients combined in this novel sweetmeat or comfit, and their approximate proportions, are, sugar, 7oz.; marmalade of any kind, 1oz. 12 drachms; rum or other spirit, 11 drachms; and extract of meat 11 drachms.—Patent abandoned.

3979 W. R. LAKE, Southampton-buildings. *Spinning machines.* (A communication.) Dated December 31, 1868.

This consists, first, in a flyer, so arranged as to be suspended directly from a hollow tube, the latter being provided with a pulley or wheel or equivalent device, by which the flyer and tube are caused to revolve, the yarn to be twisted, whether single or double, passing through the hollow tube, and the flyer and tube with its whirl being entirely independent of the bobbin spindle. Second, in the combination of the bobbin with a swinging adjustable rail, in such manner, that when the said rail is let down for "doffing" the bobbins, it can be swung out from under the flyer, and thereby facilitate and expedite the operation of doffing.—Patent completed.

3980 W. R. LAKE, Southampton-buildings. *Separating fibres.* (A communication). Dated December 31, 1868.

This relates to a machine for picking hair from hair ropes. It consists of a revolving tube through which the rope passes, and of an arm projecting from one end of the tube, and carrying a spool or roller, the axis of which is at about right angles with that of the tube. The rope is wound once around the spool which revolves around the axis of the tube, and thus the twist is taken out of the rope as it is being drawn forward. That end of the rope which is not being acted upon is attached to a swivel hook which is secured to a sliding block. The latter is guided on a wire or other rail, so as to move towards the machine as the rope becomes shorter. Second, in the construction of the aforesaid swivel hook or clamp. The same is made of two spring plates, the ends of which are bent towards each other, and are pointed so as to grasp the rope between them. A sleeve sliding on the plate presses them together, so as to clamp the rope when the sleeve is on the front end of the plates. When the rope becomes so short that it cannot be held by the hook, the latter is drawn against the tube, and thereby the sleeve is pushed back on the plates, so as to release the rope.—Patent completed.

3981 F. A. K. W. VON OPPEN, Pall Mall. *Firearms.* (A communication). Dated December 31, 1868.

This relates to pistols or rifles which have a revolving chambered breech or cylinder capable of being loaded from the front, the principal object of the invention being to produce a device by which a revolver adapted for the use of loose ammunition can at a small cost be so changed that cartridges having primed metallic shells may be used. It has for a further object to provide a revolver with means for the ejection at will of the cartridges or empty cases from the chambers of the rotating breech, and also to provide against accidental discharge of the weapon. It has for a further object the reloading of the empty cartridge shells, by an attachment which can be placed upon and used with the arm, and also the provision of a suitable cartridge for the said arm.—Patent completed.

3982 A. BARCLAY, Kilmarnock. *Air pumps.* Dated December 31, 1868.

This relates to an arrangement or construction of air pumps, whereby a vacuum may be formed in a receiver or other vessel of any assigned degree of completeness or perfection, which consists as follows:—The lower part of the air pump, barrel, or cylinder is connected by a pipe or passage to an upright hollow column, the column terminating at the upper end in a cup or receptacle, the latter being provided at its junction with the hollow column with a valve. At a distance below the cup or receptacle hereinbefore mentioned, a branch proceeds from the hollow column, by which the hollow column communicates to the receiver, a suitable valve and valve seat being placed between the hollow column and the receiver. In the cup or receptacle at the head of the hollow column, an overflow is formed, and situated immediately below the overflow is a reservoir communicating with the barrel or cylinder of the air pump, the communication, however, being closed by valves except at the time, as hereinafter set forth, when it is requisite that the communication should be open. The required quantity of mercury is placed in the barrel or cylinder, the communicating pipe or passage, the upright hollow column, and the branch leading to the receiver as well as in the reservoir in connection with the barrel or cylinder.—Patent completed.

3983 B. SAMUELSON, Banbury. *Iron and steel.* Dated December 31, 1868.

The objects are, first, to produce a superior quality of wrought iron from pig or cast iron containing phosphorus, silicon, sulphur, or other impurities. Second, to prevent sand, slag, and other extraneous substances from running into the moulds when iron or steel is melted in a reverberating furnace and run into moulds. According to the first part of this invention, the inventor proposes to purify pig or cast iron in a reverberatory furnace, having, by preference, what is ordinarily known as a cinder bottom, and being by preference suspended for the convenience of discharging its contents. This purification may be effected by such appropriate re-agents as will dispense with the necessity of using a blast, and the purification is carried on until the iron approximates as to its per centage of silicon to that contained in ordinary refined iron, during which operation a large proportion of the other impurities will also have been removed. The purified iron is then tapped out, and subsequently puddled in a puddling furnace. By this method, it is easy to produce from cast iron containing one and a-half per cent. of phosphorus wrought iron, in which the ultimate per centage of phosphorus shall not exceed 1-10th to 2-10ths per cent. The metal when purified or refined is run into moulds, and the ingots or blocks are, whilst still hot, removed from the moulds and placed in a furnace, by preference situated in close proximity to the puddling furnace, where they are removed in a heated state for the purpose of being puddled.—Patent completed.

3984 D. SPILL, Hackney. *Compounds containing xyloidine.* Dated December 31, 1868.

This relates to the production of materials or compounds containing xyloidine, and consists in the admixture of xyloidine (or that product which results from the action of a mixture of sulphuric and nitric acids upon ligneous or vegetable fibre) with animal, fish, vegetable or mineral oils oxidized or otherwise, such for example, as vegetable or mineral tar, lard, oil, cod liver oil, camphor oil or liquid camphor, linseed oil, or heavy coal oils, or with mixtures of the same together with the admixtures of other ingredients, such as paraffine, camphor, resins, fat, wax, india-rubber, gutta-percha, or Balata gum, or mixtures of the same, so as to produce a material or materials which may be employed either alone or in conjunction with pigments or other inert bodies, for the production of a compound, which may be applied for useful purposes in the arts, such for example, as for moulding into forms such as dishes, bowls, tubing, covering telegraph wire, or for rolling into sheets, or otherwise for spreading either upon or between fabrics or otherwise, or for the coating, or for the preservation of metals, wood, and other bodies.—Patent completed.

3985 S. M. WELLS, Barnsbury. *Wrenches.* (A communication). Dated December 31, 1868.

This consists, first, in an adjustable S wrench, composed of two parts morticed and tenoned together, in the manner hereinafter described, the mortice being formed in the exterior, and the tenon in the interior jaw of each part. Second, in combining with the two morticed and tenoned parts of the S wrench, a right and left hand screw and thumbpiece to operate it, thereby contracting or extending the jaws much more speedily than when a single screw is employed. Third, in the construction and combination of the two parts composing the S wrench, each being provided with a tenon and mortice, arranged on opposite ends, so that the plane of movement of the two parts shall be in the direction of the length of the wrench, and at right angles or transversely to the jaws. Fourth, in the combination in an adjustable S wrench of scales upon the shank with the right and left hand screw and thumb piece, so that the wrench may serve the purpose of callipers for measuring iron or nuts.—Patent completed.

3986 H. E. NEWTON, Chancery-lane. *Washing machines.* (A communication). Dated December 31, 1868.

This consists chiefly in the use of a perforated hollow cylinder, inside which is formed a cage consisting of horizontal rods or bars. A door is formed in the perforated cylinder and cage, so that the articles to be washed may be placed in the cage, which, with the whole cylinder, is mounted in a suds box. An oscillating motion is imparted to the cylinder, so that the articles are constantly moved or stirred about in the cage and exposed to the action of the hot water and steam.—Patent completed.

3987 W. E. NEWTON, Chancery-lane. *Firearms.* (A communication). Dated December 31, 1868.

This consists in constructing a metal-cased cartridge with a hollow flange around the rear end of its metal case. The hollow flange projects backwards parallel, or nearly so, with the length of the cartridge, and has an external circumference no greater than the rest of the case. This flange contains the fulminate priming, which may be fired by the hammer of the firearm striking through a suitable opening provided in the rear of each chamber of the cylinder.—Patent completed.

3988 R. GRIFFITHS, Flint. *Screw propellers.* Dated December 31, 1868.

This relates to improvements by means of which the blades of screw propellers may be carried to assume such a position as will offer the least possible resistance to the passage of a vessel through the water at those times when the propeller is not employed in moving the vessel. The inventor forms the blades of the screw propeller separately from the boss, and with shanks, which are inserted in suitable sockets formed in the central boss, so that the blades can be turned from an angle or "pitch" suitable for propelling the vessel to such an angle, in relation to the axis of the screw shaft, as will present the least resistance to the passage of the vessel through the water when the propeller is stationary. Into the shank of each blade the inventor inserts a key, which serves to connect the blade to the boss. These keys are secured in the shanks of the blades, and project through apertures formed in the sockets in the boss for the reception of the shanks of the blades, such apertures being so formed as to allow of the partial relation of the shanks of the propelling blades within the sockets, one end of such aperture stopping the keys and blades at the "projecting pitch" and the other end at the "sailing pitch." In addition to the keys above named, he forms the collar of the shank of each blade with an angular edge, and secures rings upon the boss after the shank of the blade is inserted, so as to hold the angular edges upon the collars of the shanks, and so assist in securing them to the boss.—Patent completed.

3989 T. GIBSON, Newcastle-on-Tyne. *Buffers.* Dated December 31, 1868.

A movable hollow piston, to which the buffer head is connected, is accurately fitted within an iron shell or cylinder, fixed to the carriage or waggon or other situation on railways, and a convex steel disc is inserted in the piston between a packing plate and collar, and suitably packed. Another convex steel disc is inserted in the shell or cylinder, such disc being set on a turned shoulder and packed and being held in its required position by the ordinary backing plate to which the flange of the shell or cylinder is fixed.—Patent completed.

3990 J. SEELIG, Bunhill-row. *Ventilating hats.* Dated December 31, 1868.

The inventor makes the body of the hat of muslin, calico, or other fabric, covered with merino, silk, or other ordinary material used for covering hats, and he forms therein one or more ventilating holes or orifices at the back and front in such a position as to be covered by the hat band. He also forms in the body of the hat other ventilating holes at a part or parts above the hat band. The ventilating holes are preferably in many cases protected by eyelets. He forms an improved tip for the hat of net buckram, galvanized wire, or other open mesh or large gauge fabric, which is rendered sunproof and waterproof (without interfering with the ventilation through the same) in the usual mode in which such fabrics are treated for the purpose, or the tip may be made of a reticulated fabric, which he calls air cloth, and which consists of wool and cotton threads woven, of about the same gauge, mesh, or shed, or net or buckram, each thread being compound, that is to say, consisting of a number of component threads, each of which is first separately twisted, and then the whole are twisted together. The air cloth or the tip made of air cloth is made waterproof and sunproof, as above described. The tip is covered with merino satin, or other covering material ordinarily used in the covering of hats. There are no holes formed in the tip, as the net, buckram, air cloth, or wire permits the passage of currents of air through the whole tip.—Patent completed.

3991 C. SHALES, Westbourne Grove. *Shuttles.* Dated December 31, 1868.

This relates to improvements in the shuttles used for tatting. The inventor makes the shuttle solid instead of forming it of two blades having a space between them, as above referred to, and at the centre of the shuttle he forms a slot or opening for receiving an ordinary spool or reel

containing thread. This spool he places on an axis or pin fixed to one side of the shuttle in a transverse position across the centre of the slot, on which pin the spool is free to revolve. One side of the shuttle, by which the spool is enclosed when in position on its axis, is made movable, either on a hinge or in any other way, or it may be detachable, to permit of the introduction of the spool, the side of the shuttle being secured in the closed position by entering a dovetail, groove or otherwise. This latter arrangement is also applicable to existing shuttles.—Patent abandoned.

1 J. HEAP, Lancaster. *Gearing.* Dated January 1, 1869.

This consists in a modification of a perpetual wedge machine. To make this apparatus applicable to the present purpose, the inventor arranges, modifies, and combines it with a wheel, drum, or speed pulley running loose on the shaft spindle or axis, to which the slow motion is to be communicated. The first modification and arrangement consists in the application of two internal toothed wheels of the same diameter or thereabouts, one of which has one, two, or more teeth more than the other. These two wheels are placed on the shaft spindle or axis, to which the slow motion is to be communicated, and with which they are concentric. One of the wheels is keyed on to the shaft spindle or axis, and the other is loose and is prevented from turning round by being attached to the framework of the apparatus. The wheel, drum, or speed pulley runs loose on the shaft, spindle, or axis, and has on its boss an eccentric which carries an external toothed wheel. This external toothed wheel gears into both the internal toothed wheels, and is, consequently, about as broad on the tooth as both of them together. The two internal toothed wheels, the external toothed wheel, and eccentric are so modified, constructed, and arranged as to be enclosed in the interior of the wheel drum or speed pulley, which is made hollow for that purpose, and which receives motion from the first mover.—Patent abandoned.

2 T. SINGLETON, Lancaster. *Yarn apparatus.* Dated January 1, 1869.

This consists, first, in certain improvements in sizeing machines and operations connected with them, and also in the management of the size. In the sizeing machines having cone drums, the inventor drives the drums with one or more india-rubber straps coupled together in one or more places, by which means the strap or straps can better adapt themselves to the angle of the cones. The india-rubber band is cut in the middle into two straps, but leaving one or more parts uncut to form the coupling. In all sizeing machines he attaches to each end of the first dividing rod a weight or spring for the purpose of drawing the rod forwards towards the point of the separation of the yarn, so that when there is a hard and matted place in the yarn the rod can recede and prevent breakage.—Patent abandoned.

3 S. LYONS, Finsbury. *Designs on cloth.* Dated January 1, 1869.

The inventor forms the selvages thereof into ornamental borders by weaving or printing the same with emblematical or other devices or designs (in imitation of the various games or sports), upon tinted or coloured grounds, in such manner that the fabrics when made up into trousers shall represent upon the dark coloured stripes or borders a device corresponding to the game or sport for which the trousers aforesaid are to be worn; for example, as a device for cricketing, it is preferred to employ small vignettes disposed throughout the entire length of the border (pourtraying a cricketer at the stumps with bat and ball) in relievo upon a dark ground obtaining in like manner corresponding results, with varied designs and shades of colour, emblematical of boating, yachting, racing, hunting, sporting, fishing, velocipeding, football, or similar sports or games.—Patent abandoned.

4 W. M. WILLIAMS, Sheffield. *Puddling furnaces.* Dated January 1, 1869.

This consists in fettling or lining the beds and sides of puddling furnaces with crude or prepared oxide of manganese or manganese ore, either as the chief ingredient of the fettling or as an addition to the oxide of iron or other material which is or may be employed for fettling or lining the said furnaces. In using crude or native oxide of manganese, or manganese ore without admixture with other solid, the inventor selects an ore which, when pulverized and moistened, will form a plastic or pasty mass, and which, when heated, will harden and adhere firmly to the sides and bottom of the puddling furnace. For this purpose the cheap oxides containing a considerable proportion of iron are best suited, provided they do not also contain other impurities, such as sulphur and phosphorus, which would injure the iron in the furnace.—Patent completed.

5 G. SMITH, Strand. *Clipping horses.* Dated January 1 1869.

This consists of a band saw or a band knife arranged or fixed for use somewhat differently, so as to be applicable to the various uses indicated below. For the purpose of clipping horses and sheep the inventor forms a small case of iron, and by a barrel spring turns a centre spindle, on which is also fixed a pinion wheel, which drives two pinions right and left of the first pinion. On the spindles of these outside pinions the inventor fixes pulleys for a band knife, which is to pass between a double comb; the double comb is roughed or barbed on the inside so as to detain the hair or wool; when the knife is brought forward, pressure is given to the hair or wool, and is thus cut. The knife band will be brass, copper, or leather with steel face or cutting part.—Patent completed.

6 T. GREEN, Leeds. *Boilers.* Dated January 1, 1869.

In place of employing inclined tubes passing across the firebox, the inventor places within the firebox of vertical boilers having internal fireboxes, as above described, a tube or tubes bent into coils rising one above the other from the bottom to the top, or any less intermediate space of the firebox, the upper and lower ends of the coil being connected to the annular water space of the boiler at or near its upper and lower ends respectively. By this means a greater amount of heating surface is obtained, with fewer joints to be made, and a more perfect circulation of the water in the boiler is obtained.—Patent completed.

7 T. GREEN, W. BURROWS, and R. TURNER, Leeds. *Casks.* Dated January 1, 1869.

The inventors employ a bush composed of two tubes, one of which fits within the other. Each tube has at one end a flange formed around it; the flange of one tube is to rest against the inside face of the stave, whilst the flange of the other is to rest against the outside face of the stave. The outer tube is made of a conical form, and to fit within the hole which is to be bushed. It may be of malleable cast iron or other metal sufficiently strong and tough; the inner tube or liner is made with parallel sides, and to fit within the smaller end of the conical tube; this inner tube or liner is made of a metal which will allow of its being expanded to fit within the conical outer tube.—Patent completed.

8 B. G. GEORGE, Hatton Garden. *Almanacks, &c.* Dated January 1, 1869.

The inventor introduces the use of flock, especially such as that employed by wall paper manufacturers for enriching the appearance of the show card and giving it a novel aspect. For this purpose he prints upon paper in or with adhesive cement or varnish the pattern or design of letters or ornaments or the device which he desires to produce, and he then applies flock thereto, and these operations he repeats as often as desired until he produces a highly raised surface in flock. Or, reversing this process, the inventor raises the ground with repeated coatings of flock, and thus produces a sunken device; or he first prints a design in water colours, after the manner of wall paper printers, or in the ordinary method of oil printing, and to certain parts of the design he applies, as above described, as many superimposed layers of flock as may be required. The combination of the two methods greatly enhances the beauty of the work.—Patent completed.

9 F. PERRY, Fenchurch-street. *Preserving substances.* (A communication). Dated January 1, 1869.

The inventor employs a solution hereinafter distinguished as solution No. 1, which is a solution of bisulphite of lime in water, with the specific gravity of 1·020 to 1·080. Under some circumstances it will be found convenient to substitute a solution of bisulphite of lime and magnesia, which compound may be formed by saturating acid sulphite or bisulphite of lime with carbonate of magnesia, or by saturating acid sulphite or bisulphite of magnesia with carbonate of lime, or the admixture of solutions of sulphite or bisulphite of lime with sulphite or bisulphite of magnesia in combining proportions. The specific gravity of the solution may be between 1·020 and 1·080, or even greater when required for the purpose of bringing up the strength of solutions which have been weakened by repeated use. The inventor sometimes forms another solution by dissolving the ordinary gelatine in boiling water, using from 1 part to 2 parts of gelatine in 10 parts of water, and adding 10 parts of solution of either of the solutions above described. In determining the proportion of gelatine to be used, he increases such proportion in the inverse ratio to the decrease of the temperature of the place at which the solution is to be applied, using a larger proportion of gelatine when the temperature is low and a smaller proportion of gelatine when the temperature is high.—Patent completed.

10 M. HENRY, Fleet-street. *Combing fibres.* (A communication). Dated January 1, 1869.

In this machine a variable number of rollers are used. Supposing there be two pairs of rollers, each pair consisting of an upper and under roller, the under rollers being driven by a steam engine or other prime mover, and the upper rollers acting as pressure rollers working by friction, and suppose that between two pairs of rollers there be two combs passing through a sliver lap or hank of fibrous material passed between the rollers. Now, if one pair of rollers revolves while the other pair remains stationary, the revolving pair will seize the fibrous materials and readily draw them through the teeth of the combs, provided that when the rollers begin to move, the ends of the filaments shall not have reached the point of contact between the cylinders, as these would otherwise have held them, or if the other roller were not pressed down at that moment upon the corresponding roller, but just rested thereon so as to allow the filaments beyond the point of contact to pass freely towards (when drawn by) the first pair of rollers. If these rollers continue working until the ends of the filaments are drawn quite from between them, all the filaments which that pair had laid hold of or drawn out will remain between the pairs of rollers.—Patent completed.

11 J. H. JOHNSON, Lincoln's Inn-fields. *Velocipedes.* (A communication). Dated January 2, 1869.

The front and rear wheels are held together by a curved central bar, the front end of which forms a socket for the reception of the vertical forked spindle carrying the steering wheel, whilst the hinder extremity is forked and connected freely with the main axle upon which the two driving wheels are made fast. Near to the upper end of the vertical forked spindle is jointed a horizontal propelling lever provided at its rear end with swivel cross handles for imparting a reciprocating motion thereto in a vertical direction, whilst a counter weight is attached to the front overhanging extremity of the propelling lever to assist in lifting it after each depressing or downward stroke. The swivel cross handles are coupled by rods to corresponding cross arms fast on the vertical spindle, so that by turning the handles more or less the steering wheel will be also turned to a greater or less angle, thereby altering the course of the vehicle, and enabling it to be steered with facility. A connecting rod descends from the propelling lever, and is jointed to a pawl lever working loose on a horizontal shaft, such shaft having mounted loosely thereon two ratchet wheels, the teeth of which are in reverse directions. To one of these ratchet wheels there is secured a chain wheel which drives by means of a pitch chain or chain pinion fast on the driving axle.—Patent abandoned.

12 S. SMITHSON, G. SENIOR, and J. INMAN, York. *Taps and valves.* Dated January 2, 1869.

This relates to taps or valves for regulating the discharge of fluids, and consists in constructing the valve either so as to have a surface of cork fixed to it, or to press upon a surface of cork fixed in the seating, and to be capable of moving to or from the seating without turning on its axis, being attached to the spindle by a screw thread, and the spindle is formed to fit a conical gland so as to avoid packing. By turning the spindle in one direction the valve will be removed from its seating to open the passage, and by turning it in the other direction it will be pressed upon it, and thereby close the passage.—Patent abandoned.

13 A. BATCHELOR, Brockham. *Bricks, &c.* Dated January 2, 1869.

This consists in so constructing an ordinary kiln of circular or other form with fireplaces, that the heated air and products of combustion may be made to pass first upwards around the bricks or other ware stacked in the kiln, and then being made to descend through and amongst the bricks may either be allowed to pass direct into the chimney (which may be constructed in the centre thereof or at a distance from it, the passage leading thereto being at or near the bottom of the kiln), or they may be conveyed by suitable flues into one or more other kilns of similar structure, which, as hereinafter explained, may be made to work in conjuction with it.—Patent completed.

14 W. S. RAWBONE, Birmingham. *Firearms.* Dated January 2, 1869.

This consists of a strong tubular plug of a size and figure proper to accurately fill up the cartridge chamber of the barrel. The base or rear end of the plug is provided with a rim or flange similar to the rim or flange of a breech-loading cartridge. The rim or flange of the plug, when the plug is placed in the barrel, occupies the depression at the mouth of the barrel in the same way as the rim or flange of the breech-loading cartridge.—Patent abandoned.

15 A. CARTER, Birmingham, and C. R. E. GRUBB, Dalston. *Candlesticks.* Dated January 2, 1869.

This consists in providing candlesticks with a receptacle for containing a supply of matches, so that should the candle be extinguished the means of reigniting it may be always at hand. In making flat candlesticks, for instance, the inventors provide a suitable box or receptacle for matches at the bottom of the central stem or holster, the latter being mounted upon it, and the box being fixed at the centre of the tray forming the base of the candlestick. This box, which may be of any convenient shape, they prefer to provide with a hinged lid at one or both ends, while the lid may be inclined, and also carry the friction surface. By means of this improvement, the danger of dropping matches when carried loosely on the tray, as heretofore, is obviated, whilst the means of igniting the candle are always at hand; other kinds of candlesticks may also be similarly provided with a match receptacle placed in the foot or pedestal.—Patent completed.

16 J. G. TONGUE, Southampton-buildings. *Bookbinding* (A communication). Dated January 2, 1869.

This relates to a previous patent, dated January 10, 1868 (No. 98). Two adjustable tables are provided, one to hold the unstitched and the other the stitched parts of the volume or volumes, and it is preferred to cause the one table to rise as the other falls, by means of rack and pinion or other suitable mechanical contrivances, so that as the parts or folds are transferred from one to the other, the surface of the paper upon the tables will be maintained at the same relative height. The saw nicks or binding cuts in the folds are placed over the needles or instruments where the thread is to be laid, part of the fold resting upon the stitched work or table, and the other part, according to this invention, upon an auxiliary table, which is called the assistant folder. There are also fingers or instruments provided termed "lifters and folders," which are below the fold when laid over the needles, and after the thread is laid by the thread carrier. The "lifters and folders" are so actuated as to first raise the sheet up, the needles at the same time moving from between them, the "assistant folder" also at the same time turning over the fold, and at the right moment the "lifters and folders" move forward again between the needles and complete the turning over of the fold, the "assistant folder" at each movement pressing down the folded parts and the table upon which they rest sufficiently to make room for the next fold to be laid over the needles. At the same time that the fold is turned over as above described, guides or thread carriers are caused by suitable mechanism to pass a thread at the back of one or both of the end needles, and these guides are so actuated as to pass the thread first from right to left and then from left to right at the back of the needles, the guides being mounted upon a sliding rod and actuated by a pin and a shifting cam surface.—Patent completed.

17 M. WOLFSKY, Pilgrim-street. *Locks, &c.* Dated January 4, 1869.

This consists in a lock or fastening in which there are two plates of metal and a catch or clip which is fixed to the outer plate, and works over a plate on a centre having a movement to the right and left. There is a small steel spring under clip, and a plate is placed over the other plates, the circular opening in the same being immediately over the clip. The three plates being thus arranged, the plate being moved a little on one side, the flap is folded down in the usual way, the circular opening in upper, plate closing over the metal pin, the catch or clip on the plate is moved slightly, so as to be caught by the head of the pin, and thus becomes fastened. To open the lock, the outer plate has merely to be moved to the right or left and the catch is released.—Patent abandoned.

18 H. A. BONNEVILLE, Sackville-street. *Steel.* (A communication). Dated January 4, 1869.

This consists, first, in introducing fuel or fluxes, either in a gaseous, liquid, or solid form, into the molten metal in a converter, by suction (in contradistinction to the process heretofore known where fuel has been introduced by force) in such a manner that the quantity of fuel as well as the quantity of air introduced into the molten metal can be regulated, and the requisite amount of heat for refining the iron or for converting it into steel can be produced. Second, in subjecting the fused metal in the converter to a forced current of air in combination with the current produced by suction, or by a vacuum apparatus, in such a manner that the advantages of the vacuum process are combined with those of the forced air process, and that the action of the air on the fused metal can be regulated with greater facility and nicety than it can if either the vacuum process or the forced air process is used independent of the other.—Patent completed.

19 W. A. BIDDELL, Birmingham. *Chandeliers, &c.* Dated January 4, 1869.

This relates, in the first place, to a new mode of forming or ornamenting chandeliers, lamps, lustres, and other articles. This is effected by attaching, either by fusion or by other suitable means, various ornamental devices made of pressed glass, either plain, coloured, or inlaid. The inventors produce their ornamental pressed glass suitable for this purpose by colouring or inlaying the interior of the glass after being taken from the moulds.—Patent abandoned.

20 P. J. PEEL, Leeds. *Valves.* Dated January 4, 1869.

The sliding portion of these improved valves are divided longitudinally into two parts, which, when the valve is

closed, are pressed apart from one another and against their seats; when the valve is to be opened the two parts are drawn towards one another and away from their seats, and the slides can then very readily and with very little friction be drawn up into the chamber. To thus force the two parts parts away from one another when the valve is closed, a wedge is employed which is formed with a stem passing up through a stuffing box in the top of the chamber; the stem of the wedge has a screw thread cut upon it, either to work into corresponding portions of threads cut in the two halves of the slides, or the screw of the stem may work into a thread cut around the sides of a hole formed through the wedge itself; in either case, the wedge may be forced down between the parts of the slides by turning the stem.—Patent completed.

21 J. M'KENNY, Dublin. *Horses' shoes.* Dated January 4, 1869.

This consists in the application of an artificial additional frog or solepiece of india-rubber, leather, or other suitable material, to the shoes or feet of horses or other draught animals, the solepiece bearing on the ground when in action for the purpose of bringing the natural frog into action, instead of the wall of the hoof sustaining the whole of the pressure, as is the case in the ordinary mode of shoeing, and which is the reverse of the natural arrangement of the foot. This solepiece also serves as a protection to the foot. The inventor attaches the solepiece to the foot in any suitable manner, such as by means of pins projecting from the solepiece taking into corresponding holes in the inside of the shoe, so as to allow of the ready application and renewal of the solepiece, or it may be otherwise secured in position.—Patent completed.

22 J. MAJOR, Haddington Trigg, and W. WRIGHT, Middlesex. *White lead.* Dated January 4, 1869.

This consists, essentially, in the employment of a chamber capable of being opened and closed as desired, composed of slate, glass, marble, or of other materials not acted upon by either of the hereinafter mentioned acids, and of any convenient dimensions according to the production desired. Within this chamber are suspended or deposited a number or series of sheets of lead, which are by preference rolled or otherwise shaped or perforated, with a view to expose as large a surface as possible to the action of the vapours and the atmospheric acid hereinafter referred to, which are introduced into the said closed chamber after the lead has been placed therein.—Patent abandoned.

23 H. A. BONNEVILLE, Sackville-street. *Plating.* (A communication). Dated January 5, 1869.

This relates to a new and improved process for coating all sorts of articles with gold, silver, platinum, zinc, and all other such metals or mixtures of metals as may be beaten into sheets between the gold beaters' skin in the usual way. Like coatings may be effected upon silken, woollen, cotton, flaxen, hempen, or other thread, and upon the textile materials made of such thread, without losing anything of their suppleness, and at the same time imparting to them a metallic brilliancy. Preparation for the gold coating:—Ochre or oxide of iron not calcinated, and perfectly purified by a washing, is mixed with painters' varnish made of linseed oil boiled with litharge or oxide of lead. This varnish must be perfectly pure and clear. The mixture is crushed in a mill or on a marble slab, by adding from time to time some good oil of turpentine, called American oil of turpentine. To this mixture is added, for every 500 grammes of matter or substance, 150 grammes of painters' varnish of the finest quality, 30 grammes of old mordant varnish, slow in drying, like that used in a fresh state to make typographical ink, and 45 grammes of oil called East Indian oil, and of cobalt resin diluted in painters' varnish. The whole is then intimately mixed by crushing on a marble slab or in a mill. The mixture is next subjected, in a glazed gritstone vase, to the action of a moderate heat, until it attains such a consistency as to form threads between the mass and the end of a stick steeped into it on being withdrawn. The mixture is then allowed to cool, and when required for use it is diluted with pure and rectified oil of turpentine in such a quantity as to avoid soaking and drenching the articles or objects to be ornamented.—Patent completed.

24 L. HANNART, Clerkenwell. *Types, &c.* Dated January 5, 1869.

This consists in making a long pattern or trough in wood or other suitable material or substance with several separate letters thereon or therein, placed at suitable distances asunder, for the purpose hereinafter stated. The pattern, when cast from sand, the inventor places on a planing machine, and planes all the sides true and to a gauge. This done, he cuts or divides the casting crosswise by a circular saw or other suitable means, so as to separate the letters, which are then ready to be set up by the printer, each piece being as near as may be of the same size, so that when set up they may present a flush surface.—Patent completed.

25 S. BATEMAN, Paris. *Paddlewheels.* Dated January 5, 1869.

This consists in placing round the wheels for moving vessels and other floating bodies movable paddles consisting of two parts united together, one part placed beyond the axis of oscillation. Relatively to the centre is the paddle properly so called. It carries a joint at its outer end, the second part placed between the axis of oscillation, and the centre of the wheel has also a joint at its inner end. Each paddle is jointed to the following one by a connecting rod passing from the inner joint of one paddle to the outer joint of the other, or by any other suitable means.—Patent completed.

26 W. PROSSER, Lancaster. *Oils, &c.* Dated January 5, 1869.

This consists in the purification, bleaching, and saturation of certain animal and vegetable oils, also of gums and resins, as well as of such liquids as oil of turpentine, spirits of turpentine, and methylated spirits, by means of ozone, whereby much time is saved and greater purity obtained than by the methods at present in use. For this purpose the inventor treats the oils, such as raw or boiled linseed oil, calve's foot oil (otherwise called neat's foot oil), cod liver oil, castor oil, olive oil; also such gums as gum aniline, gum copal, gum caori or Australian gum, amber, and gum sandarach; also methylated spirits, spirits of turpentine, and oil turpentine with ozone.—Patent completed.

27 E. W. and J. VOCE, Salford. *Rotary fans.* Dated January 5, 1869.

This relates to the construction of rotary fans, such as are used for the production of currents of air for ventilation and for various manufacturing purposes, and has for its object the increase of the amount of blast produced. The improvements consist principally in providing the casing or shell which surrounds the fan with two or more vents or discharge openings (in lieu of one only, as commonly employed), and in increasing the diameter of the central or inlet openings in a corresponding degree. In fans as usually constructed with, say, three vanes and only one vent or discharge opening, much air enclosed between each two vanes is carried round more than two-thirds of the interior of the casing uselessly before it is discharged at the vent, whereas by making three vents in the casing the wind raised between each two vanes is discharged immediately, and, consequently, about three times the volume of air may be propelled by a fan of the same diameter. In order to compensate for the rapidity with which the air is discharged, and to prevent "wire drawing," the inventor increases the diameter of the central or inlet openings in a corresponding ratio, so that their united area is somewhat in excess of the united area of the three vents or discharge openings.—Patent completed.

29 J. J. HAYS, King's Cross. *Peat.* Dated January 5, 1869.

This relates to improved machinery or apparatus for getting peat from the bog, to improved machinery for working and drying peat for fuel, and to improved modes of carbonizing peat. The machine employed for digging or getting peat from the bog consists of a drum fixed to a proper framing, and caused to rotate by means of a portable engine, either attached to the machine, though it may be separate therefrom. The drums are formed with inclined cutting segments that pare down the peat in thin strips or layers, which fall into the interior of the drum and are there triturated and thrown out on to endless bands or otherwise by rapidly revolving arms rotating round the axis of the drum but at a greater speed.—Patent completed.

30 J. BALBIRNIE, M.D., Sheffield. *Vapour inhaler.* Dated January 5, 1869.

This consists of a jar or other vessel provided with one or more necks or outlets and inlets, through which water and the medicated material are inserted, which are required to be inhaled in the form of vapour, as well as connecting tubes inside and outside, through which the air and vapours or gases find entrance and exit. The interior tubes may be of glass or any other suitable material, connected on the outside with the india-rubber tube or tubes of any other suitable flexible material. The entrance tube is provided with either a common pair of bellows or a force pump, or with one or more compressible balls, vessels, or reservoirs, which, when worked or compressed, force air through the water contained in the jar or vessel, continuing to a mouthpiece or outlet, whereby the vapour may be inhaled directly, either with or without the contact of the mouth of the patient, or whereby the vapour may be caused to permeate the room of a patient, or surround his couch, chair or bed.—Patent completed.

31 J. H. JOHNSON, Lincoln's Inn-fields. *Sewing machines.* (A communication). Dated January 5, 1869.

A grooved wheel is employed, mounted loosely on the driving shaft, which by the upward motion of the treadle is brought into contact with a friction ring by means of a lever acting upon the same. A second and similarly grooved wheel acts in the same manner upon another friction ring upon the downwards motion of the treadles, the friction ring acting alternately upon a third wheel, which may be termed the driving wheel, situate between the two grooved wheels above referred to, and secured to or made fast on the shaft by a set screw, the parts being held together by means of adjustable collars upon the shaft.—Patent abandoned.

32 A. MASON, Craven-street *Oils.* (A communication). Dated January 5, 1869.

The oil to be distilled is placed in a closed still, and retained under pressure, whilst it is vapourized by means of steam blown into it. A pipe fitted with a throttle valve leads from the top of the still to a condenser, and this valve is kept closed until the desired pressure of steam has been obtained in the still. The valve on the pipe leading to the condenser is then gradually opened, and it and also a valve on the steam pipe is kept so adjusted that whilst the oily vapours and steam pass off the condenser, the desired pressure in the still is kept up by the inflow of steam. A pressure gauge is fitted to the still, so that the pressure in the still may be readily ascertained; it is preferred to employ a pressure of about 90lb. to the square inch, but this may be varied.—Patent abandoned.

33 G. SMITH, Manchester. *Consumption of smoke.* Dated January 5, 1869.

The inventor places at the back of the fireplace an additional bridge, composed of firebrick, or clay, or other suitable material, one end of which bridge rests on the firebars a short distance from their back ends, and its top part and other end project over the ordinary bridge, so as to leave a hollow space or air chamber the whole width of the fireplace communicating with the flue. By this arrangement, a current of cool air is introduced through the spaces between the back ends of the firebars to the hollow space or air chamber, from which it immediately comes in contact with the smoke and gases from the ignited fuel, and causes their instant combustion or conversion into flame.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated July 20, 1869.

2185 R. G. Fisher, Great George-street, Westminster. Improvements in rafters or bearers for roofs and floors.

2186 T. Holt, Rochdale, Lancashire. Improvements in apparatus for supplying and distributing disinfectants to closets and similar purposes.

2187 R. Olivier, Paris, Boulevard de Strasbourg. Certain improvements in the manufacture and construction of velocipedes and other similar vehicles.

2188 F. Fleming, Halifax. Improvements in driving straps or belts.

2189 R. Saunders, Croydon, Surrey. Improvements in buffing railway carriages, and in materials for the same, which is also applicable for springs generally.

2190 J. Rehse, Rupert-street, Middlesex. An improved system for the cure of stammering.

2191 J. E. Holmes, Buckingham-street, Strand. An improved mode of attaching or securing the free ends of wire and other ropes.

2192 W. Rose, The Mount, Halesowen, Worcestershire. An improvement or improvements in bearings for cast-iron rolls and shafts, and other rotating bodies made of cast iron.

2193 D. Trevor, Birmingham. New or improved apparatus for facilitating the production of photographic pictures, as also in the mounts or cases and fittings for the same.

2194 A. Stansfeld, Cornhill Chambers, City. Improvements in apparatus for propelling on land and in water.

2195 S. Hall, Swansea, Glamorganshire. Improvements in apparatus for moulding artificial fuel, applicable also to the moulding of bricks or building blocks.

2196 J. H. Johnson, Lincoln's Inn-fields. Improvements in dyeing and printing.

2197 H. Higgins and T. S. Whitworth, Salford, Lancashire. Improvements in machinery or apparatus for preparing, spinning, and doubling cotton, and other fibrous materials.

2198 G. Finnegan, Dublin. Improvements in machinery for sawing wood and stone, part of which is applicable also to other machines in which cranks are used.

2199 J. Ellison, Lisburn, Antrim. Improvements in the manufacture of rope, cord, and twine, and in the machinery therefor.

2200 H. B. Clark, Hyde Hall, Buntingford, Herts. Improvements in horse rakes.

Dated July 21, 1869.

2201 J. W. Larmuth, Pendleton, Lancashire. Improvements in means for connecting together the ends of the hoops or bands employed in the packing of cotton or other substance or material.

2202 J. Duke, Dover, Kent. Improvements in the construction of ships.

2203 J. Ogden, Manchester. A combined tap and filter for water and other liquids.

2204 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in marline spikes.

2205 W. Brookes, Chancery-lane. A new or improved mode of spinning carded wool on small cops ready for weaving.

2206 G. Follett, Bird-in-Bush-road, Peckham, Surrey. An improved waterproof facing for brick buildings.

2207 G. H. Ellis, Gracechurch-street, City. Improvements in rotary engines.

2208 A. H. Brandon, Rue Gaillon, Paris. Improvements in springs applicable to railroad or street cars and other purposes.

2209 G. Allibon, Rosherville Iron Works, Northfleet, Kent, and A. Manbre, Baker-street, Middlesex. Improvements in steam boilers.

2210 J. Boyd, Glasgow. Improvements in machinery for winding yarn or thread.

2211 A. C. Kirk, Glasgow. Improvements in apparatus for abstracting heat.

2212 J. H. Johnson, Lincoln's Inn-fields. Improvements in obtaining extract from hops.

2213 H. E. Newton, Chancery-lane. An improved brad driver.

2214 M. Tildesley, Willenhall, Staffordshire. Improvements in ties, clips, or fastenings for connecting the bands employed in securing bales of cotton, wool, and other products capable of being packed in a similar manner.

2215 A. M. Clark, Chancery-lane. Improvements in carding engines.

2216 F. M. Mole, Birmingham. Improvements in the manufacture of matchets and cutlasses.

2217 H. Knight, Ryde, Isle of Wight, Southampton. Improvements in instruments or apparatus for clipping horses and other animals.

2218 G. T. Abbey, Birmingham. Improvements in breech-loading firearms.

2219 J. Dawson and T. C. Fawcett, Leeds. Improvements in raising gigs.

2220 W. Currie, Edinburgh. Improvements in manufacturing and fastening the soles and heels of boots and shoes.

2221 W. H. Gosling, Calthorpe-street, Middlesex. Improvements in sewing machines.

2222 J. Rowley, Wells-street, Camberwell, Surrey. Improvements in the manufacture of certain coal tar products.

2223 W. H. Stone, Dulwich-hill, Surrey. Improvements in arrangements and apparatus for taking, counting, and recording votes by ballot.

2224 J. Green, Lisburn, Down. Improvements in the manufacture of ropes, cords, and twines, and in the machinery therefor.

2225 W. Warren, Jersey, Channel Islands. Improvements in ships' anchors.

2226 W. Bull, Waltham Cross, Essex. Improvements in velocipedes.

2227 W. A. Gilbee, South-street, Finsbury, Middlesex. An improved method of preserving the aromatic principle of hops.

2228 W. Dennis, Aldermanbury, City. Improvements in letter boxes, letter pillars, and such like depositories.

2229 W. K. Stock, Darlington, Durham. Certain improvements in looms for weaving.

2230 J. Walsh, Manchester. Improvements applicable to hoods for invalid perambulator and other vehicles.

2231 J. G. Wilson. Improvements in velocipedes.

2232 R. Boyd, Strand. Improvements in boilers and furnaces for producing superheated steam.

2233 T. Barnes, Whitehaven, Cumberland. Improvements in the treatment of coal for the removal of the sulphur compounds contained therein.

2234 J. Hayward, Eckland Bridge Works, near Penistone, Yorkshire. Improvements in the manufacture of combs.

2235 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in telegraph wire insulators.

2236 W. Laing, Carron Vale, Stirling. Improvements in washing machines, which improvements are also applicable to churns.

Dated July 23, 1869.

2237 W. Morris, The Avenue, Blackheath, Kent. Improvements in points or switches for tramways.

2238 W. Lincolne, John-street, Glasgow, and E. Chafer, Thistle-street, Glasgow. Improvements in the manufacture of artificial marble or stone, which improvements are also applicable in the manufacture of the beds of billiard and bagatelle tables.

2239 E. Stevens, Gordon House, Margate, Kent. Improvements in cooking, in the means and articles employed, suitable either for roasting, baking, toasting, or broiling.

2240 J. H. Johnson, Lincoln's Inn-fields. Improvements in the joints of pipes and tubes.

2241 J. H. Johnson, Lincoln's Inn-fields. Improvements in purifying alcohol and paraffin, and in the apparatus employed therein.

2242 G. T. Bousfield, Loughborough, Park, Brixton, Surrey. Improvements in the harness motion for power looms.

2243 S. Bishop, Great St. Helen's, Lancashire. Improvements in lamps for burning paraffin oil and other hydrocarbon oil.

2244 S. Cotton, Brookfield Foundry, Crumlin-road, Belfast. Improvements in machinery for hackling flax and other fibrous substances.

2245 W. Mort, Fenchurch-street, City. Improvements in refrigerating and freezing apparatus.

Dated July 24, 1869.

2246 I. Frankenburg and S. Phillips, Manchester. Improvements in the manufacture of hats and hat bo lies, or other coverings for the head.

2247 H. Greaves, Abingdon-street, Westminster. Improvements in the construction of the permanent way of railways and tramways, and the carriages and engines used thereon.

2248 W. Dredge and A. Stein, Buckingham-street, Adelphi, Westminster. Improvements in machinery for propelling carriages, part of which improvements are applicable to the transmission of power between shafts which are not parallel to one another.

2249 R. Pictet, Rue Jean Goujon, Paris. Improvements in the building of pumps in general, which permit their working without pistons and oil.

2250 J. Dewe, Toronto, York, Ontario. Improvements in mail bags, and in apparatus for fastening such bags, boxes, and other receptacles, where the security of a seal is required.

2251 C. L. Caldesi, Pall Mall East. Improvements in collars and false collars for horses and all other beasts of burden.

2252 G. N. Blane, Glasgow. An improved machine for morticing timber.

2253 R. G. Lowndes and J. Reid, Auldhousefield Mill, Renfrewshire. Improvements in the manufacture of textile fabrics.

2254 T. Auchincloss, Glasgow. Improvements in apparatus for heating feed-water, and for feeding the same to steam boilers.

2255 C. Y. Michie and G. W. Murray, Banffshire, Scotland. Improvements in pillars or standards for straining and supporting wires for fences and other useful purposes.

2256 W. Tongue, Brixton, Surrey. Improved means, apparatus, and furnaces for generating steam with economy in fuel.

2257 D. H. Brandon, Rue Gaillon, Paris. Improvements in metallic cartridges, their primers, and in the methods of manufacturing the same.

Dated July 26, 1868.

2258 W. Crossley and J. W. Swithenbank, Bradford, Yorkshire. Improvements in shuttles.

2259 T. Winter, Wiveliscombe, Somersetshire. Improvements in machinery for combing reeds.

2260 J. Holding and J. Eccles, Manchester. Improvements in looms for weaving.

2261 J. G. Rollins, Old Swan Wharf, Upper Thames-street, City. Improvements in combined reaping and mowing machines.

2262 J. Hyde, West Bromwich, Staffordshire, and J. Hyde, Warwickshire. An improved safety lamp for preventing explosions in collieries.

2263 E. Attenborough, Nottingham. Improvements in means and apparatus employed in the manufacture of looped or knitted fabrics.

2264 B. Hunt, Serle-street, Lincoln's Inn. Improvements in valves.

2265 C. Cochrane, The Ellowes, Upper Gornall, Staffordshire. Improvements in the preparation of iron ores for smelting, and in kilns or furnaces employed for that purpose.

2266 W. W. Roberts, Portland-road, Notting Hill, Kensington. Improvements in the construction of furniture and fittings, also in cornices, skirtings, walls, and ceilings of buildings generally, for the prevention of bugs.

2267 E. Ginder, Aston-juxta-Birmingham, Warwickshire. Improvements in breech-loading firearms.

2268 W. E. Tilley, Kirby-street, Hatton-garden, Middlesex. Improvements in coating or electro-plating iron, copper, brass, lead, and other metals, with tin.

2269 J. H. Johnson, Lincoln's Inn-fields. Improvements in the treatment of night soil and other waste products, and for the manufacture of manure therefrom.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1890 H. Trotman
1906 E. Leigh, H. T. Palmer, and W. E. Whitehead
1912 G. T. Bousfield
1935 J. Vavasseur
1941 H. A. Bonneville
1948 W. Weldon
1953 J. Orr
1957 J. Phillips-Smith
1965 T. and J. Bibby
1968 J. A. Birkbeck
1982 J. Robinson

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2108 W. Clark
2130 W. Spence
2956 M and R. M. Merryweather and E. Field

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following uumbers:—

755	2049	2062	2076	2084	2093	2101	2114
1716	2051	2066	2077	2085	2094	2102	2115
1905	2055	2067	2078	2087	2096	2105	2116
1992	2056	2068	2080	2088	2097	2108	2120
2028	2057	2069	2081	2090	2098	2109	2121
2041	2058	2070	2082	2091	2099	2111	2123
2043	2060	2071	2083	2092	2100	2112	2124
2047	2061	2074					

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," July 27, 1869.

748 C. H. Cooper
755 J. M. Napier
757 F. R. Aikman
760 W. Coxhead
766 G. Bray
786 W. A. Martin
795 W. R. Lake
802 W. Robertson
806 E. Roper and G. Shaw
811 J. J. G. Damitte, J. M. Agnellet, and H. D. Dubois
812 H. Claughton
819 C. F. Claus
832 A. B. Walker
834 J. Cox
838 A. Albini
840 J. Jack
844 W. R. Lake
848 F. D. Nuttall
850 H. Whitehouse and W. Probert
857 F. E. Newton
868 J. Combe and J. Barbour
871 M. Sigler
880 J. Macintosh
895 J. Nevill
898 T. Shakespear and G. Illston
903 E. Peyton
943 S. Firth
926 G. Hodgson, H. Bottomley, and E. Cockroft
962 A. Chambers
976 J. Livesey
977 J. A. and J. Hopkinson
1055 W. Powell
1105 O. Vivier
1152 J. H. Johnson
1201 S. Shaw
1252 S. Smith
1268 J. Crabtree
1416 L. Wray
1534 R. E. Keen
1599 A. Barclay
1600 J. Brittain
1760 G. Fenner
1900 W. R. Lake
1928 J. Brooke and J. Hirst
1970 W. E. Gedge
2013 T. Grahame
2033 T. Wilson
2028 G. Buchanan
2068 M. A. Muir and J. M'Ilwham
2070 G. A. Nowell
2087 W. R. Lake
2090 W. R. Lake
2106 J. Piret
2118 J. A. Horlick
2119 J. A. Horlick

The full titles of the 'patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 23, 1869.

226 R. G. Lowndes and M. M. Callum
229 J. Carr
241 J. Wilson
243 W. R. Lake
252 T. Vaughan and J. W. Smith
253 H. Barcroft
256 J. H. Johnson
261 C. Lungley
262 A. C. Pass
266 W. Brown and T. H. Garbutt
273 J. Box
278 J. Pickering
307 J. A. Limbert
317 A. E. Harris
332 C. E. Brooman
374 H. A. Bonneville
399 L. A. C. St. P. de Sincay
558 A. Jobson
637 J. Townsend and P. Forbes
1075 G. D. Hughes and A. H. Sellers
1469 J. Townsend and P. Forbes

Sealed July 27, 1869.

270 R. Blackbee
272 L. P. Hebert and L. A. Moulin
276 G. Hawksley
280 J. M'Donald
289 T. Whimster
302 A. S. Andrews
319 W. A. Smith
320 J. Bird
330 C. D. Abel
340 H. and J. Bryceson and T. H. Morten
347 R. W. Knowles and G. Green
389 H. J. Richman
390 F. Jenkin
408 W. Hilton
418 G. Broadhurst and J. Kershaw
428 G. A. Nowell
432 B. P. Stockman
477 F. Walton
699 J. P. Budd
728 T. Obach
737 F. O. Palmer
781 J. and W. Thomlinson
820 J. Ramsbottom
914 C. Marsden
928 N. Voice
1036 A. Helwig
1167 J. Vivian
1351 R. Saunders
1360 F. W. Kaselowsky
1551 J. Langham
1554 A. J. Dudgeon
1591 L. J. Crossley and R. Hanson
1694 J. A. Bindley
1730 G. W. Ley

LIST OF SPECIFICATIONS PUBLISHED

For the week ending July 24, 1869.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
571	0 4	3676	0 8	3730	0 8	3810	0 4	3837	0 4	3865	0 4
2086	0 4	3683	3 4	3731	0 8	3816	0 4	3839	0 4	3866	0 4
3578	0 8	3686	0 8	3754	0 6	3818	0 4	3840	0 4	3867	0 4
3579	1 4	3688	0 8	3763	0 8	3819	0 4	3841	0 4	3868	0 4
3590	2 10	3689	0 8	3792	0 4	3822	0 4	3842	0 4	3870	0 4
3610	1 2	3699	0 8	3793	0 4	3823	0 4	3844	0 4	3872	0 4
3614	0 10	3703	0 10	3794	0 4	3824	0 4	3846	0 4	3889	0 4
3618	0 10	3704	0 10	3795	0 4	3826	0 4	3849	0 4	3892	0 6
3637	1 2	3707	0 10	3796	0 4	3827	0 4	3850	0 4	3893	0 4
3660	1 10	3708	0 10	3801	0 4	3828	0 6	3851	0 4	3898	0 4
3661	0 6	3710	0 10	3802	0 4	3832	0 4	3859	0 4	3923	0 4
3663	1 0	3712	0 8	3803	0 4	3833	0 4	3862	0 4	214	1 0
3668	1 4	3722	0 6	3807	0 4	3835	0 4	3864	0 4	456	1 0
3670	0 8	3726	0 8	3809	0 4	3836	0 4				

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 6, 1869.

THE NEW CANADIAN PATENT LAW.

THE selfish spirit in which the Canadian Patent Law of 1849 and its successors was conceived has long been fully appreciated by British inventors, but it was confidently anticipated that advantage would have been taken of the opportunity created by the enactment of a new law, rendered necessary by the recent consolidation of the several provinces of North America into one Dominion by the Legislature, to reconsider the terms on which patents for inventions should be granted to non-resident inventors. The manner in which this opportunity has been used will be seen by reference to the text of the new Act, which we have been enabled to lay before our readers in our last and present issue. Under the Canadian law, which the Act that came into force on the 1st of July has repealed, patents were granted to inventors being subjects of Her Majesty and inhabitants of the province; and also to importers of inventions similarly qualified, provided they obtained a knowledge of the imported invention while travelling in a foreign country; but inventions of British origin, and those emanating from the United States of America were expressly excepted from protection.* To remedy the injustice of this provision of the law, the interposition of the Colonial Office was sought, the present Lord Chancellor (then Solicitor-General) undertaking, if we remember rightly, to lay the case before the Colonial Secretary. At that time, however, the relations between the Home and the Colonial authorities were on a very different footing from those which at present obtain, and the very idea of interfering with colonial legislation was considered the height of rashness. Nothing was, therefore, done to remedy the evil which the law inflicted upon British inventors, and they were left to buoy themselves up with the hope that a wiser and more Christian spirit would in time prevail, when Canada would, like other countries, invite to her shores the ingenuity of all nations. We have now, however, received the answer to our hopes.

Through a defect in the old law, means were found of making it apply, to a limited extent, to non-Canadians; and inventors of whatever country, on visiting the provinces, were enabled to obtain, through a personal application, protection for their improvements. But they are now effectually debarred from this privilege, as it is only residents of one year's standing who have the right to apply for protection under the new law. It would be difficult to speak too strongly of the folly of this provision; for, while acknowledging the benefits of patent law protection, the Legislature has taken the most effectual means of keeping new industries out of the country. This they have done with their eyes open, and in direct opposition to the advice of their Commissioner of Patents, as will be seen by reference to the letter of our correspondent, Mr. Fordred, published in the present number of the MECHANICS' MAGAZINE. In his letter, the writer gives extracts from the last annual report of the Minister of Agriculture (acting also as Commissioner of Patents) in reference to the contemplated alteration of the law, in which he urges the desirableness "of assimilating our laws more closely to those of the nations now at the head of civilization."

We are glad to find that the subject has already been noticed in the House of Commons. On Tuesday evening last, Mr. James Howard called the attention of the Under-Secretary of State for the Colonies to the terms of the new Canadian Law, with the view of obtaining from the Government an expression of opinion as to the policy of postponing the assent of the Crown to the Act, and thus giving an opportunity to the Canadian Legislature to reconsider its provisions. The answer elicited was eminently unsatisfactory; and it is possible that, through the speedy termination of the session, the opportunity for bringing pressure on the Colonial Office, while there is yet time to object effectually to the Act, will pass away. We trust, however, that this notice will not be without result, and that the Dominion of Canada may yet be saved from the effects of the suicidal policy to which it has clung for the last twenty years. As a mere matter of right, we think that British inventors might claim protection in Canada for their discoveries; for it seems monstrous that a local Legislature should be allowed to deny to their fellow subjects privileges which they enjoy in every other part of Her Majesty's dominions—to say nothing of all foreign countries where the policy of patent laws prevails. It is some satisfaction to know that this act of injustice cannot be maintained without the concurrence of the home authorities; and that public opinion is now far more efficient in keeping governmental departments up to their duties than when the unavailing attempt above referred to was made to teach the Canadians the obligations of common justice.

* This strange provision was first enacted in 1851. I appears to have been gradually developed, for in a rough copy, now before us, of the Bill of 1849, any discoverer, "whether a subject of Her Majesty or an alien," was to receive a patent; but in the progress of the bill through the Legislature these words were altered and the following clause was added, "Nothing herein contained shall extend to inventions or discoveries of any new or useful art, machine, manufacture or composition of matter . . . . discovered or used in the United States of America, or in any part of Her Majesty's dominions in America" (12 Vic. cap. 24, sec. 18). The law of 1851 altered the above proviso, making it extend to "any part of Her Majesty's dominions in Europe or America."

THE ROYAL AGRICULTURAL SOCIETY'S SHOW AT MANCHESTER.

THIRD NOTICE.

IN stone-dressing machines we have, besides that already described, an improved form of Golay's diamond millstone dressing machine, which was exhibited at the well-filled stand of Messrs. Bryan Corcoran and Co., of Mark-lane, London. One of the greatest difficulties hitherto experienced by even the most efficient workmen in working diamond millstone dressing machines has been in keeping millstones in "floor," or in a perfectly true plane. Obviously, no machine can be expected to keep a stone in absolutely true face if any part of the apparatus rests on or is dependent on the face of the millstone itself. Messrs. Corcoran have patented an improved machine on Golay's system, whereby these defects in existing machines are removed; and it appears to leave nothing to be desired where complete efficiency, accuracy, and simplicity are the objects in view. Anyone who can trace up a millstone spindle is able to set this machine ready for dressing, and when once fixed a child can work it, as the stone is brought to the absolute truth of the plane on which the diamond revolves, and not, as in other cases, the machine to the stone. This can be easily understood by the following explanation of the principles of its construction. The machine consists, first, of a short vertical spindle or cone, which is fixed in and having its sole bearings in the eye of the millstone; or, in the case of a bedstone, on the square of the stone spindle. The vertical spindle is fixed so as to carry a boss, from which radiates an arm set to the required angle corresponding to the drift. On the arm the tool carriage moves, producing the rectilinear cracks or cuts as desired on each land in succession. It will thus be seen that the apparatus is adjusted on the principle of the "Jack-stick," and when fixed for work cuts exactly as it is set to do, with a precision unattainable by any other known system. The diamond revolving in each quarter on an arbitrary plane is independent of the judgment of the operator. From the simplicity of the machine it can be made entirely self-acting.

Whilst on this class of machinery, we may refer to the stone-dressing machine for delf stone, freestone, marble, or granite, which was exhibited by the inventors and makers, Messrs. Coulter and Harpin, of Thongsbridge, near Huddersfield. The machine consists of a circular iron table, revolving at great speed, on which the flags or stones are laid. Across this is a reciprocating frame, carried on rollers, which can be raised to any height, according to the thickness of the stones on the table, and sufficiently high to work clear of the stones. The top flags or stones are put loosely into the frame, face downwards, and are carried backwards and forwards whilst the bottom flags are revolving, water and sharp sand being added. Thus great friction is produced, and two faces are worked at the same time. These machines are working in England and Scotland, and they are now becoming generally adopted for mason's work, dressing large blocks of ashlar, heads, sills, and steps on one or all sides, and in nothing is so great a saving effected as in the dressing of small wall stones for fronts of buildings. A quantity of these can be wedged together in the top frame face downwards, and they will be speedily reduced to a true surface.

Messrs. Ransomes, Sims, and Head, of the Orwell Works, Ipswich, had a fine show of ploughs, haymakers, thrashing machines, and various other machines and implements. Their newly patented Star haymaker is a great improvement upon the generality of these implements. In other double-action machines the tines have to be curved to throw the hay over; consequently, when used back-action (for turning the hay) they slip over the green parts, and a portion of the hay is not moved at all. In the Star haymaker the tines are straight, as the forward overhead action is dispensed with, and a quick back-action is introduced, which requires much less draught, and at the same time leaves the hay much lighter than when it is thrown over the machine. It is also fitted with a slow back-action for turning the hay, which brings all the green parts to the surface, and leaves it light and hollow, without breaking off the leaves and seeds. By a simple arrangement the tines can be set at any angle, to toss the hay more or less as required. The Star haymaker is strong and durable, without being heavy. It is fitted with a straight wrought-iron axle and wrought-iron travelling wheels, 4ft. 6in. high. The gearing is placed in the centre of the machine, and is protected by a close case, so that clogging is entirely prevented, and also all risk of breakage in passing through gateways. Both rake barrels revolve when turning at either end of the field, and make several revolutions after the horse stops, thereby clearing a space to start again. From the travelling wheels and rake barrels being both on the same axle, the work is done quite as well in a ridge and furrow field as on the level. The same firm have introduced some improvements in horse rakes. They fit them with large steel teeth, and mount them on wrought-iron wheels 3ft. high, which are capped to exclude dirt. The frames are of wrought iron, and are fitted with side levers, by which the teeth can be raised or lowered to suit the requirements of the work. The teeth can thus be set so as just to skim the ground and prevent any dirt being collected when raking hay or corn, or when required for raking weeds, they can be set deeper into the ground. A bar is attached to the frame, by which each alter-

nate tooth can be taken up when raking corn, to prevent any stones being collected. A seat, on an improved principle, giving ample leverage, has been designed. By this arrangement the driver can ride or walk at pleasure, as the ordinary hand lever is not removed when the seat is added. Messrs. Ransomes had also a very good specimen of enginework in a 14-horse power portable expansion engine, which was driving Messrs. Allen Ransomes' wood-working machinery. It worked very smoothly and with a great economy of fuel, being designed to meet the increasing demand for steam for motive power where coal is not indigenous and where wood is becoming scarce.

The great point of attraction at the Royal Agricultural Show was a large clock tower, in the centre of a square plot, between the implement ground and that set apart for animals and produce. In this tower, Messrs. J. Bailey and Co., of Salford, exhibited a turret clock, which was of special benefit to those who went to the Show. The many peculiarities of the clock we cannot now enter into, except simply to state that it seemed exceedingly strong and well made, and that the design of it is that known as R. Roberts, the celebrated inventor, and of which J. Bailey and Co. make a large quantity. It may here be mentioned that Richard Roberts was the first to introduce cast-iron wheels into his clocks, a system which has since been ably advocated by Mr. E. B. Denison in his book, and which compared with brass are infinitely more durable. One great peculiarity about the clock was the manner in which the hours were struck by means of a centrifugal hammer. This—so the makers say—reduces the motive power required about 50 per cent. A drawing of the clock is being prepared for us, and we will shortly give a more full description of it. The brass fittings for engines and boilers were displayed in great profusion on the handsome piazza under the clock dials. Of the other exhibits of Messrs. Bailey and Co., we may say their name was legion, for the stand was a small show itself, exhibiting a variety of useful inventions patented by that firm. There were regulating tallow cups, oil syphons, low-water alarms, speed indicators, pressure and vacuum gauges, tell tales and peg clocks, alarm signals, and all sorts of indicators, for the special purpose of recording the neglect of watchmen, engineers, stokers, mining cage tenters, and for generally protecting life and property, and promoting statistics for the special benefit of proprietors of steam power. We especially noticed Shaw's patent bar-iron cropper, which will cut ¾in. bar iron with ease. This is a new tool, which will be found useful to the smith and others who use from ¼in. to ¾in. bar. There was also Calow's patent safety cage for collieries, warehouses, and hotels, which is made by Messrs. Bailey and Co., and its simplicity of action caused much admiration, and we are glad to learn that many orders were booked on the ground for it. We propose illustrating this apparatus shortly. It appears that the Clay Cross Colliery Company, after trying it, made arrangements for the right to use it to all their pits for the full term of the patent. We understand that over one hundred are now at work.

The patent chronometrical regulator for steam engines at Messrs. Bailey and Co.'s stand attracted considerable attention. The regulator is a pendulum, which, in a most simple manner, is actuated by the engine, and in connection with it is a lever, which maintains a perfectly fixed position so long as the speed of the engine is exactly uniform with the strokes of the pendulum. This lever is connected to the throttle valve or starting gear in combination with any ordinary governor, and the moment the engine varies, by the friction of a stroke from the pendulum, the lever immediately acts upon the valve and prevents further irregularity. The steam engine, by means of this invention, is under as perfect control as a good clock or watch, and it will perform with the same regularity. The Manchester patent powerful hand fire pumps, invented by the chief of the Manchester fire brigade, seem very desirable little machines for all proprietors of property. The Great Western Railway Company have given an order for these pumps for Paddington and other stations. Messrs. Bailey and Co. claim for this pump that, with its copper air vessel all complete, it is the most powerful pump out for its weight. The new tube expander manufactured by this firm (Walker and Stuart's patent) seems a useful tool for boiler makers. One of Norton and Bailey's pressure recorders, for indicating and recording steam and water pressure, was at work on the ground indicating the town's water pressure. There are many improvements in this recorder, which were kindly pointed out by Mr. N. H. Bailey, the inventor; one great peculiarity is the arrangement whereby the friction of the pencil on the paper does not interfere with the correct working of the instrument—a difficulty which required some scheming to overcome. The patent cavendish tobacco cutter is perfect, and was much admired; the ease with which different degrees of fineness of cut could be obtained is worthy of attention. Before leaving this stand we must allude to one more novelty, out of many others for which we cannot find space. It is Mr. W. H. Bailey's patent pyrometer, an instrument the manufacture of which has had much attention from that gentleman. Agriculturists were much interested in the pyrometer for hay stacks, an instrument 8ft. long, for probing them, to enable the temperature to be immediately indicated, in case of spontaneous combustion. They are also useful for corn mills, to enable grain to be tested as to its condition. The question was asked if they would do for coal stacks when large amounts are stored. The only difficulty is that the instrument would not be strong enough to penetrate the coal. Mr. Bailey, however, recommends iron tubes to be built in the stack, so that the pyrometer could be inserted. The pyrometer for cooks are handsome little instruments, and also those for the engineer to indicate the waste heat of boiler flues; about a dozen different sorts were exhibited for every conceivable purpose where heat is employed.

Mr. Robert Boby, of St. Andrew's Works, Bury St. Edmunds, had some very well designed double-action haymakers. His full-sized machine for heavy crops is very light in draught, and well balanced. The arrangement of the driving gear is very simple. The machines are fitted with Mr. Boby's concentric adjustment, covers being provided to prevent the grass winding round the axle. The smaller sizes of these machines are equally worthy of notice for design and finish. At this stand there were also horse rakes of new design, requiring no frame, and in which manual labour is almost entirely dispensed with. There were also a great variety of corn, malt, coal, and gravel screens. Our attention was particularly directed to Mr. Boby's chaff-sifter, which perfectly sifts grown or cut chaff, rendering it more digestible for horses and cattle. It also clears land of small annual weeds very quickly and cheaply. Several of the well-known oval beam iron ploughs complete Mr. Boby's exhibits.

The stand of Messrs. Holmes and Sons, of Prospect-place Works, Norwich, was well filled with the manure distributors, drag-rakes, portable engines, thrashing machines, corn, seed, and manure drills, &c. In their manure distributor the delivery barrel and scrapers are of metal, to prevent corrosion; the spindles all work in brass bearings, and the delivery appears to be perfect for large or small quantities. The horse lever drag rakes are strongly made; the teeth are lifted for clearing the rake of its load in a very simple manner. The portable seed sheller, with dressing apparatus, deserves notice, as having lately been perfected for shelling trefoil as well as clover. The lever corn-drilling machines exhibited by this firm are very light of draught, and are adapted for all descriptions of soil and any required quantity of seed.

Messrs. James Powis and Co., the saw-mill engineers, of the Victoria Works, Vine-street, Lambeth, had an excellent show of wood-working machines. Their general joiners were shown at work; one was tenon cutting, another was cutting moulding, and the third was planing 9-inch boards. All these machines will saw, plane, mould, edge, tongue, groove, thickness, chamfer, mitre, cut tenons, crosscut, and bore. There was also the Messrs. Powis' moulding and planing machine, which has four cutters working outside with the exhibitors' patent disc feed. We also noticed a new endless band sawing machine, cutting up to 12in. in depth, which is fitted with a spring and self-adjusting packing for the prevention of breakage to saws, which is a very material improvement in this class of machine. In addition to the foregoing, there were machines for sharpening straight and circular saws, tenon cutting machines, mortise and boring machines, shaping and moulding machines, &c. Messrs. Powis also exhibited a noiseless disc-fan blower, so constructed as to be capable of being taken to pieces, cleaned, and put together again during the workmen's dinner hour. This is a decided advantage over the old mode of construction, which caused a day's stoppage.

Messrs. John Warner and Sons, the hydraulic engineers of Jewin-crescent, Cripplegate, London, had their usual extensive selection of pumps and hydraulic apparatus of every kind. There was a model of Warner's annular sail wind engine, which has been satisfactorily applied to the purposes of raising and forcing water for irrigation or for the supply of houses. They are also applicable for many kinds of machine work. There was also a model of a water-wheel and double-action pump, which affords an economical means of raising water where a small but constant supply can be obtained with a fall from a spring or river. It is fixed with but four bolts and nuts, and there are only two joints to be made to put it into working order. The sluice valves invented by these exhibitors are to be desired wherever a full waterway is required. As we have before fully described these valves, we need only add that they are particularly simple in construction, and are not liable to become clogged.

At the stand of Messrs. Aveling and Porter, of Rochester, we found an improved steam road roller, to which a silver medal had been awarded. This machine weighs 15 tons, and rolls 6ft. in width. It has two driving and two steering rollers, and turns round in its own length. The front rollers are so contrived as to adjust themselves to the inequalities of the road. This firm also exhibited an 8-horse power agricultural locomotive of the ordinary type, which showed the usual excellent style and finish of their manufacture. A set of patent travelling rope porters for steam cultivation, suitable for the double engine and roundabout system of steam ploughing, fitted with improved steering gear, completed the list of exhibits here, which, if not extensive, at any rate well represented the class of work turned out at Rochester.

While on this class of machinery, we may notice the steam road roller manufactured and exhibited by Messrs. Manning, Wardle, and Co., of the Boyne Engine Works, Leeds. This machine is the patent of Messrs. E. Gellerat and Co., and the machine exhibited at Manchester was a *fac-simile* of those used by them, as contractors, for making and repairing the streets and boulevards of Paris, and the roads of the Bois de Boulogne. In

this machine both its rollers are drivers, and therefore all the weight is available for useful adhesion, so that it will start at once, and ascend a steep incline. It will work equally well in either direction—forwards or backwards, and will pass easily along curved streets, and will turn round in a small circle. It is suspended on springs, and therefore is not liable to injure gas or water pipes or drains under the surface of the streets. It has a "counter," which registers the distance travelled and the work performed. The firebox is of copper, the tubes of brass, and the boiler of best Yorkshire iron; many parts usually cast are of wrought iron; the motion, the driving chains, and other parts, are of hardened steel. Syphon lubrication is provided throughout; the boiler is lagged and covered with sheet iron, painted, lined out, and varnished, the whole machine being finished equal to the best locomotive work.

Messrs. Garrett and Sons, of the Leiston Works, Suffolk, have improved the details of their agricultural self-moving engines since we last inspected them. These engines, which are very light, will draw a thrashing machine and straw elevator with ease, and will pass over soft land and other places where it would be almost impossible to take machinery by horses. The weight of the new engine is but a few hundredweights more than a portable engine of the same power. It can be steered either by a man in front, or a horse can be attached with shafts. The tender carries water and fuel sufficient for ordinary thrashing journeys. Messrs. Garrett have also made some improvements in Haye's straw elevator, by which the height and angle of delivery can be adjusted with much more ease than hitherto. The drills of this firm are in good demand; they combine the merits of the Suffolk corn drill with those of the seed and manure drills. The box in which the grain or seed is contained is made separate from the manure box, so that when the drill is required for corn or seeds without manure, the whole manure apparatus may be removed. This firm also exhibited a very light and simple seed drill suitable for drilling turnips, mangold, &c., without manure, upon the flat and ridge. These implements are in large use in France and Germany, where beet is grown for sugar, under which circumstances such an implement becomes a necessity.

At the adjoining stand of Messrs. Woods, Cocksedge, and Warner, of the Suffolk Iron Works, Stowmarket, were some very good examples of vertical engines, and a large assortment of mills, root pulpers, turnip cutters, horse gear, &c. The vertical engines of this firm are well put together, and possess many special advantages. They occupy less room than any other form of engine, are entirely self-contained, and, requiring no fixing, the expense of brickwork or other form of foundation is entirely saved. They are well adapted for places where space is a consideration, or for exportation, as they can be shipped without disturbing any of the parts. All the details have been designed so as to secure strength with easy access to every part. The main shaft is arranged so that the flywheel may be placed on either side of the engine; thus two machines can be driven at once direct from the engine, one from each end of the crank shaft. The governors, which are on a new principle, are simple but very sensitive, and can be regulated so as to keep the engine at any speed desired. The feed pump is fitted with gun metal ball valves, and an extra valve is placed between the pump and the boiler, and close to the latter, so that the valves of the pump can be examined or even removed without stopping the engine. This firm also exhibited Paterson's centrifugal pump, which is opened at the side of the casing. The valves are thus easily got at, and without disturbing either the suction or delivery pipes.

The "Eureka" smut and separating machine, referred to last week in our list of awards as having obtained the gold medal, was exhibited by Messrs. Nell, Harrison, and Co., of 75, Aldermanbury, London. It is the invention of Messrs. Howes, Babcock, and Co., of New York, and is a new machine which requires more than a passing notice In addition to a perfect scourer, it has two suction separators—one before the scourer which separates from the grain smut balls, chess and other light substances; and the other after, thoroughly cleansing the grain from remaining impurities after being scoured. Each acts independently of the other, depositing two kinds of screenings, one taken from the grain before it is scoured, and the other after, and both cleaned from dust and chaff, and fit to be sold or ground into feed. It has a very reliable shaking shoe, the first screen of which is for the purpose of carrying off any impurities larger than the grains of wheat. The second screen separates the sand seeds, &c.; the machine is therefore a complete grain cleaner of itself. The scouring case is made of sheet cast steel, and the beaters of chilled cast iron, making it very durable. It is constructed on the smooth surface principle, which, by its direct action on the grain, removes all smut and dust that may adhere to the berry, discharging it through the perforated scouring case, perfectly scouring and polishing the grain, and is not liable to break wheat, or lose its scouring qualities, as is the case with rough surface machines. There is a strong current of air taken through the bottom plate of the scourer, discharging the dust through the perforations of the scouring case, and, at the same time, a strong current of air is drawn through the centre of the scourer to the fan above. This is a most important principle, as the scourer is always kept free from dust without a possibility of its coming in contact with the grain during the process of its being scoured. The scourer is enclosed within a circular casing, leaving an inch space, through which there is a current of air passing of sufficient strength to take every particle of dust that escapes from the scouring case directly to the fan, the fan thus absorbing all the dust from the entire machine, which can be conducted out of the mill. For its perfect safety as regards fire by friction, the bridge trees are cast iron, with but two bearings, the steel step at the bottom and the babbitt metal box at the top; always convenient to be got at while in operation, a fact more or less noticed by insurance agents. For its entire reliability in cleaning smutty wheat, no matter how bad, when not absolutely wet, we understand that this machine has been put to the most severe tests repeatedly in Oswego, Albany, Philadelphia, Cincinnati, Chicago, London, and other important milling points within the last three years, and has never yet failed. It may, therefore, be expected rapidly to supersede other machines, and, considering its qualifications, we consider that, when it was awarded the gold medal, that distinction was judiciously and worthily bestowed.

Messrs. Hornsby and Sons, of the Spittlegate Iron Works, Grantham, had no special novelty to show, but, in most of their numerous exhibits, improvements had been made in minor details. And it is this careful attention to minutiæ that make up the sum of perfection and tend to success. If we could select anything for a few words beyond the rest of this firm's implements, it would be a new mower of simple construction and light draught, and which appeared to us peculiarly adapted for cutting difficult crops on uneven as well as on level land. This mower, which is termed the "Manchester," is made in various sizes, both heavy and light. The "Progress" self-raking reaper by this firm is remarkably simple, compact, and light in draught, although strongly put together.

One of the most extensive stands of agricultural machinery and implements was that of Messrs. J. and F. Howard, of Bedford. They had a new arrangement of steam cultivating machinery consisting of 12-horse power self-propelling engine with two winding drums, 5-tined cultivator, &c. The cylinders are placed in the same position as on ordinary locomotive engines, and the power is given off from the engine to the winding drums by open gear. The apparatus can be worked either on the stationary or direct system. There was also at this stand a new steam drill, which has been designed by Messrs. Howard to meet the demand for a corn drill adapted for use with steam cultivating apparatus. This implement has drilled 100 acres of corn this season, and was found in every respect satisfactory. Howard's ploughs were, of course, well represented, and formed a prominent feature on their stand. Amongst the haymaking machines, we specially noted their double-action haymaker, which contains an important improvement, adding greatly to the strength and durability of the machine. The axle carrying the fork barrels, instead of being cranked, is perfectly straight, and also the axle for the travelling wheels. In their British mowing machine, the framework is of iron. The gearing is simple and compact, and the whole weight is carried by the travelling wheels. The machine is strong and durable as well as effective, and, being perfectly balanced, there is no weight on the horses. We understand that the Howard safety tubular boiler is in good demand, and continues to work satisfactorily.

Messrs. Tuxford and Sons, of Boston and Skirbeck Iron Works, Boston, Lincolnshire, had a large show of portable engines, which exhibited the usual excellence of this firm. They have introduced various improvements into the details of construction, which cannot but have our approval. The guides to the slides are made adjustable, so that they can be compensated as they wear away. The packings are well arranged, and a very simple safety valve is used on all the engines turned out by Messrs. Tuxford. Their adjustable brasses for the crank shaft, and which are in three segments, are another good feature. The feed water is heated by the exhaust steam, and there is every appliance for economizing heat. The driver of one of these engines, which was in motion at the Show, told us he could hardly keep the fires low enough, and this fact was verified by the appearance of the fire at the time, which was exceedingly low, although full steam was kept. Altogether, these engines showed themselves in every way satisfactory, as did also the thrashing machines exhibited by this firm, in which, as well as in the engines, several useful improvements have been introduced.

The old and well-known firm of Messrs. Worssam and Co., of the Oakley Works, King's-road, Chelsea, had a collection of wood-working machinery which well sustained the reputation these makers have acquired for this class of machinery. It is not very long since we described and illustrated several of their machines, so that a general reference to their exhibits is all that is here necessary, the especial merits of their manufactures being well known. There was their general joiner, their self-acting saw bench, a large hand mortising machine, and their improved saw sharpener. Messrs. Worssam have lengthened the table of their general joiner, and have arranged it to cut curvilinear moulding, and it will do work 11in. by 4in. The gut is also done away with, and the machine is now working with straps, which is an obvious advantage.

The stand adjoining that of Messrs. Worssam was occupied by Messrs. Tangye Brothers, and Holman, of Laurence Pountney-lane, London. Here we found their special steam pump in every variety of size; one of these, adapted for raising sewage, was at work lifting some 60,000 gallons per hour. This firm also exhibited a 1-horse power

engine of good construction, and fitted with Tangye's patent governor, respecting which we shall shortly have something more to say.

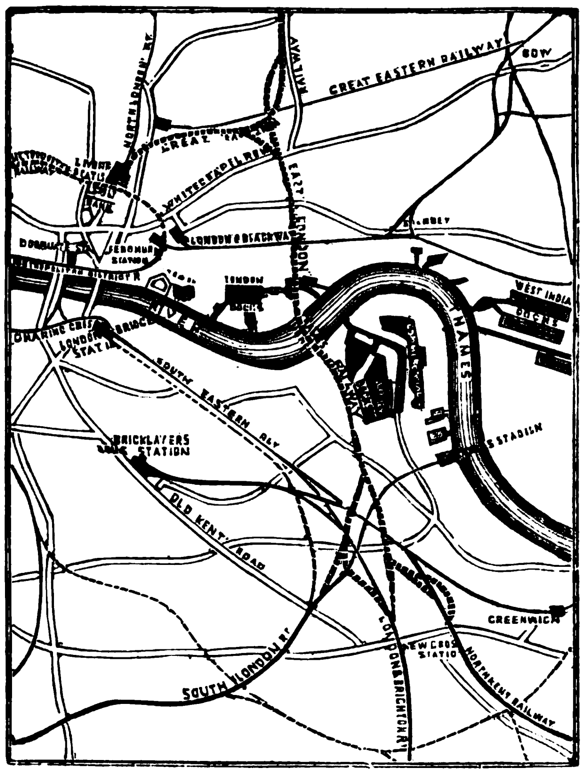
Messrs. D. Adamson and Co., of Newton Moor Iron Works, Hyde, near Manchester, exhibited a portable engine which embodied some special features. It had a solid welded circular firebox, a novelty well worthy of notice. There were other examples of this manufacture, in the way of a Cornish boiler, in which the shell plates were made in solid rings; the flue was also made in solid rings, with Adamson's flange seam and with conical tubes welded in. The finish of the work was all that could be desired, and the principle is one of importance in boiler work.

The remaining exhibits of which we have to speak must of necessity be summarized, owing to the great length to which our notice of this unprecedentedly extensive show has run. To make a beginning of the end, then, let us first mention some excellent turbine water wheels and silent blowing fans, on Schiele's system, exhibited by the Union Engineering Company, of 2, Clarence-buildings, Booth-street, Manchester. This company are sole proprietors and manufacturers of Schiele's patents of 1863 and 1867, which are well represented in the examples under notice. Mr. G. Z. Scott, of St. Mary's Gate, Manchester—whose wheel moulding machine was recently described and illustrated in the Mechanics' Magazine—exhibited an apparatus for this purpose of a size to mould, spur, bevel, and mortise wheels without patterns from 12in. diameter up to 4ft. 6in. diameter, and 12in. broad. The apparatus attracted the attention of all passers, and we heard some well-merited encomiums bestowed upon it. Messrs. Gregory and Haynes, of St. Stephen's Works, Salford, had a good show of brewing utensils of the latest design and containing many improvements. Their seamless copper steam coil for a ten-quarter brewery is well worthy attention from the efficient principle of construction adopted. Mr. John Cameron, of the Egerton-street Iron Works, Hulme, Manchester, had several very good portable engines on feet, as well as some powerful punching and shearing machines. The peculiarities of the engines are such as deserve a more extended notice, for which we reserve them.

Messrs. Clayton, Son, and Howlett, of the Atlas Works, Harrow-road, London, were busy making bricks with clay off the Show ground, in one of their direct-action brick-making machines, which admirably illustrated their system of manufacture. Mr. John Weighell, of Pickering, Yorkshire, had some good portable engines, grinding mills, and straw cutters. The chief attraction here, however, was Storey's indicator, particulars of which will be found on another page. At the stand of Messrs. Pooley and Son, the well-known weighing machine manufacturers of Liverpool and Manchester, we found, amongst other things, an exceedingly useful and correct machine. This was their automatic grain weighing and registering machine, which weighs, records, and discharges, by the sole momentum of the grain in the process of being weighed. Paints were represented by Messrs. Walter Carson and Sons, of Belle Sauvage-yard, Ludgate-hill, who had samples and patterns of their anti-corrosion paint, which is specially prepared for resisting the weather, and which does not blister under the sun. And last, though not by any means least, we found the attractive stand of Mr. T. B. Ayshford, of the Britannia Carriage Works, Fulham. Here was the celebrated canoe waggonette, which affords ample sitting room for eight persons. Ingress and egress are obtained at the sides instead of the back, as in the ordinary waggonette. This vehicle, although so commodious, weighs less than 8cwt., and is of very elegant design.

We can only conclude as we commenced, by observing that the late Show at Manchester was a success in every sense of the word. This it deserved to be, as the executive spared no pains to promote the interests of the exhibitors and the comfort and convenience of the public. The results are to the lasting credit of the exhibitors and of the Royal Agricultural Society of England.

THE EAST LONDON RAILWAY ROUTE



THE SOCIETY OF ENGINEERS AT THE EAST LONDON RAILWAY WORKS.

The works of the East London Railway present several features of interest to engineers, and by permission of Mr. Hawkshaw, the members and associates of the Society of Engineers visited them on Friday last. On this occasion, the executive was represented by Messrs. F. W. Bryant (President), J. H. Adams (Member of Council), A. Williams (Hon. Sec.), P. F. Nursey (Auditor), and G. W. Harris (Secretary). Amongst the members were Messrs. J. Westwood, W. T. Hendry, J. Bernays, A. E. Stephenson, F. Colyer, P. Jensen, H. Gore, &c. On assembling at the Wapping shaft of the Thames Tunnel, the visitors were received by Mr. Hawes, the Chairman of the East London Railway Company; Mr. Cooper, the Secretary; and Mr. Burleigh, the resident engineer in charge of the works. The course of the line, with its various branches and ramifications, will be clearly seen from the annexed block plan, upon which it is indicated by dotted lines. Starting from the Liverpool-street station, where it will be in communication with the North London and Metropolitan Railways, the railway will run to Whitechapel-road, where a junction will be established with a branch running into the Great Eastern Railway. The line will then cross the Whitechapel-road and the London and Blackwall Railway, proceeding thence nearly in a straight line to the river, which it will cross through the Thames Tunnel. The line as at present laid out and nearly completed, commences at the Wapping end of the Thames Tunnel, through which it proceeds, running past the Grand Surrey Canal Docks and through Deptford to the Old Kent-road station of the South London Railway. A branch which leaves the line near Rotherhithe runs to New Cross, where it communicates with the North Kent and the London and Brighton Railways. The Surrey Cana is crossed by these two lines, in each case by a lattice girder bridge of 80ft. span, with two side openings of 13ft. span each. On another page of our present issue, we have illustrated and described one of these bridges in detail. So far, the line is nearly ready for opening, a preliminary notice to that effect having been given by the company to the Board of Trade. The works remaining to be executed consist of that portion of the line between Wapping and Liverpool-street, which latter place will eventually be the terminus of this railway. The completion of this section of the line, however, will occupy about two years, the works upon it being of an unusually heavy nature.

There is a heavy piece of bridge work at Cross-street, Rotherhithe, which bridge carries the main road, and is divided by cast-iron columns into two spans of 25ft. each. The piers are of the ordinary description of brickwork, laid on cement concrete foundations, with proper offsets; and each pier has a 4-inch drain pipe passing through from top to bottom to carry off surface water, and this discharges into a 9-inch vitrified pipe, which latter discharges directly into the main sewer in the road. Asphalte is carried down the end of the arch and bed stone, and wherever its use is found desirable. The asphalte is laid on in two coats of ¾in. each, and then covered in. The parapets are of brickwork, 10½in. in thickness, and the coping is of Bramley Fall stone moulded. The girders are of cast iron, of the ordinary description, 2ft. 2in. high—the facia girder being straight, and the inside tapering from 2ft. 2in. at centre, to 1ft. 6in. at bearing points. The girders are in lengths of 27ft. 6in., and butt on the centre of the columns. The cross girders are of cast iron, the web of each being 1⅜in. thick, the bottom flange being 1ft. 10in. wide, 2¼in. thick, and the top flange 8in. wide, and 1¾in. in thickness. Lewis bolts are used in all the girder work. The cast-iron columns are of a handsome pattern, standing on a surface of brickwork in cement; the diameter of the castings is 12in., the capitals are appropriate, and are secured to the stem by lewis bolts and nuts. The cross arches between the cross girders are of brick in Portland cement, and asphalted.

It will be seen that the East London Railway will unite the Brighton, South London, South-Eastern, and North Kent Railways, accommodating in its course the Surrey and Commercial Docks, the London Docks, and the east of London. The London and North-Western Railway will also be brought into this system. The line will thus open up the important districts of Rotherhithe, Wapping, Deptford, St. George's-in-the-East, Limehouse, Stepney, Whitechapel, Bethnal Green, Bishopsgate and Shoreditch, thereby affording an outlet by the principal railways of the kingdom for the most densely populated parts of the metropolis. The terminus, to be erected in Liverpool-street, will be in the very centre of business—close to the Bank and Royal Exchange, and it will, no doubt, command for this line a vast share of the omnibus traffic. Mr. J. Hawkshaw is the engineer-in-chief of the line, the contractors being Messrs. Brassey, Wythes, and Lucas, Brothers. It may be interesting to add that the Thames Tunnel, which was opened on August 2, 1843, was closed on Wednesday week, having thus been a public footway for nearly twenty-six years. It was purchased for £200,000 (one-third of its cost) by the East London Railway Company. The works of the Thames Tunnel were commenced in 1825, but physical and financial difficulties delayed the opening for eighteen years.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

A PROCESS FOR TINNING IN THE WET WAY—TO DETECT SMALL QUANTITIES OF ALCOHOL—THE SOLUBILITY OF SULPHUR IN THE COAL TAR OILS —HOW TO BLEACH IVORY.

VESSELS of brass or copper can be easily tinned in the wet way by the following process, devised by Dr. Hiller:—A solution is made of one part of crystallized protochloride of tin and ten parts of water. Another solution is prepared with two parts of caustic soda or potash, and twenty parts of water, and the two solutions are mixed together. The mixed liquor will be milky at first, but will become clear after a time. The utensils or objects to be tinned are placed in a proper vessel with a sheet of pure tin perforated with a good many small holes, the alkaline solution is poured over them, and then heat is applied while they are occasionally moved about with a rod of zinc. The tinning is effected very rapidly, a few minutes being sufficient for the deposition of a bright coating of the metal.

The detection of minute quantities of alcohol is not difficult by some well-known processes, but the following may be of use to some, as the re-agents will be found in every laboratory. A few drops of the suspected solution are placed in a test tube with a small quantity of iodine, and a few drops of caustic soda or potash, and a gentle heat is applied. If any alcohol is present, a very characteristic yellowish crystalline precipitate of iodoform will be thrown down. By this process, Lieben tells us, one part of alcohol in two thousand of water may be recognized.

The solubility of sulphur in the coal tar oils has been made the subject of a long series of experiments by M. Pelouze. The results may be summed up in a very few words: the solubility increases with the density of the oil and the temperature. Thus 100 part of a light benzole, sp. gr. 870, and a boiling point from 80deg. to 100deg. C., will at the ordinary temperature dissolve only 2·1 parts of sulphur, and at 100deg. C. not more than 15·5 parts. But a heavy oil, having the sp. gr. 1·020, and boiling from 220deg. to 300deg., will at the common temperature take up 7 parts of sulphur, and at 100deg., 54 parts. At higher temperatures the heavy oil will dissolve an indefinite amount of sulphur, but above 200deg., decomposition of the oil takes place, and sulphuretted hydrogen is evolved. The best oil for extracting sulphur would appear to be one which has the density ·995, and boils from 180deg. to 210deg.

A process for bleaching ivory is given by Dr. Artus. He specially mentions the application to ivory plates for pianoforte keys; but it will of course be applicable to all articles of the material, which is so liable to acquire a disagreeable dark colour. The articles are first to be soaked in a solution of carbonate of soda (half a pound of the crystals to two pounds of water) for a couple of days. They are then to be well rinsed with clean water, and afterwards transferred to a solution of three-quarters of a pound of sulphite of soda in two pounds of water, in which they must remain for five or six hours. Then, without removing the ivory, a mixture of one ounce of hydrochloric acid and four ounces of water is to be added, the whole is to be stirred together and the vessel covered up and left for thirty-six hours. At the end of this time, the solution is poured off and the ivory is to be well washed with water. If it should not have the desired whiteness, the process may be repeated. The proportions of solutions we have given above will suffice to bleach a pound of ivory.

PARLIAMENTARY NOTES.

ON Monday last, in the House of Commons, Mr. Macfie inquired whether the statement in the public press, that amongst the measures contemplated next session there was one for a reform of the patent laws, referred to any measure contemplated by the Government, and if so, whether that legislation would be preceded by an inquiry either by a committee of the House or by Royal commission.

Mr. Bright believed that every member of the Government would agree with his hon. friend that some considerable change was necessary in the patent laws. He was not sure how many, or whether any of them were of opinion that there ought to be no patent laws. But notwithstanding the agreement as to the desirableness of some alteration, it would be very imprudent for him to pledge the Government to bring in any measure of this nature when there was so great a difference of opinion, and when it seemed impossible that no two men could agree as to the change. If a committee or a commission were appointed there would be a difficulty as to whether they should inquire what amendments should take place in law, or whether there should be any patent system at all. Admitting that the question required to be attended to, whenever there was time to attend to it, he was quite unable to say that the Government would pledge itself to bring in a bill on the subject next session. If his hon. friend would propose the appointment of a committee that would be a reasonable proposition, and it was probable that both the Government and the House would accede to it.

Mr. Macfie gave notice that if the Government did not introdcce a bill on the subject at the beginning of the next session, he would propose the appointment either of a committee or a commission.

Mr. Gourley asked the Under-Secretary of State for Foreign Affairs if he had received any official information as to the probable navigable depth of water expected in and through the Suez Canal; and when it was to be opened for general commercial purposes.

Mr. Otway said he would give his hon. friend all the information that was in the possession of the Foreign Office, but he must remark that it was not official. Mr. Fowler, the engineer, was in Egypt at the beginning of the year, and he reported that the canal was originally intended to have a depth of 28ft., but that its depth was now 26ft. The first and most difficult section consisted of 22 miles. It had 190ft. of surface width, with a depth of 26ft., and 72ft. broad at the bottom. The second section consisted of 77 miles, with 327ft. of surface width, a similar depth of 26ft., and a width of 72ft. at the bottom. But they had heard from other sources that the depth did not exceed 18ft. The opening of the canal had been fixed for the 17th of November, but he doubted whether the works were so far advanced as to admit of being opened at that date.

At the same sitting, Captain Beaumont asked the Secretary of State for War that inasmuch as a considerable section of the House was opposed to the outlay contingent on the Spithead forts being constructed to mount two tiers of guns in place of one, whether he would be willing to reconsider the propriety of reducing the scale on which the forts on the Horse Sand and No Man's Land Sand were proposed to be constructed, and so effect a saving of £225,000.

Mr. Secretary Cardwell hoped the House would remember that, in preparing the bill which had its approval, the whole amount had been reduced below the amount included in the Act of 1867 by £491,000; and if £75,000, allowed by the Act to meet unforeseen contingencies, was included, the total reduction of the amount placed in the schedule to the Act of 1867 was £566,000. This had been accomplished by giving up works not yet commenced, and postponing other works, the construction of which might be considered at a future time. The smaller forts had been reduced to one tier of guns, and with regard to the larger forts it had been considered a more economical arrangement to construct them of two tiers, as originally designed. He hoped the hon. and gallant gentleman would be satisfied with this answer, and the assurance that the works would be constructed with a regard to the strictest economy.

Mr. J. G. Talbot asked the President of the Board of Trade how soon the various railway companies would comply with the provisions of the Act 31st and 32nd Vic., cap. 119, sec. 22, requiring them to provide means of communication between the passengers and the servants of the company; and, whether he could inform the House what the nature of such communication would be.

Mr. Bright replied that on the 1st of August, on all trains to which the Act applied, some mode was established of communicating between the passengers, the drivers, and guard. There were three means of communication, by means of a cord or rope, and one was managed on the electric principle. These had been sanctioned by the Board of Trade. Of course the board could not say positively whether the plans were perfect and satisfactory, but they had met so entirely the views of those most conversant with railway matters that the board had sanctioned them, and they had reason to believe that they would do all the Act intended.

In the House of Lords, on Tuesday, the Earl of Morley, in moving the second reading of the Nitro-Glycerine Bill, said its provisions were of a very stringent nature, but it contained a clause to the effect that if hereafter any compounds should be discovered that would render that substance harmless the stringency of those provisions might with respect to those substances be relaxed.

Lord Cairns had a petition to present against this bill, which he did not think ought to be allowed to pass without great modifications. The Government spoke of certain compounds to render nitro-glycerine harmless that might hereafter be discovered; but if they had made inquiries they would have found that some of those compounds were in daily use, and were perfectly harmless, and that explosions were nearly, if not altogether impossible. One of these substances was dynamite, and the petition he held in his hand was from a Welsh company engaged in its manufacture, who set forth that it was nearly as strong as pure nitro-glycerine, and much stronger than gunpowder, but that it was perfectly harmless, and being a powder, not a liquid, was not subject to leakage or to explosion from concussion. They complained that this bill, which prohibited not only nitro-glycerine but every substance into which nitro-glycerine entered, would be a practical confiscation of their manufacture. He (Lord Cairns) understood that dynamite was not the only compound that was in use, but they would all be prohibited under this bill.

The Earl of Morley promised the Government would look into the matter, and pointed out that if their compounds were innocuous, they would be protected under the third clause of the bill.

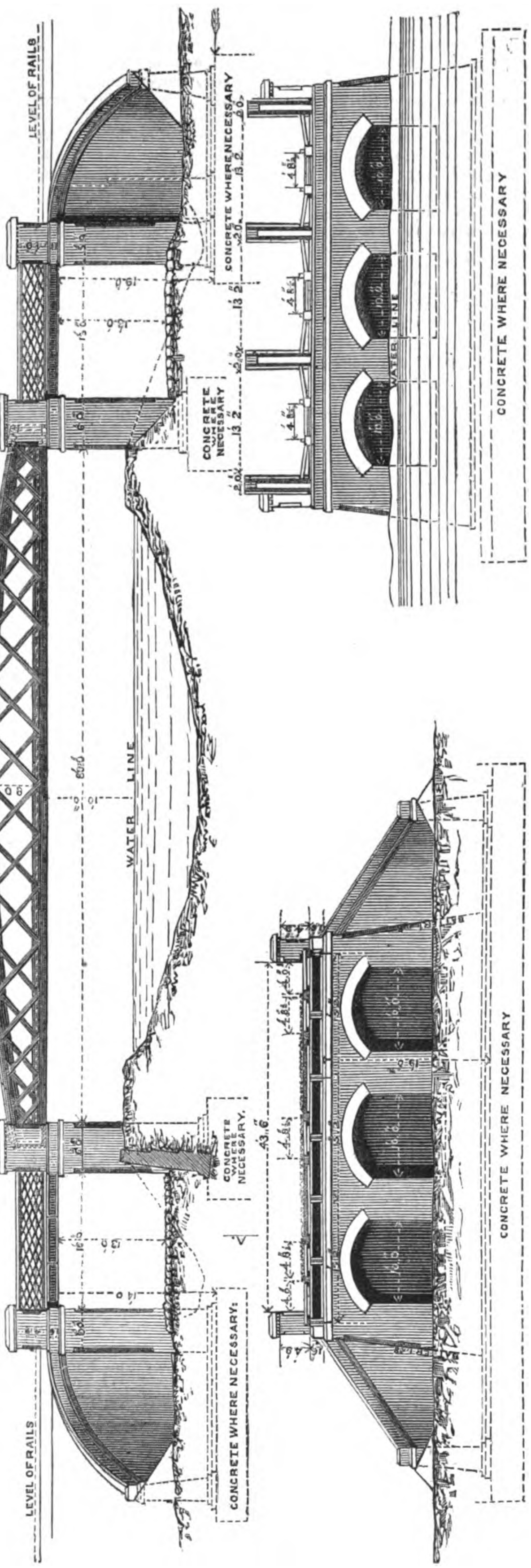
The bill was then read a second time.

In the House of Commons, on the same day, the question of the new patent law in Canada was opened by Mr. J. Howard, who asked the Under-Secretary of State for the Colonies if his attention had been directed to the new Patent Law Act passed by the Senate and House of Representatives of Canada, and to which the Governor-General gave his assent on the 22nd of June last; if he was aware that by the terms of that Act the rights hitherto enjoyed by British subjects and foreigners were abolished, and that, unlike the patent laws of England and all other countries, the benefits of its provisions were limited to persons permanently resident in its own dominions; and whether the Colonial Office was prepared to recommend the Government to advise Her Majesty to withhold or postpone her assent to the Bill with a view to give an opportunity to the Canadian Legislature to reconsider its provisions.

Mr. Monsell replied that no such Act as that to which this question referred had reached the Colonial Office.

EAST LONDON RAILWAY—GRAND SURREY CANAL BRIDGE.

MR. J. HAWKSHAW, ENGINEER.



EAST LONDON RAILWAY—GRAND SURREY CANAL BRIDGE.

THERE are two bridges which carry the two arms of the East London Railway over the Grand Surrey Canal. These structures are similar in design, and their construction will be seen from the annexed engraving. Each bridge has a centre span of 80ft., and two small side spans, each 16ft. The great span carries the railway over the canal, and the lesser spans over two roadways. The head-room from water level to soffit of girder is 10ft. 6in., being ample for the boat traffic. The height from crown of roadways to centre of soffit of girder is 13ft., and at water tables 14ft., so that in passing through the headway will not be interrupted by the bridge. The abutments and piers are built of brickwork, laid in blue lias lime mortar. The foundations are of Portland cement concrete. There are three sets of rails of 4ft. 8½in. gauge, the width in clear of dividing girders being 15ft. 2in. The batter of the piers is 1 in 8. The coping of the parapet is of Bramley Fall stone, neatly moulded. The entire width of the bridge at the points marked *a a*, or over the roadways where no intermediate girders occur, is 43ft. 6in. The wrought-iron lattice girders for the large span are four in number, made for the contractors by Mr. T. Shaw, Cannon-street, 8ft. high in the centre, and 4ft. high at bearing points. The top and bottom flanges 2ft. wide. The width in clear of box plates is 1ft. 3in. Height of girder from out to out, 8ft. Stifners are placed 6ft. apart. The camber of each girder is 2in. The rivets are ⅞in., with a 4in. pitch. The web of side girders is ¼in., and the angle irons 3in. × 3in. × ⅜in. and ¾in. rivets. The flanges are 9in. wide, and ½in. thick. The road openings are spanned by ordinary wrought-iron girders, 1ft. 6in. in depth.

THE BRITISH ASSOCIATION.

WE have already announced that the thirty-ninth meeting of the British Association for the Advancement of Science is to be held at Exeter. The preliminary arrangements for the meeting have just been completed. The meeting will occupy a week, and the inaugural address will be delivered at the opening meeting on the 18th of August, when the president, Dr. Hooker, D.C.L., F.R.S., &c., will resign the chair, and the president elect, Professor Stokes, M.A., D.C.L., Sec. R.S., &c., will assume the presidency. On the next evening (Thursday, August 19), there will be a soiree; on Monday evening a discourse; and on Tuesday evening a soiree. Sectional meetings will be held daily at 11 a.m., except on the opening day—viz., on Thursday, August 19, Friday the 20th, Saturday the 21st, Monday the 23rd, and Tuesday, August 24. The lectures are:—A. Mathematical and Physical Science; B. Chemical Science; C. Geology; D. Biology; E. Geography; F. Economic Science and Statistics; and G. Mathematical Science. The presidents, vice-presidents, and secretaries of each section will be appointed by the general committee on the opening day of the meeting. The place of meeting next year will be fixed on August 23, and the concluding meeting will be held on Wednesday, August 25. Sir Roderick I. Murchison, Lieutenant-General Edward Sabine, and Sir Philip de M. Grey Egerton, are the vice-presidents of the Association.

A NEW GAS-MAKING MACHINE.

LIQUID fuel may now be said to have achieved and established a reputation of being applicable with success to various useful purposes; but, hitherto, comparatively little has been heard of its capabilities as an illuminating agent. The only description of gas produced from mineral oil with which the public is familiar, is the brilliant flame of the long necked and ungainly naphtha lamp, which gives light to the costermonger and his customers in the street markets. Gas made from oil is not a novelty, but we venture to think that a machine which has been patented by Mr. George Flintoff is an improvement upon anything hitherto known or employed in that direction. This new gas-making machine may be made of any size, and, up to a certain size, is portable, and may either remain stationary in a particular part of a building or be carried from room to room as may be required, and as the fittings attached to it may permit. The machine is cylindrical in form, and has a space between an inner cylinder which receives the charge of rock oil and the outer case. From the charge cylinder the oil exudes slowly into the space referred to, at the bottom of which it is absorbed by a layer of wool. The vapour rising from this oil in the saturated wool furnishes the essential element in the gas to be produced; the only other element is atmospheric air, with which the vapour is diluted. The air, which is only introduced into the machine when the consumption of gas is going on, is regulated in its admission by a piece of machinery actuated by a spring barrel movement, similar to that of a spring timepiece. The pump which admits the atmospheric air, and the machinery with which it is connected, are put in motion as soon as gas begins to be drawn off, and the process of manufacturing the gas, the mixture simply of the atmospheric air with the vapour of the oil, at once commences and continues self-acting, as long as the charge of oil lasts, and gas continues to be drawn off. The process is beautifully simple, the gas being made instantaneously, without the application of heat or any

labour or attention whatever. The gas, as we saw it produced, was not very brilliant, but experience as to the qualities of the oils used, and practice in the use of the machine, will probably lead to the production of as high a quality as can be desired. According to the inventor's statement, a gallon of oil at 2s. 6d. will produce 1,000 cubic feet of fifteen-candle gas, and a charge of 3½ gallons will burn for 750 hours through an argand burner. The apparatus is adapted for use in houses, shops, theatres, churches, or other public buildings.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

(Continued from page 88.)

MR. H. F. ALEXANDER read the following paper on aerial navigation:—

Aerial navigation is a subject which has always to me had a certain amount of fascination about it—one to which my attention was somehow drawn in boyhood, and one which has never, though I have had no chance of carrying out any experiments, lost its attraction. Though my lot has for some years past been cast abroad, I never saw a paragraph in any paper or book about balloons or aerial machines that I did not read with great interest, and when I first noticed the formation of this society I hailed it with a kind of internal satisfaction. The more an intelligent mind examines this subject, the more thoroughly must it be convinced that there is nothing in the laws of Nature which militate against it. True, man has not yet been able to unravel the mystery, but that is undoubtedly due to his ignorance; as his knowledge extends throughout the various branches of science, he may be—he is—yet destined to accomplish it.

The flight of birds proves that the air can not only support a considerable weight, but that it can (a point which has often been disputed) supply a fulcrum for progressive motion, and one which results, too, from physical conditions peculiar to itself, in effect far surpassing those afforded to the steamboat by water, or to the locomotive by the rail. No motion, on land or in water, whether of nature or of art, is so easy, so graceful, and, for its size, so swift, as that of the bird.

What are the requisites for aerial locomotion? They are not many, and, to a certain extent, they are within our grasp. They are, first, a floating or sustaining power; second, light machinery which will successfully act on the air, so as to give an onward motion; and, third, a power to drive this machinery, and the moment that you obtain the power to "move on," you acquire the ability to guide. A sustaining power we already have in coal gas, hydrogen, and others yet more suitable which are still being experimented upon—as exhibited in the balloon. We have propelling machinery on the principle of the screw, and in various devices, as a substitute for wings, some of which have at different times, I believe, been described to you. And a power, equal to all requirements as a power, we have in steam; but—and here comes our great difficulty—the weight of engine, boiler, and water, to say nothing of fuel, is such as to render the use of a steam engine, in the ordinary acceptation of that term, utterly impracticable. Give us, however, a motive power equal to steam, but generated from only a few pounds' weight, and we shall at once have aerial machines on both the wing and screw principle, when practical experience will soon decide which is the most suitable. Such a power man will yet have; such a power our scientific men may yet work out, even in our own day.

But passing over, for a short time, those who are endeavouring to work out these problems, and wishing them every success, just let us take another look at what we actually have, and see if we cannot, even yet, turn it to practical use, even if no more than a working model. Produce but a working model, a model that can be looked at as it travels from one end of a hall to the other; a model that can, by the simple closing or opening of a valve, be caused to proceed in any direction wished, to rise in the air or descend to the floor. Give us such a model, something to close the teeth upon, something to grip, and I will guarantee that John Bull, like his canine namesake, will never loosen his grip till he can throw down this aeronautical difficulty a solved problem at his feet.

Before taking up the question of a model, just let us examine for a few minutes the main principle with which we should have to deal. This principle is that a fluid or gas confined within a given space under certain conditions exerts in every direction a powerful uniform outward force in a ratio proportionate to the conditions. What these conditions are, or what that ratio may be, does not concern our present purpose; we have only to deal with the fact that it is a force, and a uniform force. To explain it in simple language, we may suppose this gas to be confined in a hollow sphere, or, what may be more suitable for our purpose, a cylinder, and that it is pressing equally over all parts of this cylinder. If the pressure is 1lb. to the square inch, and the superficial circumference of this cylinder equal to a surface of 200 square inches, then the one-half of this cylinder would be pressed in one direction with a force of 100lb., and the cylinder would move in that direction were it not that the other half, being of the same area and subjected to the same amount of pressure, presses in the opposite direction with an equal force, and so the cylinder remains stationary. Then suppose each of two ends to represent individually a surface of 20 square inches, then each would oppose the other with an equal force of 20lb., and thus balanced the cylinder would still remain stationary. Now, suppose one of the ends to be knocked out, would not the other end, now released from its opposing and preventing force, move forwards in its own direction? Of course it would, and as long as the force within the cylinder continued undiminished, so long would the end, together with the cylinder, continue to travel with a force of 20lb.

That is the steam engine in its simplest form, and in that form we would suggest its application to aerial navigation. That in this form its force is not generally capable of being economized to anything like the extent to which it can, when applied through the medium of the piston and cylinder, is readily admitted; but if it gives us as much power as we wish in the meantime, that is all that is required. We are working, in a manner, in the dark, and we really do not know the amount of force that we require, but I am very much inclined to believe that it is very much less than is generally supposed; and I base my supposition on, for one thing, the following:—You have all, no doubt, heard of the albatross, and perhaps some of you may have seen it. This last has been my pleasure, and I watched the flight of these birds with great interest. They appeared to rise from the water with difficulty, and must have tripped along the surface some twelve or fifteen yards, with outstretched neck and flapping wing, which awkwardly struck the water before they rose entirely free. During a gale of wind they appeared to require less space, as the wave sinking from below them left them comparatively unimpeded, when a few powerful strokes of their wing soon placed them far beyond the reach of the next. Once fairly on the wing, these were stretched out to their full, and the bird floated rapidly along without any apparent effort. Seen from before or behind, the appearance of the wings suggested the idea of a strung bow. In this manner would they cross the stern of the vessel, keenly scrutinizing the surface of the water to see if anything had been dropped from the ship; they would shoot far ahead, would drop as far astern, would again cross our bow, would strike away from the ship, would skim the surface of the surging wave, the tips of their wings just touching; they would rise to the rising wave, and sink to the sinking one, and to all the ever and sudden shiftings of a heavy sea they would as quickly adjust the line of the plane of their wing—now it was 45deg. on this side, and the next 30deg. on the other. To some sudden gust of the gale they would rise some 20ft. or 30ft. at once, and the next minute they would be soaring above our heads as if to bid us farewell, and then with a few sweeps of their wing strike away for the horizon. Till then, however, what I have described had been done without a single stroke of the wing, without any great visible effort whatever! How is this done? Various explanations have been given as to how this is or may be accomplished, but as these have already been recorded, I shall only mention the following, which I have never seen noticed. In common with other birds, we know that the albatross has the power, and likely to a much larger extent than usual, of inflating itself, and *vice versa*, at will. May it not, therefore, avail itself of this, and, by expelling the air in all its downward motions, and inflating itself again in all its upward, secure a constant surplus force, as it were, fully equal to these results which so excite our wonder, or, shall I say, our envy. I have also observed a motion in the extremes or last joints of the wings, a wavy up and down motion, but hardly perceptible. Could this be sufficient for the purpose?

But it does not concern us so much to know by what means the bird acquires this power; it is sufficient for our present object to know that it has means equal to these results, and the fact that even close observation fails to determine these with certainty, suggests very strongly the idea that the force required must be very much less than what we, from our want of knowledge, have generally supposed. That which the closest observation cannot detect must be very small indeed, and we may, therefore, be encouraged to hope that though the steam power which we suggest should be employed may be comparatively small, it may yet produce results far beyond our expectations. The working model which we would propose we should construct as follows, and if made to work for full ten minutes, we should be very well content. We should begin with the boiler, which, as it would not be required to store much steam, might be made very light indeed. It would only require to contain water sufficient to give a ten minutes' supply of steam, but require a considerable heating surface, so that the steam might be kept up all that time with a good deal of force. It would require five valves; the main one would open backwards, and would thus force the machine forwards. Another would open upwards, and so press the machine downwards. Another would open downwards, and thus press the machine up again, and the remaining two would be required to turn the machine, by forcing the head round either to the one side or to the other, as desired, and thus the machine ought to be under perfect control. Of course, the force would be exerted on those parts immediately opposite the openings by which the steam escaped, and these would be removed to different parts of the balloon or machine, and so distributed over that comparatively bulky object, which should thus be perfectly under command. The steam would be carried up to the points required by light tinsel pipes. Now, the weight of such with boiler, water, and spirit lamps could scarcely exceed a few ounces, and a hydrogen gas balloon could easily be constructed from gold-beater's skin, sufficient to bear up the whole in mid-air. Some such we would suggest as the model; it is simple, it is a machine without machinery, and there appears to be nothing which would imply any difficulty in the construction of such.

A working model once made, and careful experiments carried out, we should no doubt soon acquire an insight into aerial navigation far surpassing any which we now have, and one which would justify the construction of a larger and improved machine for practical experiment. Had we but a motive power equal to steam, but generated from only a few pounds' weight, there would be no difficulty in the matter of a practical machine; but not having that, steam is our great difficulty. Notwithstanding that we propose to throw away the pistons, cylinders, cranks, beams, connecting rods of all kinds, and the large lumbering boiler, retaining only a steam generator, water and fuel, yet even then weight is our great encumbrance. The weight of the water and steam generator or boiler we shall have just to bear, but the weight of the fuel may be overcome by the use of some patent fuel, oil, or gas. It might just happen that coal gas might be found capable of being burned with safety. In this case, the supply of gas might be adjusted in such a way as to equalize the weight of water, and as the gas was slowly consumed so might the water in the same proportion, and thus the relative weight carried by the balloon be kept uniform. When the word balloon is used, you must bear in mind that it refers not to the usual clumsy pear-shaped machine, but to one of a cigar, cylindrical, or other more convenient shape. Such a machine as that to which our paper refers, should be able to ascend or descend, or to maintain a given distance from the surface without any waste of gas or ballast.

(To be continued.)

THE Erie Railway, which is one of the worst managed railroads in the United States, has had another frightful accident. At midnight, July 14, an express train from New York was going westward, along the banks of the Upper Delaware, at a speed of thirty miles an hour, and at a place called Masthope ought to have passed a goods train which was on a siding. The latter, however, stood partly on the main line, and there was a collision, which threw the engine and seven coaches of the passenger train off the track, setting them and a station-house near by on fire. Of course there was a frightful loss of life. The coroner's investigation developed the fact that it was caused by the engine-driver of the goods train sleeping on his post. His train was on a siding waiting for the passenger train to pass by. The sleeping man interpreted the rush of the latter as an order from his guard to proceed, and, suddenly awakening, started his train out on the main line, when the collision occurred.

BRICK-MAKING MACHINE.

BY MR. P. HOOKER.

FIG. 1.

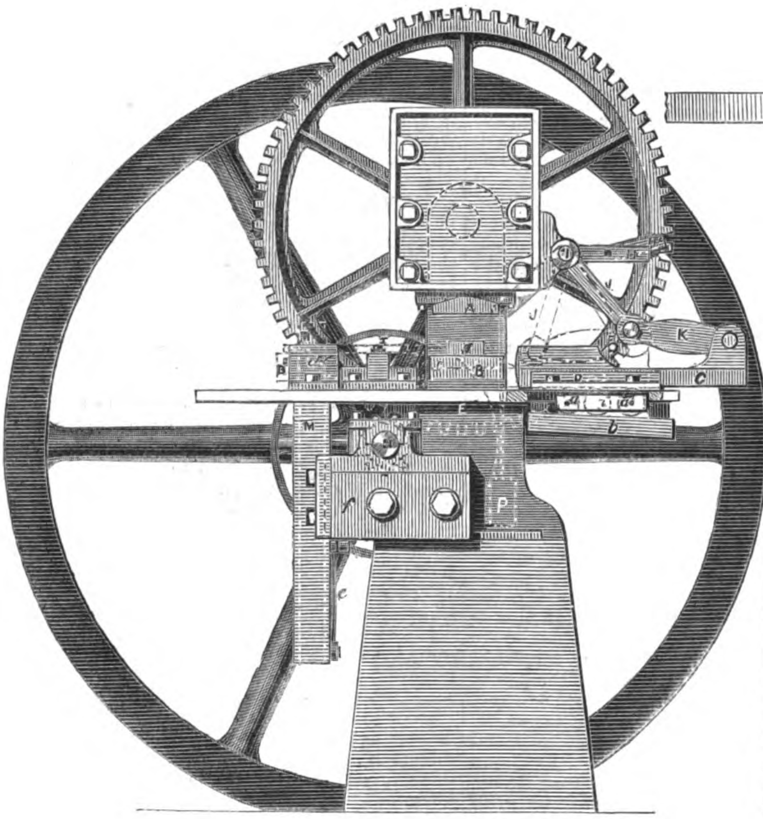
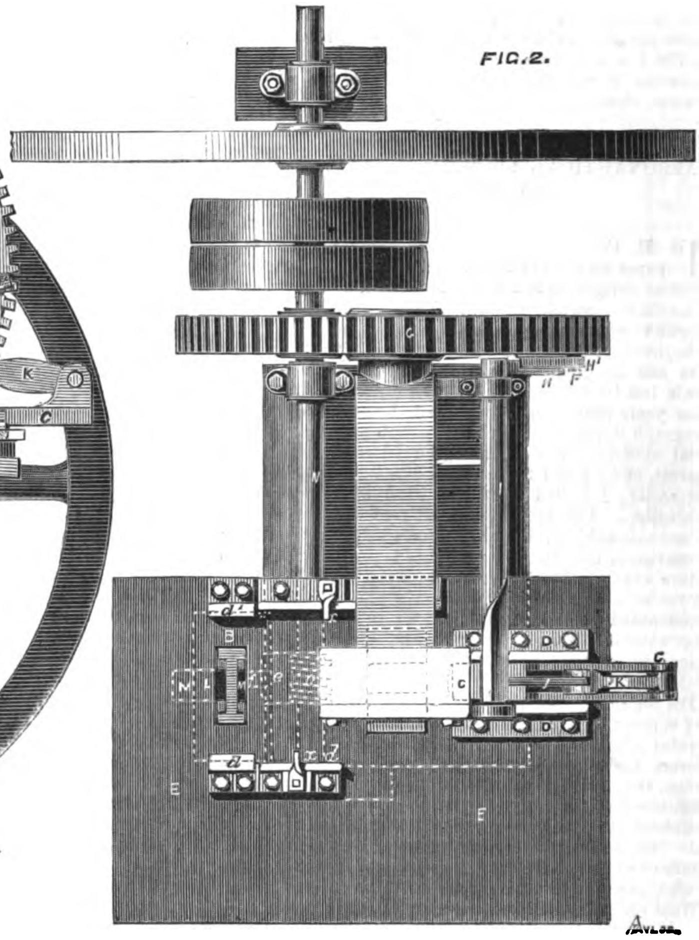


FIG. 2.



IMPROVEMENTS IN BRICK-MAKING MACHINERY.

SOME improvements in brick-making machinery have recently been patented by Mr. P. Hooker, of Pump-row, Old-street-road, and are illustrated in the accompanying engravings. Fig. 1 represents an elevation in front view of a brick-pressing machine arranged according to his invention, fig. 2 being a plan of the same. A is a plunger adapted to an ordinary punching machine, and serving to compress the material to form the brick in the mould B on the table E of the machine, this plunger being operated in a similar manner to that of a punching press.

The improvements consist, first, in providing a slide C at one side of the table E for removing the mould from under the plunger A after compressing the material contained. This slide C works in guides D fixed on the table E, and may either be worked by means of a hand lever and connecting rod, or operated directly by the gearing working the plunger. For this purpose there is a projecting tappet F on the spur wheel G, which is brought into contact at each revolution of the wheel with a part H 1 of lever H keyed to one end of a horizontal shaft I. The other end of the shaft I carries a second lever J connected to the slide C by a rod K, and in this manner the slide C will be brought forward each time the tappet F comes in contact with and depresses lever H, which takes place after each descent of the plunger A into the mould. The latch H 1 is hinged to the lever H, so that should the machine be accidentally driven in the backward direction, the tappet F will raise and pass the latch H 1 without operating the slide C, and thus prevent injury to the machine.

The slide C is returned to the position shown by its own gravity, aided if required by a counterbalance weight P suspended from a lever arm carried on the shaft I. The motion of the slide C is further assisted by mounting it on friction rollers a and a^1 of unequal diameter, connected together by a frame i, and resting upon an inclined grating or support b fixed to the under side of the table E of the apparatus, the smaller roller a being in advance, so that when the lever H is released from the tappet F, the slide C will run back down the incline by the aid of the friction rollers in readiness for acting on the next mould which it pushes forward as before to the point of delivery after a brick has been compressed therein by the plunger A. The grating b is provided so that the dust or other matters from the table E may fall through, which would otherwise check the action of the slide C.

In order to remove the compressed brick from the mould B the latter is brought by the slide C to the position shown in dotted lines over an aperture L in the table E at the opposite side of the apparatus, the edge of the mould passing under clamps d fixed on the table so as to keep the mould firmly down on the table E when removing the brick therefrom. The brick is removed from the mould by a vertical follower M sliding on guides below the table E, which rises through the aperture L and through the mould, carrying with it the compressed brick, which is thus raised completely out of the mould. This follower M is operated by a shaft N carrying a pinion N 1 gearing with the spur wheel G, and provided with endless screw gearing O, communicating with the follower M by means of a connecting rod e and crank pin f, arranged so that after the descent of the plunger A for compressing a brick in the mould placed beneath it, the follower will rise and remove the compressed brick from the mould previously brought over the aperture L by the slide C. The brick is removed from the top of the follower M in the position shown in dotted lines in fig. 1, either directly by hand or by the mechanical arrangement already described, as being operated by the machine for removing the brick on to the platform or table raised above table E, from which it is removed by hand or otherwise. The follower M then returns to the position below table E as seen, to permit of the removal of the mould.

The action of the machine is as follows:—A mould B having been filled with the material of which the bricks are to be made, a metal block g exactly corresponding in size to the aperture of the mould is placed on the material, and the mould then brought by hand under the plunger A of the machine, which on its descent will force the block g into the mould, and thus compress the material contained into a brick of the form and dimensions desired. By employing blocks of different thicknesses the thickness of the brick may be varied, the block employed thus forming a gauge for the same. The mould B is moved from under the plunger between guides d by the forward motion of slide C, and brought to the position shown in dotted lines at B 1 and another mould having been similarly acted on by the plunger, the whole are moved forward together by slide C, and brought successively over aperture L in the table E, as at B 2. The first mould having arrived over aperture L and under the clamps d, the brick is raised therefrom by the follower M, from which it is conveyed on to the raised platform by the arrangement already described. Another brick having in the meantime been similarly compressed beneath the plunger A, the next mould is moved under the clamps d by the slide C displacing the first mould which is now empty. A small scraper x is fixed above the table E in a line with each clamp d to remove any sand or grit which may lodge on the edges of the moulds; m is the inclined shoot, placed under the aperture L to carry off any dust or matters from table E, brought to that point by moulds.

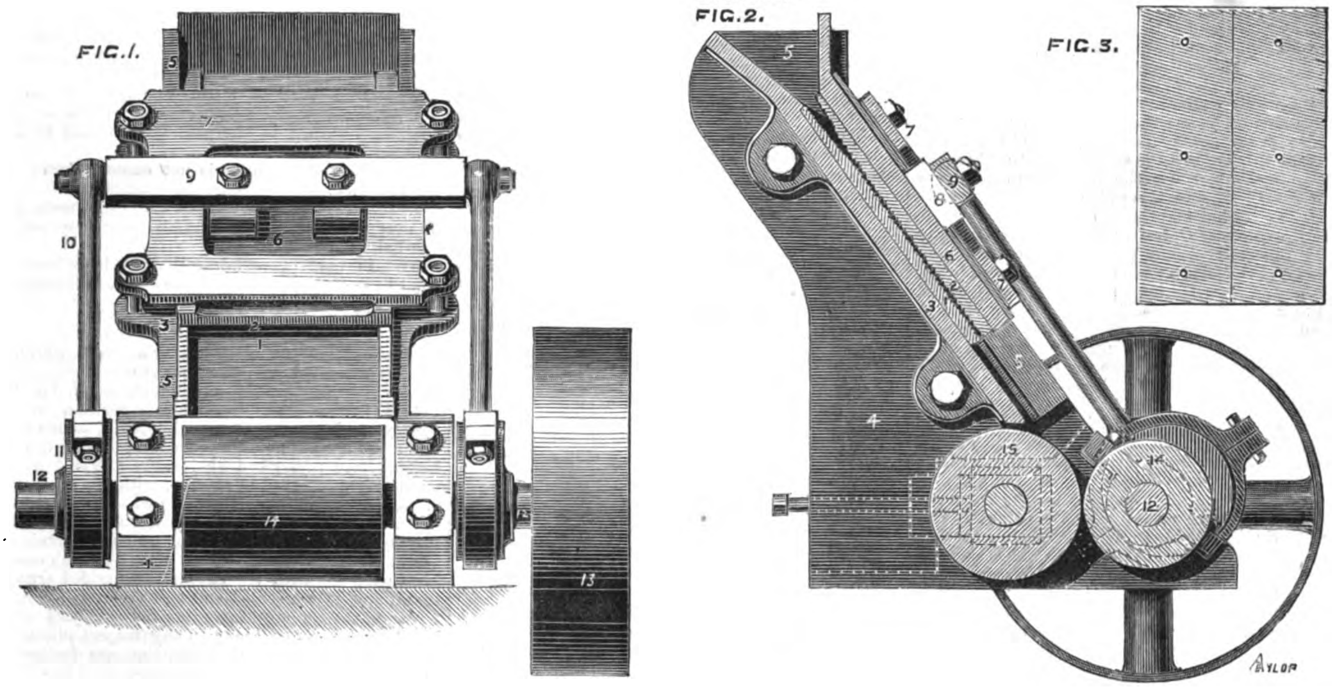
INSTITUTION OF MECHANICAL ENGINEERS.

THE annual congress of the Institution of Mechanical Engineers was opened on Tuesday in the Theatre of the Literary and Philosophical Society of Newcastle, under the presidency of Sir W. J. Armstrong, C.B. There was a large attendance of representatives from all parts of the country. Papers have been read on the hydraulic swing bridge over the Ouse, by Sir W. J. Armstrong; the mechanical ventilation of mines, by Mr. William Cochrane, of Elswick; and mechanical firing of steam boilers, by Mr. John Daglish, of Seaham. Excursions have been made to Seaton Delaval Colliery; to sea, on board the "Duchess of Sutherland," a handsome new paddle steamship, built by Messrs. A. Lesslie and Co., of Hebburn, for the London and North-Western Railway Company, to trade between Holyhead and Dublin, her engines from the works of Messrs. R. Stephenson and Co.; and to Ryhope Colliery, near Sunderland. Reports of these papers will appear in due course.

APPARATUS FOR GRINDING GRAIN.

BY MR. J. NORMAN.

FIG. 1. FIG. 2. FIG. 3.



APPARATUS FOR GRINDING GRAIN.

MR. JOHN NORMAN, of Glasgow, has patented an invention for grinding or reducing grain by means of apparatus of a simple and inexpensive character, and which may be worked by hand, or adapted to any amount of power. The apparatus comprises two serrated plates, between which the grain passes. One plate has imparted to it a short rapid reciprocating stroke. In our engraving, fig. 1 is a front elevation of the machine, and fig. 2 is a vertical section at right angles to fig. 1, whilst fig. 3 is a face view of one of the serrated plates. The serrated plates 1 and 2 are placed in an inclined position, one of them being fixed to a cast-iron bed, plate 3, which is bolted to two side standards 4, and combines with these standards to form the framing of the machine. The bedplate is formed with cheeks 5 at the sides, which serve as guides to an upper moving frame plate 6, to the under side of which is fixed the upper moving serrated plate 2. The plate 6 is kept down by a cover plate 7, which is fixed to the bedplate by screw bolts, by which its distance from the bedplate can be nicely and easily adjusted. It is adjusted so that the upper serrated plate 2 can move slightly away from the fixed one 1 when rising.

The cover plate 7 is in the form of an open frame, and through the opening in it snugs 8 formed on the moving plate 6 project, to have fixed to them a crossbar 9, by means of which the plate 6 is actuated. The ends of the crossbar 9 have jointed upon them the ends of connecting rods 10 from eccentrics 11 on a shaft 12, carried in bearings in the lower part of the standards 4, and fitted with a pulley 13 to receive a driving belt. By these means the upper serrated plate 2 is made to reciprocate rapidly over the fixed plate 1, and this action grinds or reduces the grain as it gradually passes down between them. The serrated plates 1 and 2 are tapered at their upper parts so as to be sufficiently wide apart for the grain to enter easily, and the space between them becomes gradually narrower from their upper ends downwards. The upper parts of the bedplate and upper plate 6 are shaped so as together to form a kind of hopper mouth to receive the grain from a duct or funnel, and lead it in between the serrated plates 1 and 2.

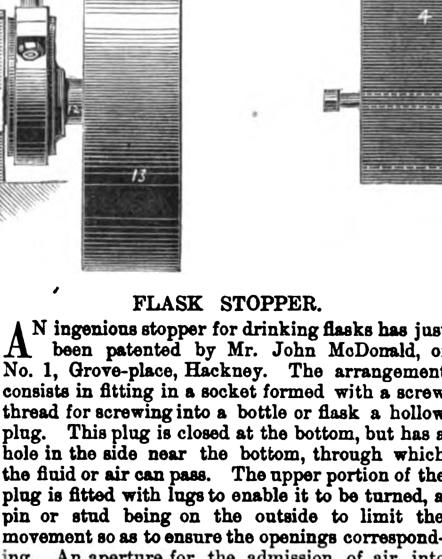
The serrations are in lines, inclined across the plates, as shown in fig. 3, and when the plates are in position, the upper ends of the serration lines of one are at the right-hand side, and those of the other at the left-hand side, so that the lines cross. The serrations are made with a downward set on both plates, that is with the lines that bisect the projecting angles inclined towards the lower end of the plates. Two smooth rollers 14 and 15 are arranged below the grinding plates (one being on the shaft 13) to receive the reduced grain or meal as it falls from them, and to crush and equalize it, and this addition will be more particularly advantageous in the case of small machines to be worked by hand, and designed for domestic use.

FLASK STOPPER.

AN ingenious stopper for drinking flasks has just been patented by Mr. John McDonald, of No. 1, Grove-place, Hackney. The arrangement consists in fitting in a socket formed with a screw thread for screwing into a bottle or flask a hollow plug. This plug is closed at the bottom, but has a hole in the side near the bottom, through which the fluid or air can pass. The upper portion of the plug is fitted with lugs to enable it to be turned, a pin or stud being on the outside to limit the movement so as to ensure the openings corresponding. An aperture for the admission of air into the bottle is formed on the outside of the plug; this aperture coincides with a small hole in the socket, so that, when the plug is turned and the vessel tilted, air enters through the aperture, and the fluid is free to run out.

In the accompanying engraving, fig. 1 is an

FIG. 3. FIG. 1. FIG. 4. FIG. 2. FIG. 5.



elevation of a drinking flask with a stopper in the mouth, and made according to this invention. *a a* is a socket which is formed with a screw thread *b* on its exterior for screwing into the neck of the flask *c*. Inside the socket *a* is a hollow plug *d*, which is closed at the bottom and has a hole *e* at its side, through which the fluid passes. The upper portion of the plug is fitted with lugs or finger pieces *f f* to enable the plug to be turned by hand. There is a stud or stop pin *g* on the outside of the plug for limiting the extent to which the plug may be moved. It rides in a recess cut in the top edge of the socket, and comes against the end of its rim. At some portion of the socket is a hole *h* which, when the plug is turned into the position for allowing the fluid to flow out, is in communication with a groove cut vertically on the plug to admit air into the flask, and so allow of the fluid flowing freely. A square is formed on the bottom of the plug, over which a washer is placed, and is held firmly thereon by means of a nut *j*. In order to prevent any fluid escaping up through the bottom of the plug, or between the plug and socket, a cap *k* is screwed on to the bottom of the socket, by which means all leakage is prevented. The socket has a hole *l* in it which, when the hole in the plug is brought round to correspond, forms a free passage to the interior of the flask. When the flask is full of fluid, and it is necessary to remove some of it, the plug must be turned a sufficient distance to bring the holes in a line to form the passage, and the flask tilted, when the fluid will run out. The top edge of the plug is rounded off so as not to cut the mouth of the person drinking from it. The plug and parts connected with it are shown in the detached views, figs. 2, 3, 4, and 5, and need no further description.

PATENT LAW FOR THE DOMINION OF CANADA.

(Concluded from page 80).

20. SIMILARLY, whenever by any mistake, accident, or inadvertence, and without any wilful intent to defraud or mislead the public, a patentee has made his specification too broad; claiming more than that of which he, or the party through whom he claims, was the first inventor or discoverer, or has in the specification claimed that he or the party through whom he claims was the first inventor or discoverer of any material or substantial part of the invention or discovery patented, of which he was not the first inventor or discoverer, and had no legal right thereto; the patentee may, on payment of the fee hereinafter provided, make disclaimer of such parts as he shall not claim to hold by virtue of the patent or the assignment thereof; such disclaimer shall be in writing, and in duplicate, and attested in the manner hereinbefore prescribed for a patent, one copy to be filed and recorded in the office of the Commissioner, the other copy to be attached to the patent and made a part thereof by reference, and such disclaimer shall thereafter be taken and considered as part of the original specification. Such disclaimer shall not affect any action pending at the time of its being made, except in so far as may relate to the question of unreasonable neglect or delay in making it. In case of the death of the original patentee, or of his having assigned the patent, a like right shall vest in his assigns or legal representatives respectively, any of whom may make disclaimer. The patent shall thereafter be deemed good and valid for so much of the invention or discovery as is truly the disclaimant's own, and not disclaimed, provided it be a material and substantial part of the invention or discovery, and definitely distinguished from other parts claimed

without right; and the disclaimant shall be entitled to maintain a suit for such part accordingly.

ASSIGNMENT AND INFRINGEMENT OF PATENTS.

21. The Government of Canada may always use any patented invention or discovery, paying to the patentee such sum as the Commissioner may report to be a reasonable compensation for the use thereof.

22. Every patent for an invention or discovery, whensoever issued, shall be assignable in law either as to the whole interest or as to any part thereof, by any instrument in writing; but such assignment, and also every grant and conveyance of any exclusive right to make and use and to grant to others the right to make and use the invention or discovery patented within and throughout the dominion of Canada, or within and throughout any one or more of the Provinces of Ontario, Quebec, Nova Scotia or New Brunswick, or any part of any of such provinces or of the dominion, shall be registered in the office of the Commissioner; and every assignment affecting a patent for invention or discovery shall be deemed null and void against any subsequent assignee unless such instrument is registered as hereinbefore prescribed, before the registering of the instrument under which such subsequent assignee may claim.

23. Every person who, without the consent in writing of the patentee, makes, constructs, or puts in practice any invention or discovery for which a patent has been obtained under this Act, or procures such invention or discovery from any person not authorized to make or use it by the patentee, and uses it, shall be liable to the patentee in an action of damages for so doing; and the judgment shall be enforced, and the damages and costs as may be adjudged shall be recovered in like manner as in other cases in the court in which the action is brought.

24. An action for the infringement of a patent may be brought before any Court of Record having jurisdiction to the amount of damages asked for, and having its sittings within the province in which the infringement is said to have taken place, and being at the same time of the courts of such jurisdiction within such province the one of which the place of holding is nearest to the place of residence or of business of the defendant; and such court, shall decide the case and determine as to cost. In any action for the infringement of a patent, the court, if sitting, or any judge thereof in chambers if the court be not sitting, may, on the application of plaintiff or defendant respectively, make such order for an injunction, restraining the opposite party from further use, manufacture, or sale of the subject matter of the patent, and for his punishment in the event of disobedience to such order, or for inspection or account, and respecting the same and the proceedings in the action, as the court or judge may see fit; but from such order an appeal shall lie under the same circumstances and to the same court as from other judgments or orders of the court in which the order was made.

25. Whenever the plaintiff fails to sustain his action, because his specification and claim embrace more than that of which he was the first inventor or discoverer, and it appears that the defendant used or infringed any part of the invention or discovery justly and truly specified and claimed as new, the court may discriminate, and the judgment may be rendered accordingly.

26. The defendant in any such action may specially plead as matter of defence any fact or default which by this Act or by law would render the patent void; and the court shall take cognizance of that special pleading and of the facts connected therewith, and shall decide the case accordingly.

NULLITY, IMPEACHMENT AND VOIDANCE OF PATENTS.

27. A patent shall be void if any material allegation in the petition or declaration of the applicant be untrue, or if the specification and drawings contain more or less than is necessary for obtaining the end for which they purport to be made, such omission or addition being wilfully made for the purpose of misleading; but if it shall appear to the court that such omission or addition is simply an involuntary error, and it is proved that the patentee is entitled to the remainder of his patent *pro tanto*, the court shall render a judgment in accordance with the facts, and determine as to costs, and the patent shall be held valid for such part of the invention described, and two office copies of such judgment shall be furnished to the Patent Office by the patentee, one to be registered and to remain on record in the office, and the other to be attached to the patent and made a part of it by reference.

28. Every patent granted under this Act shall be subject and expressed to be subject to the condition that such patent and all the rights and privileges thereby granted shall cease and determine and the patent shall be null and void, at the end of three years from the date thereof, unless the patentee shall, within that period, have commenced and shall after such commencement carry on in Canada the construction or manufacture of the invention or discovery patented, in such manner that any person desiring to use it may obtain it or cause it to be made for him at a reasonable price at some manufactory or establishment for making or constructing it, in Canada, and that such patent shall be void if after the expiration of eighteen months the granting thereof the patentee or his assignee or assignees for the whole or a part of his interest in the patent, imports or causes to be imported into Canada, the invention or discovery for which the patent is granted.

29. Any person desiring to impeach any patent issued under this Act may obtain a sealed and certified copy of the patent and of the petition, declaration, drawings and specification thereunto relating, and may have the same filed in the Office of the Prothonotary or Clerk of the Superior Court for the Province of Quebec, or of the Court of Queen's Bench or Common Pleas for the Province of Ontario, or of the Supreme Court in the Province of Nova Scotia, or the Court of Queen's Bench in the Province of New Brunswick, according to the domicile elected by the patentee as aforesaid; which court shall adjudicate on the matter and decide as to costs. The patent and documents aforesaid shall then be held as of record in such court, so that a writ of "scire facias" under Seal of the Court grounded upon such record may issue for the repeal of the patent, for legal cause as aforesaid, if upon proceedings had upon the writ in accordance with the meaning of this Act the patent be adjudged to be void.

30. A certificate of the judgment voiding any patent shall, at the request of any person or party filing it to be of record in the Patent Office, be entered on the margin of the enrolment of the patent in the office of the Commissioner, and the patent shall thereupon be and be held to have been void and of no effect, unless and until the judgment be reversed on appeal as hereinafter provided.

31. The judgment declaring any patent void shall be subject to appeal to any court of appeal having appellate jurisdiction in other cases over the Court by which the same was rendered.

PATENTS ISSUED UNDER FORMER LAWS.

32. All patents issued under any Act of the legislature of the late Province of Canada, or of Nova Scotia or New Brunswick, and all patents issued for the Provinces of Ontario and Quebec under the Act of the late province of Canada, to the date of the coming into operation of the present Act, shall remain in force for the same term, and for the same extent of territory, as if the Act under which they were issued had not been repealed, but subject to the provisions of this Act in so far as applicable to them.

2. And it shall be lawful for the Commissioner, upon the application of the patentee named in any such patent, being the inventor or discoverer of the subject matter of the patent and a British subject, or a resident in any Province of Canada for upwards of a year, if the subject matter of the patent has not been known or used or with the consent of the patentee on sale in any of the other Provinces of the Dominion, to issue on a payment of the proper fees in that behalf a patent under this Act extending such provincial patent over the whole of the Dominion, subject to the provisions of the seventeenth section; but no patent so issued shall extend beyond the remainder of the same mentioned in the provincial patent.

33. All the records of the Patent Offices of the late Province of Canada, and of the Provinces of Ontario and Quebec, of Nova Scotia, and New Brunswick, shall be handed over by the officers in charge of them to the Commissioner of Patents of invention or discovery, to form part of the records of the Patent Office for the purposes of this Act.

TARIFF OF FEES.

34. The following fees shall be payable to the Commissioners before an application for any of the purposes hereinafter mentioned shall be entertained, that is to say:—

	Dollars.
On a petition for a patent for five years	20·00
On petition for extension from five to ten years	20·00
On petition for extension from ten to fifteen years	20·00
On lodging a caveat	5·00
On asking to register a judgment *pro tanto*	4·00
On asking to register an assignment	2·00
On asking to attach a disclaimer to a patent	4·00
On asking for a copy of patent with specifications	4·00
On petition to re-issue a patent after *demande*, and on petition to extend a former patent to the Dominion, the fee shall be at the rate of for every unexpired year of duration of such patent.	4·00
On office copies of documents, not above mentioned, the following charge shall be exacted:—	
For every single or first-folio of certified copy	50
For every subsequent hundred words (fractions) from and under fifty not being counted, and over fifty being counted for one hundred	25

35. For every copy of drawings the party applying shall pay such sums as the Commissioner considers a fair remuneration for time and labour expended therein by any officer of the department or person employed to perform such service.

36. The said fees shall be in full of all services performed under this Act in any such case by the Commissioner or any person employed in the Patent Office.

37. All fees received under this Act shall be paid over to the Receiver General and form part of the Consolidated Revenue Fund of Canada, except such sums as may be paid for copies of drawings when made by persons not receiving salaries in the Patent Office.

38. No fee shall be made the subject of exemption in favour of any person; and no fee once paid shall be returned to the person who paid it except:—

1. When the invention is not susceptible of being patented.

2. When the petition for patent is withdrawn, and in every such case the Commissioner may return one-half of the fee paid.

And in case of withdrawal a fresh application shall be necessary to revive the claim, as if no proceeding had taken place in the matter.

MISCELLANEOUS PROVISIONS.

39. An intending applicant for a patent who has not yet perfected his invention or discovery and is in fear of being despoiled of his idea, may file in the Patent Office a description of his invention or discovery so far, with or without plans, at his own will; and the Commissioner on reception of the fee hereinbefore prescribed shall cause the said document to be preserved in secrecy, with the exception of delivering copies of the same whenever required by the said party or by any judicial tribunal—the secrecy of the document to cease when he obtains a patent for his invention or discovery, and such document shall be called a "caveat." Provided always that if application shall be made by any other person for a patent for any invention or discovery with which such "caveat" may in any respect interfere, it shall be the duty of the Commissioner forthwith to give notice by mail to the person who has filed such "caveat," and such person shall, within three months after the date of mailing the notice, if he would avail himself of the "caveat," file his petition and take the other steps necessary in an application for patent; and if in the opinion of the Commissioner the applications are interfering, like proceedings may be had in all respects as are by this Act provided in the case of interfering applications, provided further that unless the person filing any "caveat" shall within four years from the filing thereof have made application for a patent the "caveat" shall be void.

40. The Commissioner may object to grant a patent in the following cases:—

1. When he is of opinion that the alleged invention or discovery is not patentable in law.

2. When it appears that the invention or discovery is already in the possession of the public with the consent or allowance of the inventor.

3. When it appears that the invention or discovery has been described in a book or other printed publication before the date of the application, or otherwise in the possession of the public.

4. When it appears that the invention or discovery has already been patented, except, however, when the case is one within the seventh section of this Act; or one in which the Commissioner has doubts as to whether the patentee or the applicant is the first inventor or discoverer.

41. Whenever the Commissioner objects to grant a patent as aforesaid, he shall notify the applicant to that effect and shall state the ground or reason therefor with sufficient detail to enable the applicant to answer, if he can, the objection of the Commissioner.

42. Every applicant who has failed to obtain a patent by reason of the objection of the Commissioner as aforesaid, may at any time within six months after notice thereof has been addressed to him or his agent, appeal from the decision of the Commissioner to the Governor in Council.

43. In cases of interfering applications for any patent, the same shall be submitted to the arbitration of three skilled persons, one of whom shall be chosen by each of the applicants, and the third person shall be chosen by the Commissioner, or by his deputy or the person appointed to perform the duty of that office:—And the decision or award of such arbitrators, or any two of them, delivered to the Commissioner in writing, and subscribed by them, or any two of them, shall be final as far as respects the granting of the patent.

2. If either of the applicants refuses or fails to choose an arbitrator, when required so to do by the Commissioner, the patent shall issue to the opposite party:—and when there are more than two interfering applicants, and the parties applying do not all unite in appointing three arbitrators, the Commissioner or his deputy, or person appointed to perform the duty of that office, may appoint the three arbitrators for the purposes aforesaid.

44. All specifications, drawings, models, disclaimers, judgments and other papers, except "caveat," shall be open to the inspection of the public at the Patent Office, under such regulations as may be adopted in that behalf.

45. Clerical errors happening in the framing or copying of any instrument of the Patent Office, shall not be construed as invalidating the same, but when

discovered they may be corrected under the authority of the Commissioner.

46. In case any letters patent shall be destroyed or lost, others of the like tenor, date, and effect may be issued in lieu thereof, on the party paying the fees hereinbefore prescribed for office copies of documents.

47. No letters patent shall extend to prevent the use of any invention or discovery in any foreign ship or vessel, where such invention or discovery is not so used for the manufacture of any goods to be vended within or exported from Canada.

48. Every person who before the issuing of a patent has purchased, constructed, or acquired any invention or discovery for which a patent has been obtained under this Act, shall have the right of using and vending to others, the specific art, machine, manufacture or composition of matter patented, so purchased, constructed or acquired before the issue of the patent therefor, without being liable to the patentee or his representatives for so doing; but the patent shall not be held invalid as regards other persons by reason of such purchase, construction, or acquisition or use of the invention or discovery by the person first aforesaid, or by those to whom he may have sold the same, unless the same was purchased, constructed or acquired or used for a longer period than one year before the application for a patent therefor.

49. Every patentee under this Act shall stamp or engrave on each patented article sold or offered for sale by him, the year of the date of the patent applying to such article, thus,—"Patented, 1869," or as the case may be; and any such patentee selling or offering for sale any such patented article not so marked shall be liable to the punishment of a fine not to exceed one hundred dollars, and in default of the payment of such fine, to imprisonment not to exceed two months.

50. Whosoever writes, paints, prints, moulds, casts, carves, engraves, stamps or otherwise marks upon anything made or sold by him, and for sole making or selling of which he is not the patentee, the name or any imitation of the name of any patentee for the sole making or selling of such thing, without the consent of such patentee, or without the consent of the patentee, writes, paints, prints, moulds, casts, carves, engraves, stamps or otherwise marks upon anything not purchased from the patentee the words, "Patent," "Letters Patent," "Queen's Patent," "Patented," or any word or words of like import, with the intent of counterfeiting or imitating the stamp, mark or device of the patentee, or of deceiving the public and inducing them to believe that the thing in question was made or sold by or with the consent of the patentee, shall be deemed to have committed a misdemeanor, and shall on conviction be punished therefor by fine or by imprisonment, or both, in the discretion of the court before which the conviction shall be had; but the fine shall not exceed two hundred dollars, nor shall the imprisonment exceed three months.

51. Any person wilfully making or causing to be made any false entry in any register or book, or any false or altered copy of any document relating to the purposes of this Act, or who shall produce or tender any such false or altered document knowing the same to be such, shall be guilty of a misdemeanor, and shall be punished by fine and imprisonment accordingly.

52. Chapter thirty-four of the Consolidated Statutes of the late Province of Canada, respecting Patents for Inventions, Chapter one hundred and seventeen of the Revised Statutes of Nova Scotia (third series), Chapter one hundred and eighteen of the Revised Statutes of New Brunswick, and any Act amending any of the said Chapters, or any other Act, are hereby repealed, in so far as they or any of them may be inconsistent with this Act, or make any provision in any matter provided for by this Act, except only as respects all rights acquired and penalties or liabilities incurred under the said laws, or any of them, before the coming into force of this Act.

53. When citing this Act, it shall be sufficient to call it "The Patent Act of 1869."

54. This Act shall commence and take effect on the first day of July, 1869.

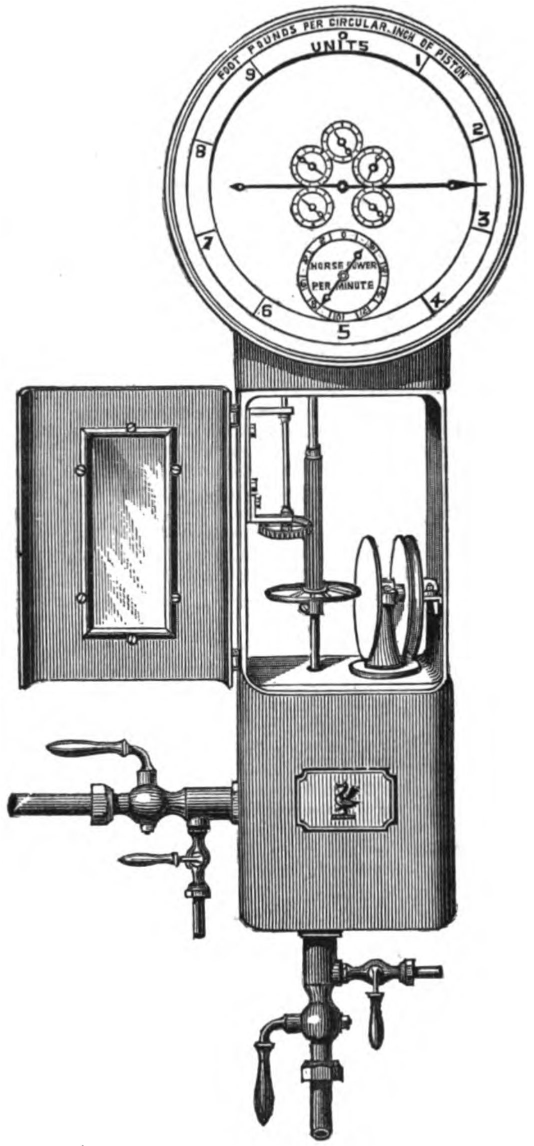
THE estimate of the sum required in the year ending March 31, 1870, to defray the salaries and expenses of the telegraph service is £90,000. This amount is required to provide for the expenses of the above service, exclusive of the interest on the purchase money, from January 1 to March 31, 1870. The revenue for the same period is estimated at £168,000.

THE number of visitors to the South Kensington Museum during the week ending July 31, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,074; Meyrick and other galleries, 2,725; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,967; Meyrick and other galleries, 188; total, 16,854. Average of corresponding week in former years, 12,298. Total from opening of Museum, 8,658,291.

CONTINUOUS INDICATOR.

BY MESSRS. ASHTON AND STOREY.

THIS ingenious instrument was exhibited at the late Manchester Show, by Messrs. Storey and Sons, of 24, Deansgate, Manchester. It was to be seen at work at Mr. Weighell's stand, as mentioned by us in another place. It is a steam power meter and continuous indicator, its use being to determine the amount of work done by an engine in any given time. Our engraving shows an elevation of the apparatus. In the lower part is placed a piston and a cylinder, working just as an ordinary indicator. The piston rod actuates a disc wheel, which slides against the face of a vertical rotating disc; both of these are shown in the cut. The horizontal disc actuates a train of mechanism, by which a hand is moved over a dial. When the indicator has no pressure on it, the horizontal wheel being opposite the centre of the vertical disc, has no motion imparted to it, but the moment the piston rises under the influence of pressure, or falls under that of vacuum, the horizontal wheel has motion imparted to it, and it will move the further in a given time the greater the distance it is removed from the centre of the vertical disc; but this distance is determined by the pressure in the cylinder. The hand actuated by the horizontal wheel records foot-pounds per minute, per hour, &c.; and, consequently, the greater the pressure in the cylinder the greater will be the travel of the horizontal disc, and the larger the number of revolutions made in a given time, and the larger the number of foot-pounds registered. The machine shows almost at a glance the power developed during each day or each hour, while diagrams can be taken, as with the ordinary indicator.



TARGET PRACTICE AT THE BERKSHIRE VOLUNTEER ENCAMPMENT.

ON Saturday, July 31st, a very interesting competition took place in the presence of Major Sir C. S. Paul Hunter, Bart., between Corporal Bambridge and fourteen picked men of the battalion, using long Enfield rifles, and three men using the Soper direct-action breech-loader. The targets were similar to those used for file firing, but only half the usual size. Distance 200yds. Time three minutes, each party to fire as rapidly as they pleased. The scores were as follows:—

ENFIELD RIFLES.

	Points.
First squad of five men	84
Second " "	94
Third " "	94
Total	272

SOPER'S BREECH-LOADER.

Sergeant Soper	140
Private Warrick	138
Sergeant Gostage	110
Total	388

Majority in favour of breech-loader, 116 points.

It will thus be seen that two men with the breech-loader scored six points more than the fifteen men with the Enfield, Private Warrick having fired eighteen shots the first minute, twenty-one the second, and seventeen the third, making a total of fifty-six shots in the three minutes; and Sergeant Soper having scored five bull's eyes before a single shot was got off by the squad opposed to him.

ROYAL POLYTECHNIC INSTITUTION.

LAST Tuesday, the half-yearly general meeting of the shareholders took place at the institution, Regent-street; the Rev. J. B. Owen in the chair. The report showed the receipts for the half-year to be as follows:—Visitors at 1s., £4,059 15s.; workmen and children, at 6d., £690 2s. 6d.; reserved seats, £602 2s.; diving bell, £11 7s.; sale of programmes, £33 2s.; students' tickets £13 2s. 6d.; annual tickets, £4 4s.; rent receivable, £423 1s. 4d.; interest, £116 13s. 4d.; making a total of £5,953 9s. 8d. The expenses had been £5,009 14s. 6d., leaving a balance of £943 15s. 2d. The report stated that the fact of the balance of the revenue account being unusually high enabled the directors to recommend a dividend of 5 per cent. for the half-year, being at the rate of 10 per cent per annum. The report was adopted *nem. con.*, as were also the reports of Mr. Pepper, the managing director; the Rev. Charles Mackenzie, hon. manager of the educational department; and the chairman's report of the general state of the affairs of the institution. Votes of thanks were duly accorded to the chairman and various officers connected with the establishment, and the proceedings closed.

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

AUGUST 3 and 4.

(Before Vice-Chancellor Sir R. MALINS.)

THE CAPTIVE BALLOON.

CROMWELL *v.* YON.

THIS was a motion to restrain the inflation and exhibition of the "Captive Balloon," on the ground of danger and annoyance from the weight of cable and ballast, the obstruction of light, and nuisance of overhanging the adjoining premises. The plaintiff is the Principal of St. Mark's College, in the immediate vicinity.

Mr. Glasse, Q.C., and Mr. Lea, appeared in support of the motion; Mr. Renshaw for the defendant.

After some discussion, the Vice-Chancellor directed the motion to stand over for a day in order

that some arrangement might be come to or undertaking given.

On the following morning, Mr. Glasse, Q.C., and Mr. Lea renewed the motion. St. Mark's College is situated across the road south of the circus, at a distance of 30ft., and, as the defendant's allege, 50 yards from the plaintiff's house, whose establishment consists of upwards of 700 pupils. The bill asked for a mandatory injunction, but this was not insisted on. The chief ground for the motion was the danger and annoyance (the cable being of the length of 2,000ft., and weighing two tons besides ballast), and the risk of explosion, it having once escaped, as is well known. On that occasion the bill was on the eve of being filed, and notice was given; but the exhibitions being continued, this bill was filed and motion made. There was a good deal of evidence of persons in the immediate neighbourhood, those on the plaintiff's part deposing to the propinquity of the rope to the chimneys and house, and the overhanging of the machine itself, causing dread and annoyance by the obstruction of light and air, and the danger of explosion when awaiting passengers, and the nuisance of the crowds collected. On the other hand, the defendant's evidence was that the balloon had, in fact, never been over the plaintiff's premises. The balloon and apparatus had cost £14,000 and upwards.

After some discussion as to the necessity of the case being heard before the vacation, it was eventually postponed till Michaelmas Term.

Obituary.

WE regret to record the death of Joseph Beete Jukes, M.A., F.R.S., Director of Her Majesty's Geological Survey of Ireland, and Professor of Geology to the Royal College of Science. Professor Jukes was born on the 10th of October, 1811, and died on the 29th ultimo. He was educated at the Free Grammar School at Wolverhampton, and at King Edward VI.'s School, Birmingham, whence he proceeded to St. John's College, Cambridge, where he took his B.A. degree in 1836. In 1839 he was appointed Geological Surveyor of the colony of Newfoundland, and returned to England in 1840. In January, 1842, he was appointed by the Admiralty naturalist to H.M.S "Fly," then about to proceed on a surveying and exploring voyage to the shores of Australia and New Guinea. In September, 1846, he was appointed to a post on the Geological Survey of the United Kingdom, under the late Sir H. D. de la Beche, the Director-General. In November, 1850, he was transferred to Ireland, as local director of that branch of the survey, and on the establishment of scientific lectureships in the Museum of Irish Industry, under Sir Robert Kane, M.D., in 1854, he was also appointed Lecturer on Geology to that institution. He is the author of many useful geological works.

Correspondence.

THE NEW CANADIAN PATENT LAW.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Copies of the new patent law for the Dominion of Canada have recently been received in this country, but none have yet reached the Patent Office in Southampton-buildings. I am glad, therefore, to see that you are printing the text of it for the information of your readers. This new law was approved by the Governor-General of Canada on the 22nd of last June, and came into operation almost immediately, viz., on the 1st of July.

The last patent law of Canada (1859) differed much from those existing in our other colonies, and was considered by most Canadians a disgrace to their statute book. It was framed purposely to prevent Englishmen or Americans obtaining patents in that country, and it enabled Canadians to pick the brains of all English and American patentees, without leaving them a chance of self-preservation. The practical effect of this law has been to entirely exclude non-resident Englishmen from the patent roll of Canada.

As for Americans, a recent writer observes that "a large number of patents taken out in Canada are the inventions of American citizens, who, on finding that patent rights cannot be obtained in their own name, on account of their being aliens, secure the services of some weak or immoral minded Canadian, who, for a consideration, makes the affirmation that the invention or discovery is his, and thus secures the patent."

The law which has just been abolished, however, permitted in a roundabout way the introduction of patents of importation. It enacted that any Canadian or British subject, being a resident in Canada, who, during his or her travels in any foreign country (*Great Britain and the United States excepted*), might become acquainted with any invention not known or in use in Canada, might on his or her return home obtain a patent for the same as the first introducer of the invention or discovery into Canada, which patent would have the same effect as if the applicant were the actual inventor, and, moreover, it could be assigned. By this curious mode of procedure, some few aliens have secured patent rights in Canada.

For many years Englishmen and Americans have been looking forward to the abolition of this disgraceful law, and the substitution of one more in accordance with the patent laws of other countries and the spirit of the nineteenth century. With what feelings of disgust, then, will they read the clauses of that which has recently passed the Canadian Parliament.

In the annual report of the Minister of Agriculture to the Governor-General of Canada for 1864, he alludes to the contemplated alteration of the patent law, in the following words:—"Of all the modifications which have been discussed for some time past, the most important are undoubtedly those which would have the effect of assimilating our laws more closely to those of the nations now at the head of civilization, and permit inventors from all countries to enjoy amongst us that protection which is now afforded them almost everywhere. The expediency and advantages of such a measure have frequently been debated. I think that the reasons given, and which seem to suggest themselves the first from a simple examination of the question, militate strongly in favour of a more liberal system than that which is possible under the present law." And, again, "I deem it unnecessary to dwell any further upon the necessity of following, in the matter of patents for inventions, the example of liberality and of reciprocity afforded us in this respect by older countries more advanced than ourselves in the development of the various branches of manufacturing industry—a course, the adoption of which it would seem they have never had reason to regret." Yet, in the face of these remarks, we find that by clause 6 it is now enacted that every alien must take up his abode in Canada for a full period of twelve months before he can apply for a patent, and the provision for "patents of importation" is entirely struck out. Under the old law, an Englishman might have applied for a patent the day after he landed in the country, but now a twelve months' previous residence is required. This is the one great defect of the new law. There are other points of much importance, but which I have not time to point out here.

Fortunately for English inventors, this new law requires the approval of the Home Government before its provisions become binding, but as only six months are allowed for examination and ratification here, it is necessary that immediate action be taken to bring the matter before the notice of the Colonial Office. There are two public bodies whose duty is to take the initiative in this matter, The Commissioners of Patents and The Inventors' Institute; and I ask also your assistance, and that of the scientific press of the day, to prevent that which would prove a great injustice to all inventors outside Canada, and would re-act on Canada herself as a material bar to her onward progress.—I am, Sir, yours, &c.,

Blackheath, S.E., August 2. JOHN FORDRED.

STEERING GEAR.

SIR,—My attention has been drawn to the letter of your correspondent "M." on steering apparatus, in your magazine of the 30th ult. After an expression of the great want of a perfect steering apparatus for merchant vessels as well as for ships of war, he briefly alludes to three patented inventions for steering ships, mine being the first one of these.

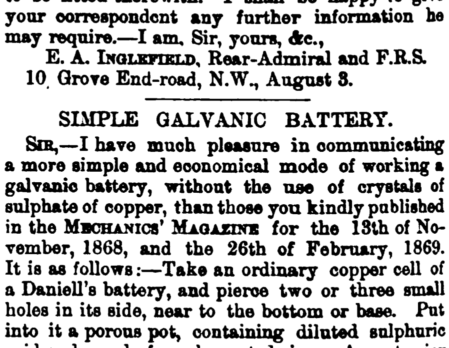
Your correspondent complains that though such inventions are sometimes tried by the Government, the public have no knowledge of the results. My invention, which has been lately fitted to one of the largest of her Majesty's ironclad frigates—the "Achilles"—was reported upon officially after trial to the Board of Admiralty. This report, being official, is retained for official use. It stated that the chief points of advantage were—1. Sufficient motive power always available. 2. The steadiness with which the power applied overcomes the resistance of the rudder at the highest rate of speed, especially when the helm is nearly hard over. 3. The security with which the rudder is held at any desired point. 4. The readiness with which the rudder is freed after being hard over, and thereby allowed to right itself rapidly when going at speed. 5. The ease with which the power is applied, one man being able to use it under any circumstances. 6. The facility with which the tiller is connected and disconnected from the hydraulic rams.

The only defects pointed out have been for the most part remedied. For a fuller description, I would refer "M." to an article in the "United Service Gazette," of June 26, which explains the form and action of my hydrostatic steering gear, and this I may supplement by saying that my steering apparatus may be kept continually in gear, and by its use one man is capable of doing what twenty men have never accomplished in the case of the "Achilles," viz., to put the helm hard down when proceeding at full speed. I desire nothing more than to test this apparatus under the greatest disadvantages, and I will undertake to fit a simple water engine, lying on the keel of the ship, which shall be available at a moment's notice, easily worked by one man on the bridge, and capable of putting the helm hard down of the largest ship, going full speed, in less than fifteen seconds. The ship may be steered by the usual wheel and ropes on ordinary occasions, but should an emergency arise, the pilot, officer of the watch, or captain, may, from the bridge, do what, as many men as he could place at the wheel, would fail to accomplish. I have been five years perfecting my invention, and it was only fitted to the "Achilles" after their lordships had received an official report from Sir William Armstrong and Mr. Penn that they considered the plan "safe, rapid, and manageable," and recommended one of her Majesty's ships to be fitted therewith. I shall be happy to give your correspondent any further information he may require.—I am, Sir, yours, &c.,

E. A. INGLEFIELD, Rear-Admiral and F.R.S.
10 Grove End-road, N.W., August 3.

SIMPLE GALVANIC BATTERY.

SIR,—I have much pleasure in communicating a more simple and economical mode of working a galvanic battery, without the use of crystals of sulphate of copper, than those you kindly published in the MECHANICS' MAGAZINE for the 13th of November, 1868, and the 26th of February, 1869. It is as follows:—Take an ordinary copper cell of a Daniell's battery, and pierce two or three small holes in its side, near to the bottom or base. Put into it a porous pot, containing diluted sulphuric acid and a rod of amalgamated zinc. An outer jar or containing vessel is required, of the same height as the copper cell, which, when filled with the copper solution, will flow through the small holes and fill the copper cell. Another porous pot is placed in the outer jar, also containing diluted sulphuric acid and a rod of platinized graphite, silver or copper, and which forms the positive pole of the battery, the zinc rod being the negative pole The outside of the copper cylinder is electrically dissolved, and keeps up the strength of the copper solution, while the inside receives a coating of copper. I have one working at the present time The arrangement will be seen from the accompanying sketch, in which a^1 is the porous pot



containing the rod of amalgamated zinc or negative pole z; a^2 the porous pot, containing the plate of platinized silver or positive pole s; b, outer jar or containing vessel; c, copper cell; d, three small holes in copper cell.—I am, Sir, yours, &c.,

95, Cross-lane, Salford, August 2. JAMES HOWARD.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscriber of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be ad dressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Received.—C. and W.—J. T.—J. A. B.—E. F.—T. F. T.—J. B. M.—H. S. and Co.—T. G.—R. M.—L. Bros.—E. S.—R. T.—M. B.—J. C. and Co.—J. B.—J. H.—R. T.—P. H.—L. C. A.—G. O.—P. M.—F. W. B.—S. and A. D.—W. R.—H. G.—W. G. S.—J. L.—J. B. and Co.—W. T. L.—T. S. G. and Co.—S. and P. S.—E. K. D.—L. Bros.—W. K.—R. T. G.—H. M.—R. D.

Naval, Military, and Gunnery Items.

The next examination of candidates for direct commissions is to be held at Chelsea Hospital on Monday, November 1, and following days.

The Belgian mitrailleuse, illustrated and described in our last issue, was undergoing trial yesterday week at the inner range, Royal Arsenal, Woolwich, under the superintendence of Major Fosbery. The object of the gun, by the rapidity of its firing and supposed destructive effect, is said to compare with that of shrapnell shell fired from field guns.

A meeting of the Military Education Commission was held on Tuesday last. Present—Lord Dufferin (chairman), Lord E. Cecil, M.P., Lord Northbrook, Sir D. Cameron, Major-General E. Wilmot, Major-General Haythorne, Dr. Butler, Mr. Lake, Mr. Parker, M.P., and Lieutenant-Colonel Chesney. The secretary, Captain J. W. Hozier, was also in attendance.

The Galway steamers "Columbia," "Hibernia," and "Anglia" have been disposed of by the liquidators of Overend, Gurney, and Co., at, it is understood, an immense depreciation from their original cost. The "Columbia" and "Anglia" have, we hear, been purchased by the Turkish Government, and the "Hibernia" is being fitted as a twin screw for telegraph purposes.

Major-General Sir W. F. Gordon, K.C.B., Inspector-General, Royal Engineers, arrived on Monday evening at Plymouth, and on Tuesday, accompanied by his aide-de-camp, Colonel Westmacott, who commands in the west, and Captain Durnford, visited the forts at Staddon, Laird, and Knackersknowie. On Wednesday they inspected the fortifications at Tregantle, Screasden, and Picklecombe.

The "Blanche," screw, built and engined by Messrs. Henderson, Coulborn, and Co., of Renfrew, for M. Frederic Mallet, of Havre, has made a trial trip under the supervision of the owner and some French engineers. The burden of the "Blanche" is 1,200 tons, and her engines are on the builders' compound principle, and of 120-horse power nominal. In her trial trip she attained an average speed of nearly 10¼ knots per hour, with a consumption of ordinary Scotch coal at the rate of 9½cwt. per hour.

A most extraordinary accident recently occurred in the Wapping Dock, Liverpool. The iron ship "Flying Venus," 1,393 tons, belonging to Mr. Edward Bates, had just discharged a Bombay cargo, and was left with nothing aboard but 120 tons of ballast. Some men were engaged about noon hauling at the ship, when the ballast suddenly shifted, and she capsized, and the hatches being open she sank into the dock. The men on board managed to scramble on shore in time to escape injury, and luckily two ships, lying near the "Flying Venus," had been removed shortly before she capsized, or the consequences might have been most disastrous.

The Belgians, anxious to return the cordial welcome given to their Garde Civique at Wimbledon, are organizing a grand international rifle contest, to take place at Liege, from the 15th to the 20th September. The programme of the fetes is a very inviting one:—International contest at short distances; official reception by the authorities; review of Garde Civique and the foreign riflemen, probably by his Majesty the King of the Belgians; musical contest open to foreign societies; grand banquet to the visitors in the Provincial Palace at Liege; balls; excursion to Spa; international shooting match at long distances at Spa, and fetes given by that city; return to Liege, and departure for Brussels for the celebration of the annual national fetes. The committee offer prizes of the total value of 20,000f., and the railway companies will make considerable reduction of fares in favour of foreign riflemen.

Miscellanea.

A new rolling mill for the production of plates, &c., is being fitted up at Alfort, near Paris. This rolling mill will be in working order in a few months.

On Monday, at a graduation ceremonial, the Senatus of the University of Edinburgh conferred the honorary degree of Doctor of Laws upon Sir Roderick Murchison.

Favourable intelligence has been received of the rising of the Nile. The inundation this year is expected to be most abundant, and all the necessary precautions have been already taken in Upper Egypt.

Captain Shaw, the chief of the Metropolitan Fire Brigade, leaves London, for New York, tomorrow, to inspect the new fire establishment recently formed in that city, as also those in Canada.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending July 31, was 3,661. Total number since the opening of the Museum, free daily (May 12, 1858), 1,612,354.

A parliamentary return gives a list of pictures presented to or purchased for the National Gallery—284 presented, 256 bequeathed, and 313 purchased. The cost of the 313 purchases, which has been spread over 45 years, has been £254,527.

Rail orders are still in course of execution in Belgium to the extent of between 190,000 and 200,000 tons, a total equivalent to about 15 or 16 months' production. The Belgium coal trade, as is usually the case at this period of the year, is somewhat dull.

Accounts from Berne state that a terrible inundation has just submerged the valley of Hasli in the Oberland, well-known to all visitors of the Hospice of the Grimsel. The Reichenbach has changed its bed, and the hotel of that name was very near being carried away by the waters.

The Missouri Pacific Railway, a road nearly 200 miles long, has just changed its line from the broad to the narrow gauge. Nearly 1,400 men were engaged in the work, and they laboured with such celerity that the task was accomplished in twelve hours, and without interrupting the business of the road.

A deplorable accident took place a week ago at Douai, involving the loss of eleven lives. At about two in the afternoon twelve workmen were being hoisted in one of the usual baskets of a coal pit called the Fosse Notre-Dame, and had reached a height of 60ft., when an earthfall took place many yards above their heads, and a block of stone striking one of the upper corners of the hoist, precipitated it with its contents to the bottom. Underneath was deep water, but only one man survived this terrible fall.

Philadelphia is to have a bigger musical jubilee than Boston has had, which was recently described by us. It is proposed to celebrate the centennial anniversary of the signing of the declaration of independence on July 4, 1876, by a gigantic musical festival, in a building especially erected in Fairmount Park, capable of accommodating 100,000 spectators and 12,000 performers. A letter has been sent to President Grant giving him the particulars of this enterprise, and asking "an expression of his kind approval, and for its success the best wishes of his patriotic heart."

It is reported that, in the course of the month of October, the frequently mooted project for an Atlantic cable from the Orkneys, via the Faroe Islands, to Quebec, will have taken definite form and be brought before the public. The cable which is to connect Thurso with the Orkneys is to be laid down immediately under the auspices of Mr. Nathaniel Holmes, of Winchester-buildings, and the Transatlantic line will be promoted by the some gentleman. It is understood that, upon its completion, it, as well as the cable across the Pentland Firth, will be taken over and managed by the Post Office.

The committee to whom the question of the sites for the new law courts was referred decided on Friday last by nine to seven on the adoption of a report recommending the Carey-street site in preference to the Embankment. The latter, it will be remembered, was not the original Embankment site, which was discarded as being too costly, but one of much more restricted area, and with no frontage to the Strand, and which, in fact, possessed none of the advantages claimed for the original proposal. The Carey-street site will, it is understood, be quite large enough for the law courts if built upon the reduced plan.

The Moselle district has been sending of late so large a quantity of minerals into Belgium and Prussia that the Eastern of France Railway has been obliged to borrow 400 trucks from a neighbouring company, the Northern of France. In the department of the Nord considerable orders for pig have been concluded of late at £2 16s. 10d. per ton; there has also been a well-sustained demand for iron, and the rail mills have been working with much activity; the Anzin Works, it is stated, have even their production engaged up to 1872. A want of labour is reported in the Nord, and one or two descriptions of iron have had to be imported in consequence.

A Government agent attended at the Palais de Justice, Paris, a few days since, to receive numbers of the "Lanterne," and other condemned publications. Of the former there were about 160,000 copies, filling 42 sacks. Formerly articles of this description were pounded in a large iron mortar, but at present the proceeding is much more simple. The agent takes the whole to a paper factory, where under his inspection they are thrown into a cauldron of boiling water and reduced to pulp, then passed under a wheel cylinder, whence the matter issues in the form of cardboard. Thus are peccant prints squashed out of existence.

A general meeting of the Royal Horticultural Society was held on Tuesday afternoon in the Council-room at South Kensington, Mr. G. F. Wilson, F.R.S., in the chair. There was an excellent show both in the fruit and floral departments. The specimens of hollyhocks were truly magnificent, and two wonderful specimens of orchid cultivation from the Bishop of Winchester were greatly admired. The greatest novelty was a curious orchid from Mr. Wilson Saunders, which was remarkable for its hispid leaves and flowers. Colonel E. T. Gourley, M.P., and Mr. Henry King were elected fellows of the society.

Mr. Horace Jones, the City architect, on behalf of the Markets Improvement Committee of the City Corporation, has submitted to the Metropolitan Board of Works a plan for utilizing the site of old Newgate-market. It is proposed to form streets on the site of the market by the erection of four blocks of buildings, divided by cross streets, one of 20ft. and the other of 30ft. in width, and surrounded by a narrow passage. The Building Act Committee, considering that by the plan proposed an improvement will be effected, recommended that the plan be approved, and the Board, under the circumstances, set aside their standing orders as to the width of new streets being of 40ft., and sanctioned the plan.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—48, 64
Buildings and Building Materials—46, 78
Chemistry and Photography—42, 70
Cultivation of the Soil, including agricultural implements and machines.—37, 60, 71
Electrical Apparatus.—40
Fibrous Fabrics, including mach ineryfor treating fibre pulp, paper, &c.—52, 57, 74, 76, 80
Food and Beverages, including the apparatus for preparing food for men and animals—43, 51, 56
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c.—34, 39, 49, 58
General Machinery—61, 68, 72, 73
Lighting, Heating, and Ventilating—45, 54
Metals, including apparatus for their manufacture—53, 66, 67
Miscellaneous—38, 41, 44, 47, 62, 83
Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—55, 63, 69, 75, 81, 82
Ships and Boats, including their fittings—50, 77
Steam Engines—35, 59
Warfare—36, 79

34 D. Nicoll, Cornhill. *Making garments.* Dated January 5, 1869.

This consists in weaving or otherwise forming or causing to be formed a single piece of cloth, having an oval shape with an oval aperture in its centre. When the oval-shaped article has been manufactured, a garment which combines the advantages of a railway rug and a cloak may be produced therefrom by dividing one of the before-mentioned oval pieces into two equal parts, and binding the cut edges so as to produce the garment. Elastic gussets may also be inserted into the oval piece, so as to admit the neck of the wearer when the article is intended to be used as a cloak. The article will also be rendered sufficiently elastic at this part to admit of it passing round the waist, so that it may be used as a railway rug. Or the article when divided in the centre may be provided with straps either elastic or non-elastic, so that it may be secured either round the neck or the waist of the wearer, according to the purpose for which it is intended to be used. By the employment of elastic gussets, the inventor is enabled to produce an article of underclothing which will serve the purpose of two articles at present in use, viz., an under vest and drawers. The advantages of making these garments in one instead of two pieces, will be, first, a considerable saving in the cost of manufacture, and, second, the production of an article of greater comfort to the wearer. In the manufacture of ordinary over and under coats, it is proposed to employ the above-mentioned elastic gussets inserted under the arm pits, whereby

greater facilities will be afforded for putting on the garment, and more freedom of action will be given to the wearer.—Patent completed.

35 W. DAWES, Leeds. *Steam engines.* Dated January 5, 1869.

This invention chiefly relates to "equilibrium" slide valves, and consists in a novel and simplified method of preventing or reducing the pressure of steam upon such valves. It may be thus described:—Round or near the upper edges of the ordinary or any slide valve the inventor casts or constructs, when necessary, a flange or projection of any convenient size and thickness, and he fits upon or to this flange or projection, in a manner hereinafter described, a strong plate or frame, by preference also rectangular (though this is not essential), and generally a little larger than the face of the valve, planed and fitted perfectly true on one side or face to work or slide "steamtight" against the inside face or surface of the steam chest cover or other fixed plate, also made true for that purpose. The before-named plate or frame is so fitted upon or attached to the valve that it is free or elastic in a perpendicular direction to the face, but is compelled to move with the valve without shake or "play" in a lateral or longitudinal direction. Dispensing entirely with the packing rings and other loose or separate parts, the inventor now constructs an elastic metallic steamtight connection, to be inserted between the flange or projection (*i.e.*, the valve), and the before-named plate or frame, and united or jointed to each of them by screws, rivets, or otherwise, in a steamtight and permanent manner, and thus constitutes what may be called an elastic valve, virtually or practically in one piece, and of a more simple, reliable, and durable nature than heretofore.—Patent completed.

36 S. REMINGTON, Ilion, U.S.A. *Breechloaders.* Dated January 5, 1869.

This relates to a previous patent, dated December 23, 1863 (No. 3253), and January 18, 1865 (No. 152). In these former specifications, the arm is described and shown constructed only for firing metallic cartridges (either rim-fire or central-fire), but by the present invention the "Remington" arm, so called, is adapted to the firing of cartridges with cases of paper, cloth, or other soft material. The invention consists, chiefly, in combining with the swinging breech-piece of the Remington arm a needle for penetrating and igniting the cartridges. In so constructing the firing bolt or pin, which carries the needle, as to permit the needle to be driven forward when struck by the hammer far enough to ignite the cartridge, in the peculiar construction of the swinging breech-piece and hammer, and in the means for extracting the exploded cartridge cases.—Patent completed.

37 A. W. C. WILLIAMS, Bridgeport. *Lawn mowers.* (A communication). Dated January 5, 1869.

This consists in a novel manner of constructing the frame of the machine and mounting it on a roller, whereby the latter is made to have sufficient traction to drive in the most efficient manner the cutting device. The invention also consists in a novel manner of applying the handle to the frame of the machine, whereby the latter may be pushed along by the operator without at all affecting the equilibrium of the machine on its roller. The invention also consists in a novel and improved cutting device, which may be constructed at a very small cost and still be strong, durable, and not liable to spring during the operation of cutting. The invention further consists in a peculiar application of shoes to the device, whereby the height of the cut may be regulated as desired.—Patent completed.

38 J. STEVENS, Orange, U.S.A. *Plaiting machines.* Dated January 5, 1869.

This consists chiefly in the peculiar devices for giving the required form or configuration to the plaiting; in the means for delivering the linen or other fabric properly to the plaiting devices; in the construction and arrangement of apparatus for holding and adjusting the plaiting devices; in the means for creasing the plaits after they have been formed by the devices; in the combination with the same of a pair of rollers for drawing the fabric through the machine; in the peculiar action of the cutting mechanism for dividing the strips into portions of the required length; and in the means for guiding the solid strips from the draught rollers to the cutting mechanism. The invention also consists in combining together the parts of the machine in such a manner that the various operations of first delivering the fabric to the plaiting devices, then forming and creasing the plaits or folds, and finally dividing the strips into portions of the required length, are properly and expeditiously effected. The invention also consists in the means employed in combination with the above-mentioned devices for winding the strips upon the spools, and, at the same time, preparing the fabric for being worked by applying soap to its surfaces in a manner which does not cause it to shrink.—Patent completed.

39 H. L. VALLEE, H. A. DOUBLET and A. M. H. ARMAUD, Paris. *Artificial flowers, &c.* Dated January 6, 1869.

This consists in the employment of vegetable or paper parchment for the manufacture of artificial flowers and foliage. The material is cut, dyed, stiffened, gaufred, or embossed glazed, and is subjected in every respect to the same treatment as at present employed for the manufacture of the flowers and foliage in present use.—Patent abandoned.

40 J. S. GISBORNE, Liverpool. *Telegraphs.* Dated January 6, 1869.

This consists in an improved construction of crank or corner piece, to be used in place of the ordinary pulleys or L cranks. This crank is made in the form of a cross, or like the letter Z, or with radial arms, and is free to move on or with a central axle or stud. The ends of the double line of motion communicators are secured to the extremities of the crank, and by the relative position of the extremities provision is made so that the motion communicators can be led away at any desired angle. Second, in an arrangement of parts to provide for expansion and contraction of the motion communicators. For this purpose the inventor connects to and suspends from the motion communicators a compensating weight or balance. The weight or balance is connected directly to the motion communicators, or to a chain, rod, or wire provided with a "biting clutch." This part of the invention is applicable where only a single line of communication is employed.—Patent abandoned.

41 E. ROBBINS, Somers Town. *Manufacture of casts.* Dated January 6, 1869.

The inventor employs pulverized substances to ornament or decorate surfaces. The pulverized substances may be of various colours and descriptions, alone or combined with one another. In order to distribute the pulverized substances in designs or patterns upon the surface to be ornamented according to this invention, the inventor employs stencil plates, placed upon or a short distance above the surface, and, if desired, the stencil plates may be embedded in the body of the slab or other form. These stencil plates or the surface to be ornamented may, according to this invention, have movements so as to produce changing effects, and various colours or kinds of powder may be passed through the stencil plate together or successively, the supply of each of such powders being under control, so as to produce shaded or other effects. The powders to form an ornamental surface may, according to this invention, be distributed over a surface, and the cement, plaster, clay, or other material which is to be decorated, afterwards laid or run over the pulverized matter, which will adhere to the plastic substance, and form an ornamental surface. The powders when distributed may be temporarily secured, so as to prevent disturbance of the design by the application of steam or moisture, or by mixing materials with the powder, which can be rendered adhesive by heat, or they may be secured by distributing them upon an adhesive surface. When carrying the first part of this invention into practice for the decoration of surfaces formed in cement, plaster, or other substance of a similar character which has the property of "setting" or indurating when moistened with water or other liquid, alone or with chemical agents in solution, the inventor compounds the decorative pulverized colours, minerals, metals, or substances before referred to with powdered cement or plaster, or with soluble silicates, or both, or with other known substances which will indurate after the application of water alone, or having chemical agents in solution, and in some cases substances, such as powdered sulphur, which will become adhesive by the application of heat, may be mixed with the pulverized materials. The second part of the invention relates to embedding on ornamental or decorative design or figure, formed from fibrous material, threads, strings, netting, lace, or fabric of fibrous material, or wire, or formed from paper pulp or flock alone, or combined with one another or with other materials, in the surface of a slab or block of plaster, cement, or other material. When carrying this part of the invention into practice for forming a slab, he employs a table or surface, such as that hereinbefore described. The inventor then arranges upon such table or surface in any desired figure or design, fibrous material, strings, or fabric of fibrous material or wire, paper, paper pulp, or flock, alone or combined with one another, or with such other material as may be required to retain them in the required form. In some cases he employs netting or lace in fibrous materials, or wire, or a woven fabric, or paper which may be in any suitable shape, and may have a design thereon. The paper or other material may be combined with plaster or cement, so as to retain the required shape for imbedding. The string or threads or other materials may be stiffened by the application of suitable size or varnish, so as to retain a definite form, and the strings or other materials may be variously coloured. After the strings or other of the above-named materials have been arranged upon the table or surface in the desired form, cement or plaster, or other material which "sets" or hardens by the addition of water or other liquid, alone or with chemical agents in solution, is applied upon the table or surface so as to cover and imbed the materials previously laid upon such table, and the threads or other materials above named may then be allowed to set with the slab, and be incorporated therewith.—Patent completed.

42 K. WALKER, Wicklow. *Sulphuric acid.* Dated January 6, 1869.

This consists in the employment of ammonia or carbonate of ammonia to condense the nitric gases escaping from the exit of a vitriol chamber. To accomplish this, the inventor causes the ammonia or carbonate of ammonia to come in contact with the escaping fumes either in a coke tower or chamber. The fluid thus resulting is again afterwards decomposed with sulphuric acid, and the escaping nitric fumes are returned into the vitriol chamber for the decomposition of the sulphurous gases.—Patent completed.

43 A. TYLER, Mark-lane, E.C. *Bonbons.* Dated January 6, 1869.

This consists in making bonbons or cossacks in a novel and extensive manner, by which bonbons of greater commercial value and use can be made. The inventor takes, say, an ordinary bottle of champagne, wine, or other bottle of large dimensions, and encloses it in paper, either fancy or plain, coloured, or not coloured, or in silk, satin, or in any other material. This paper or material may have ribbon bound round it, to secure the bottle within it; he then fastens natural or artificial flowers, flags or banners or other emblems on the outside adhesive gum, pins, or other fastenings.—Patent completed.

44 W. PIDDING, Walcot-square. *Extracting essence from plants.* Dated January 6, 1869.

The inventor places the living plant, or whatever vegetable production he may wish to subject to the process, in a receiver or vessel so formed as to allow of the air from within being extracted as required. The plant or vegetable production under process is to remain in the receiver a sufficient time to allow of it or them giving forth or emitting their aroma or essential oil or vapour. The air in the receiver thus becomes impregnated and scented by the same. The inventor extracts the air so impregnated from the receiver by means of an exhausting apparatus, or any suitable appliance (to an extent so as not to deteriorate or injure the living plant or vegetable matter under operation) and passes the same into a suitable vessel or receiver; such receiver may contain oil, fatty, or oleaginous, saponaceous, or other appropriate matter or spirits, suitably arranged so that they may become impregnated with the scented air and vapour let into them from the first receiver.—Patent abandoned.

45 G. EVELEIGH, Bow. *Manufacture of gas.* Dated January 7, 1869.

This relates to the manufacture of gas for lighting purposes from coal, shale, wood, bitumen, petroleum, or other substances containing carbon, hydrogen or nitrogen in their chemical composition and to the purification thereof. Also to certain means of producing gas from such liquefiable substance for and applying it or impure gas otherwise obtained from the substances above mentioned to the purpose of generating heat in furnaces, or in other situations where heat is required. And to the purification of mineral oil for the purpose of rendering it non-explosive below a temperature of 300deg. Fah. The improvements in the manufacture and purification of the gas obtained from the substances referred to consist in the application of certain means for the distillation or redistillation thereof, and the reduction during that distillation or redistillation of all or any of the waste products ordinarily produced in the distillation of such gas from those substances, so as to convert the whole (or nearly the whole) of such distilled waste products into an increased quantity and improved quality of gas for lighting or heating purposes. These improvements are effected by passing the gas as soon as produced from the substances through upright tubes, cylinders, or chambers, which for convenience he calls "redistillation retorts," and of which one or more may be employed of dimensions suitable to the quantity of gas to be produced and the extent of purification required. The "redistillation retorts" are loosely filled with any one or more, as may be required, of the following or any other substances which will produce similar effects, namely, charcoal, coke, chalk, lime, bones, limestone, filings, turnings or pieces of iron, or other metal or scorious metal not charged with sulphur, or of metals somewhat oxidized, which substances the patentee for convenience calls "chemical purifiers." The "redistillation retorts" (if more than one are employed) are then connected together and to the gas generating retorts by suitable pipes, so as to allow the gas as produced to pass through them and amongst the "chemical purifiers" contained therein. They are placed in a suitable furnace and raised to a more or less red heat, according to the nature of the gas or the substance from which it is produced and the extent of purification required. The gases and waste products in passing through the heated "chemical purifiers" in the "redistillation retorts" will undergo the necessary chemical changes to produce gas of the required quality and purity, and will leave little or no residue; the quantity of gas resulting will be much increased, while the sulphur will be united to the metallic substances or calcareous earths contained in the "redistillation retorts," and can thus be removed in a dry and inoffensive state when needful. The purified gas may then be cooled by passing through pipes exposed to any ordinary cooling influence; it may then go at once to the gas holder for use.—Patent completed.

46 F. MANSERGH, Westminster. *Stench traps.* Dated January 7, 1869.

This consists of a vessel of iron, clay, or other material, to be placed outside a house or dwelling in any convenient position, for the attachment of a waste pipe or pipes leading from the sinkstone or other place. These sockets, pipes, or openings are formed in the gully, two at the top and one at the side. The opening at the side is for the purpose of attaching the gully to a pipe drain conveying the refuse of the house to the main sewer. At the same end, but at the top of the gully, is formed another opening, to which may be attached airtight an ordinary water down spout or other pipe, to act as a ventilator for the house drain, and to prevent the sewer gases from being put under pressure a diaphragm is formed across the gully and in the top part, extending the full width of the gully and below the bottom of the outlet pipe or drain, thus making an ordinary water stench trap. In the upper part of the gully, and at the side opposite the house drainpipe, is placed an open movable grating, to allow of the ingress of the surface water from the yard or place where the gully may be situated, and for the removal of any deposit which may accumulate in the bottom of the gully. At the end of the gully which is farthest from the drain, and beyond the grating, is formed a smaller vessel, trapped in a similar way to that of the lower part of the gully, with an opening or provision for attaching the waste pipe or pipes from the sinkstone or any other place.—Patent abandoned.

47 J. F. COOKE, Cannon-street. *Copying ink.* Dated January 7, 1869.

The inventor substitutes for from 20 to 50 per cent. of the quantity of water used in the manufacture of ink, the same volume of glycerine. He also substitutes for glycerine in the manufacture of this ink, sugar, treacle, or chloride of calcium in solution, in the same proportions as the glycerine.—Patent abandoned.

48 H. DAVY, Adelphi. *Feeding boilers.* Dated January 7 1869.

This consists, first, in an improved apparatus, by which water is raised to and injected into steam boilers and other vessels, which apparatus may be made to measure the water injected, and to preserve the level of the water in the boiler or vessel from varying beyond narrow limits. Second, in improved means of actuating the steam admission and emission valves of steam pumps.—Patent abandoned.

49 F. N. GISBORNE, West Strand. *Sewing machines* Dated January 7, 1869.

The inventor mounts the seat on the top of a cylinder containing water or other liquid or air. The seat is capable of rising and falling within certain limits, so that when the attendant is sitting on the seat it shall be caused to force the contents of the aforesaid cylinder gradually into a smaller cylinder having a piston working therein, on the rod of which is formed or fixed a toothed rack, which takes into a pinion mounted on a shaft or axis, and giving motion to suitable multiplying gear, so as to obtain the desired speed to the driving pulley, wheel or drum giving motion to the driving shaft of the sewing or other machine.—Patent abandoned.

50 F. R. A. GLOVER, Bury-street, W. *Fishing anchors* Dated January 7, 1869.

The first improvement relates to the apparatus for letting down the anchors in such a manner that the point of the palm may be made to strike the ground, so that it will enter at once and hold firmly. It consists in adapting to one of the arms of the anchor a sliding ring and a coupling hook which lies snugly under the palm. The point or end of this hook is made with a hole or eye, which is passed through one of the links or the shackle of the chain cable, and is secured there temporarily by means of a cross pin which is passed through the eye in the hook and is suspended by a cord or short chain, which is hung loosely from the hawse bit of the hawse hole, so that the pin may be withdrawn when required, when the anchor is suspended in a proper position ready for lowering. The pin with its cord or chain will then be plumb with the hawse hole, and as the anchor descends, the pin will be drawn out and left hanging behind; when the anchor reaches the ground the lowermost palm will strike the ground and enter. The chain cable will be loosened when the anchor strikes, and will fall away from the hook, and

thus leave the cable free to haul on the stock of the anchor, in the usual manner. The cable is provided as usual with a roller and stopper, a shackle link, a swivel link, and a coupling link. The other improvement relates to a novel device for weighing the anchor when the palm has become fixed in a cleft of rock at the bottom. The withdrawal of the palm is effected by adapting to the ring on the arm a small chain cable, with a few very strong links at the end nearest the anchor. This small cable may be buoyed so that if it should not prove strong enough to haul up the anchor, an additional and stronger cable provided with a ring and grab link which will pass over, the small cable may be sent down the latter, until the grab link reaches strong links at the end of the small cable. Then by hauling on the extra cable, the grab link will tightly hold on to the strong piece of cable below, and will allow of sufficient power being put on to extricate the palm from the cleft in the rock and to haul up the anchor.—Patent completed.

51 J. H. JOHNSON, Lincoln's Inn-fields. *Concentrated food tablets.* (A communication). Dated January 7, 1869.

This consists in combining together in the form of a tablet or cake the four different descriptions of food, namely, the concentrated essence or juice of flesh meat, the concentrated essence or juice of poultry, game, or other birds, the concentrated juice or extract of vegetables, or, in some cases, the vegetables themselves, and some feculent or amylaceous substance or substances, such for example, as rice, vermicelli, tapioca, and the like. By this combination of substances, food tablets or cakes are obtained of a far superior flavour to those hitherto manufactured. The meat and other extracts may be obtained by what is known as the Liebig process, or by any other suitable or well-known method, and in order to exclude the presence of inert substances, composed chiefly of the pulpy parts of vegetables, it is proposed, in the case of carrots, cabbages, and such like vegetables, to remove them from the preparations directly they have parted with their juices.—Patent abandoned.

52 W. WEBSTER, Dundee. *Softening hemp, &c.* Dated January 7, 1869.

This consists of a tube which is placed across the machine above the softening and breaking-up rollers, and supported at each end by brackets attached to the framing of the machine, or in any other convenient manner. A valve box is situated in the centre of the pipe, and fitted with a valve at each end, by means of which communication with each section of the tube is cut off when the machine is not operating. The valves are fitted with long spindles or rods which pass through the tube at each side of the machine, each end of the tube being fitted with a suitable gland and stuffing box. A coiled spiral or other spring is placed in the valve box between the valves, so as to keep them closed on their ends when the machine is not operating; and when the machine is operating, the valves are opened by inclined bars or wedges, which are fitted to the bearing blocks of the softening rollers.—Patent abandoned.

53 J. J. BODNER, Newport. *Iron and steel.* Dated January 7, 1869.

This consists in a process by which one or more balls from puddling furnaces or other furnaces or apparatus, or a whole charge or part of a charge, either formed into balls or in the state of springy iron or steel, before being balled may be shingled, hammered, or compressed into one bloom, or such balls or springy iron or steel together with iron and steel in pieces or bars may be so treated. It is a process altogether different from the so-called "doubling." In doubling, the first ball is tapped or flattened before the second ball is added to it; the first two balls together may then be so treated, or a third ball may be added to them, and so forth. In working this new process, however, the whole weight or quantity of iron or steel, or of both, which is to be formed into a bloom is put into a mould, and is forged or compressed into a bloom. One or more holders or receivers are charged from one or more puddling furnaces or other apparatus, and are couched to the mould, which may be placed under a hammer or press or other compressing apparatus, and their charge or charges may be tipped or put into the mould. Or the mould itself may be conveyed to the furnace or apparatus containing the iron or steel, and be filled there and taken to the hammer or other compressing apparatus, or a stationary or movable compressing apparatus may be used at each furnace. In cases in which it may be desirable to have different qualities of iron or steel or iron and steel in the same bloom, such iron and steel may be charged in pieces or bars at a welding heat, put into its position in the mould, and the balled and springy iron or steel may be added. Pressure may then be applied by one or more hammers or by one or more hydraulic rams, or by a combination of both or in any other convenient way. The mould may be provided with slits or perforations or hollow parts for the escape of the slag. End plates in the shape of gratings or perforated may also be used for the same purpose.—Patent abandoned.

54 H. G. FAIRBURN, Goswell-road. *Compressing coal, &c.* Dated January 7, 1869.

This consists in improvements in that class of machinery for compressing and solidifying coal, clay, and other substances, for which letters patent were granted on December 14, 1865, No. 3242, in which the blocks of fuel are formed by passing them through a tube in portions divided and shaped by pallets or dies; and the present invention consists, first, in improvements in the construction of the cylinder portion of the machinery, the objects being to economize the consumption of steam, and to prevent breakage or injury to the dies or pallets; and, second, in an improved arrangement for introducing the dies or pallets into working position; and, lastly, in an arrangement whereby for pressing coal and other substances that require the pallets to be cool, the said pallets may, after having been in contact with the heated material, be cooled before being re-introduced into the machine; while for pressing peat and other substances that require the pallets to be hot, the said pallets can be introduced into working position in a highly heated state.—Patent completed.

55 C. KENDALL, Mile-end. *Communication in trains and working breaks.* Dated January 7, 1869.

This invention is based on a previous patent, No. 3083, of 1864. The first part consists in employing vertical pumps, combined or separate, to fill the receiver tube with compressed air, and in actuating them by an intermediate wheel. These pumps have one end open, and water is caused to fall on the buckets or pistons to keep them lubricated, a water well formed by a bent pipe being in connection with the air tube. Sometimes a donkey engine is employed to work the pumps. The joints are loop hinged, and have a bolt passed through them to retain them in place; on the train being disconnected, the bolt is withdrawn, and the joints separated. A valve in each part of the joint closes and retains the air in the pipe of each carriage, or the joint end of the pipe is bent, which acts upon a catch lever and separates them. An air cylinder is fitted under the screw shaft of existing breaks, the piston of which when raised is caused to apply the breaks without turning the shaft. A cock having four ways is fitted at each end of the carriage, and a partial movement of a spring lever attached to the plug when a cord is pulled opens a passage leading to a ball connected to the receiver, and an alarm sounded; if the cord should break or be cut, an additional movement of the spring takes place, when the whistle on the engine or other part of the train will sound, and a semaphore or light be exposed to indicate the particular compartment the signal came from. The stem of the whistle is fitted with a valve which closes the passage when the pressure exceeds certain limits. The second part consists in dispensing with one of the pipes, say No. 2 pipe, and retaining No. 1 pipe, which is kept constantly charged; the air keeps a piston to the top of a cylinder in the guard's van, and the piston rod against a bell; on a cock being turned by any cord being pulled, the air escapes, the piston lowers itself, and the bells commence ringing. Sometimes the cylinders are compressible; a spring causes them to collapse, and by being in connection with the whistle handle, moves it and sounds an alarm. Sometimes the apparatus connected with the driver's whistle is made more sensitive than that connected with the guard, so that the driver is acquainted that the pipe is getting empty. Sometimes the pistons may be worked by hand, and when the pipe is fully charged, the piston is weighted to retain the pressure. Sometimes two receivers are employed, one of small dimensions and power for working the signals; the other, of a larger size and power, for working the breaks.—Patent abandoned.

56 J. MANGNALL, Glasgow. *Coffee pots.* Dated January 8, 1869.

A cylindrical vessel is divided into lower and upper compartments by a diaphragm made by preference with its centre depressed, and with an open topped tube projecting up from it. A tube of a little larger size is provided to place over the diaphragm tube, and the upper end of this outer tube is closed, whilst a perforated straining disc is fixed to its lower end. In using the apparatus, a little water is placed in the lower compartment, the outer tube is put in its place, the coffee is put in the upper compartment, and the remainder of the water (boiling or nearly so) is poured also into the upper compartment. The flame of a spirit or other convenient lamp is then applied to the bottom of the lower compartment, and the steam produced rises up the diaphragm pipe, descends by the outer pipe, and rises up through the coffee. When this action is considered complete, the lamp is removed, and a vacuum being formed in the lower compartment, the water in the upper compartment is by the atmospheric pressure made to pass down through the coffee, and by the tubes into the lower compartment, whence it is withdrawn by a stopcock. An air tube with a plug is by preference provided in connection with the lower compartment to facilitate emptying and filling it.—Patent abandoned.

57 W. TATHAM, Rochdale. *Preparing cotton.* Dated January 8, 1869.

The chief improvement consists in a new method of obtaining the accumulation of material necessary to convert the sliver of a breaker carding engine into a web to be fed to a finisher carding engine. The sliver combed from the doffer of the breaker carding engine is passed over one or more rollers, the last of which has a light top roller laid upon it, or it is passed over a creeper to a pair of rollers, which feed it to a propelling beater, which may be formed either in the usual way, with teeth, or bars, or of bristles, or similar materials. This beater works in a space closed above it, has a series of openings or grids underneath, or it may be enclosed there; also in certain cases, except at one part which communicates with a recess expanding from the surface of the beater, at which point it is narrowest, to a pair of cage rollers enclosed at the other end thereof. The beater takes the material from the delivering rollers above described, and throws it into the expanding recess, where it accumulates against the cage rollers. In this condition of accumulation it is very diffuse and puffed up with air. The inventor communicates a slow rotary motion to the cage rollers, which by gathering the puffy mass has the effect of excluding the air, collecting dust and conveying the web continuously to a pair of clearing rollers, which may either pass it direct to the finisher engine or for the purpose of being seen and examined, there may be a space left between the clearing rollers behind the cage rollers and a pair of delivering rollers which feed the finisher engine, the said space being filled with rollers, a creeper, or a polished plate of metal. The apparatus described, will supply from the filmy sliver of a breaker carding engine a suitable continuous web, thick, comparatively uncondensed, and uniform not only longitudinally but across from selvage, as distinguished from webs which are folded or rolled and cut and joined, and have necessary inequalities when fed to the finisher engine.—Patent completed.

58 T. P. LUCAS and G. H. J. HOLT, Kent. *Carte de visite.* Dated January 8, 1869.

The carte de visite portrait or pictures are first inserted in pieces of cardboard, having spaces cut out to receive them. On the top of these cards are fixed loops composed of wire or other material, through which a rod is inserted. The ends of this rod is fixed into two separate triangular pieces of wood, cardboard, or other material, the whole being closed in, so as to form a box with glass inserted in the front and back, through which the pictures are viewed. When exhibiting the pictures, all that is necessary is to open the triangular box and turn the cards over, they revolving on the rod before mentioned.—Patent abandoned.

59 J. DAGLISH, Seaham Harbour. *Lubricating axles* Dated January 8, 1869.

This consists in the application of circular brushes of bristles or equivalent materials to grease the axles of wheels of coal tubs or other waggons whilst moving over the rails. The oil, grease, or other lubricating matter is deposited in a box below the shaft on which the brushes revolve, in such a manner as to allow part of the brushes to be constantly immersed in the lubricating matter. The necessary motion to bring the lubricating matter up to the axles is obtained by having a ring or disc of india-rubber or other suitable material attached to one or two wheels or discs on the circular brush shaft, or on an auxiliary shaft, the ring or disc being of a sufficient diameter to allow it to come in contact with the axle of the tub or waggon, whereby a partial revolution of both discs and brushes is effected. This movement brings the part of the brushes immersed in the lubricating matter up against the bearing of the axles, thereby causing them to be uniformly and regularly lubricated. The india-rubber disc may be attached either to the circular brush shaft or to a second shaft, which gives motion to the brush shaft, by means of spur gear or friction wheels of india-rubber or other material, or by other suitable known means of transmitting motion, so as to cause the brush shaft to revolve at a greater or less rate than the india-rubber disc, according as it may be wanted and in an opposite or in the same direction as required.—Patent completed.

60 R. WIGRAM, Leeds. *Ploughs.* Dated January 8 1869.

This relates to a previous patent, dated July 16, 1867, No. 2088. The invention relates, first, to simplifying the construction of the framing of the plough, whilst still retaining the capability of moving the ploughs towards or away from one another to adjust the width of the furrow. For this purpose, in place of making each plough capable of sliding to and fro upon two bars fixed transversely across the frame, as heretofore, the inventor arranges all the ploughs, so that they may be shifted to and fro on one bar, which passes across the frame at an angle, and be connected to it at different points along its length, so that the ploughs not only come one behind the other, but also can be set nearer to or further from one another by varying the points at which they are connected to the bar. By this means, the plough may be made at much less cost than heretofore.—Patent completed.

61 A. B. BROWN, Cannon-street. *Cranes and pumps.* Dated January 8, 1869.

For raising and conveying weights, the inventor employs a crane, the lifting chain of which is actuated by an hydraulic cylinder and ram, each carrying a pulley or pulleys, around which the chain is passed in such a manner that, when water is admitted to the cylinder and the ram caused to move outwards, the length of the chain extending between the pulleys is increased, and consequently the weight attached to its free end is raised. This construction is well understood; but the invention consists in an improved arrangement for supplying water under pressure to the hydraulic cylinder, so that, if desired, the whole apparatus may be mounted on a carriage as a travelling crane. This arrangement consists of a steam boiler working a small pumping engine, and having in connection with it a cylinder into which the steam or water of the boiler is at all times free to enter. This cylinder contains a ram which the pressure tends constantly to force outwards. The ram carries another smaller ram working in a corresponding cylinder containing water, and the pressure on the larger ram tends to force the smaller into its cylinder. The water is thus contained in this cylinder under a very heavy pressure, and the cylinder serves as a reservoir from which water under pressure is drawn as it is required by suitable valves to work the crane. As the water is allowed to pass out of the supply cylinder, the ram, which is directly exposed to the pressure in the boiler, moves outwards, constantly maintaining the pressure on the water in the supply cylinder, and, in moving outwards, it opens the steam valve, admitting steam to the steam engine, which immediately commences to work, pumping water into the supply cylinder until it is again full, the larger ram being at the same time forced back into its cylinder. When the supply cylinder is full, instruments in connection with the rams close the steam valve, and the engine is stopped. The supply cylinder will then contain a charge of water ready to work the crane at any moment. The pumping engine preferred consists of a steam cylinder with steam and exhaust passages arranged in the usual manner, and ports over which a slide valve works. On the valve rod are two small pistons, one at each end, working in corresponding cylinders; and each of these cylinders has a steam passage connecting its inner end with the main cylinder, and also an opening or escape passage near its other end. The small pistons working in these cylinders have small holes or leaks through them, but, the area of these is much less than that of the escape passages before-mentioned. The steam passages connecting the main cylinder with the smaller cylinders open into the main cylinder at short distances from its ends, so that the piston, when it gets near the end of its stroke in either direction, passes one of these passages, and the steam rushing through it immediately, blows over the valve, the motion of the small piston on which the steam comes being opposed only by the pressure of the atmosphere.—Patent completed.

62 W. T. WAITE, Salisbury-square. *Treating saccharine matters.* Dated January 8, 1869.

This consists in the employment of certain neutral insoluble finely divided substances prepared by precipitation, or in the employment of an intimate admixture of an acid compound and a basic compound in such proportions that, when the mixture is put into water or into a saccharine solution, it will form a neutral insoluble finely-divided precipitate. The neutral insoluble finely-divided precipitates which are employed for the purpose of the invention are hydrate of peroxide of iron, phosphate of lime mixed with carbon, phosphate of iron, phosphate of lime, phosphate of alumina, and carbonate of iron. Of these, the preference is given to hydrate of peroxide of iron and to phosphate of lime mixed with carbon, as it has been found from practice that they give the best results. To manufacture an insoluble precipitate of phosphate of lime mixed with carbon, the process is preferably as follows:—The inventor takes, say, 100 parts by weight of powdered animal charcoal, 50 parts of sulphuric acid, and sufficient water, say 1,500 parts, and mixes them, allows them to stand for a time, and then adds about 26½ parts of lime, stirring the whole well together. The phosphate of lime which was in the charcoal is formed into an insoluble finely-divided precipitate. After it has been washed and allowed to settle, the water poured off this precipitate is ready to be put into the saccharine solution for the purpose hereinbefore stated, or the precipitate may be partially dried, and then added to the saccharine solution. Instead of animal charcoal, any other source of phosphate of lime, such as coprolite, apatite, and guano may be employed, but when any of these last-named substances are used, the product is phosphate of

lime unmixed with carbon. Instead of sulphuric acid, any other acid, such as hydrochloric, which will render the phosphate of lime soluble, may be used, and, instead of lime, any other base or alkali, such as alumina, oxide of iron, or soda, which will make a finely-divided precipitate, may be employed. In preparing any other finely-divided precipitate, a solution of the base or any soluble compound of the base is taken and precipitated by a solution of the acid or any soluble compound of the acid.—Patent completed.

63 T. B. SYDSERFF, Bucklaw, N.B. *Ballot voting.* Dated January 8, 1869.

This consists of a voting ball receiver, of crystal or other transparent substance, placed in front of a screen or partition, behind which the ballot boxes secured by lock and key are placed. The voting ball is deposited in the crystal or other receiver by the polling sheriff or other officer, and is exposed to public view. The said receiver is closed at the bottom by a slide valve retained in position by a spring india-rubber band or its equivalent, the ball when released by the slide valve passing down a sloping tube through a covered funnel into an inclined delivery tube turning on a vertical spindle, the said delivery tube passing through a traversing quadrant or segment of a circle, under which the ballot boxes are placed in close proximity thereto, and in such a position that the delivery tube, actuated by a voting handle attached to the quadrant, will cause the ball when liberated to drop into the desired ballot box. The voting handle is moved by each voter as he passes into the enclosure to a point under the name board of the candidate selected by him, and, when released, is retained by a notch in a disengaging bar behind the voting rail. The voter, now passing out in the opposite direction to that by which he entered, throws open a voting wicket closed by a spring hinge or otherwise, and a cord or wire attached to the heel post of the wicket draws out the slide in the crystal or other receiver, causing the voting ball immediately to descend to the appointed ballot box, and, as the traversing quadrant continually covers all the ballot boxes, no ball can enter either of the said boxes except the one placed in the crystal or other receiver by the sheriff. Having passed through the first or voting wicket, the voter then passes through a second or departure wicket, from which a rod, wire, or cord is attached to the disengaging bar, depressing it, and relieving the voting handle from the notches therein, causing the handle to swing back to its original position by means of a weighted cord passing over a pulley, or otherwise, or the disengaging bar may be depressed by the action of shutting the voting wicket, if desired. The voter having passed out of the enclosure, the sheriff or other officer admits another voter to repeat the same process, but no voter can touch the voting balls nor approach the ballot boxes to interfere therewith.—Patent completed.

64 J. RODGERS, Sheffield. *Furnaces.* Dated January 8' 1869.

The firing hole is of the ordinary construction, and the hot air passes over a bridge into a cavity, and is there met by cold air which is admitted through pipes, and thence passes along the furnace to the chimney at the other end, thereby distributing an equal heat over the whole area of the furnace, and also consuming the smoke.—Patent abandoned.

65 M. WILKIN and J. CLARK, Paddington. *Railway brakes.* Dated January 8, 1869.

This relates to patents granted to John Clark, dated October 20, 1862, and May 13, 1867. In the present invention, a carriage framing has the leverage increased for applying the brake, and, consequently, the strain on the operating line diminished. The wood brake blocks are suspended from pins in the framing. Cross ribs connect the blocks on the same end together, and pulling rods connect the cross ribs with the leverage for applying the brake. The rods on one end are jointed to a racket bar, and those on the other end are jointed to the lever. Parallel guides keep the rods in centre line. At the lower end of the lever is fixed, in slotted eye or taking-up pawl, a chain attached to winding mechanism in the van or on the tender. This chain is carried on sheaves in brackets fixed to the framing. It is passed down under the sheave in the lever, so that, by tightening the chain, the lever is raised and operates the pulling rods attached to it. At the bottom end of the lever is fitted a shoe with ratchet teeth cut upon its lower face to suit the rack bar. The shoe provides a fulcrum for the lever to pull the rods. At the other end of the carriage, when the lever is raised, the take-up pawl is pushed forward in the link eye, so that when the blocks are much worn and the lever rises near the top of its range, the take-up pawl mounts into a fresh tooth of the rack bar, and, when the lever is again lowered, the shoe is pulled over into a fresh tooth also, and thus the wear of the blocks is maintained to keep the short fulcra of the lever in effective position. Sometimes, instead of a flat ratchet bar, a round ratchet wheel is used. To the spindle of the said wheel, chains connecting the rods would be attached, or the spindle could have an ordinary pinion cut upon it working in a rack attached to the rods. In an improved arrangement to pass the operating chain from carriage to carriage without being affected in its length by the shrink of the buffers or the drawbar being pulled out, the chain is led over and under the sheaves, and, because the bottom pair of sheaves at the end of the swing links are kept an uniform distance apart, the chain is not materially affected by the varying length of the train.—Patent completed.

66 J. HENDERSON, Auchencairn. *Iron and steel.* Dated January 8, 1869.

The furnace may be termed a double reverberatory furnace, as the hearths, four in number, are arranged two in a line and placed back to back to receive their heat from one and the same fire chamber. In this chamber the inventor uses waste or small coal as fuel, with a blast of air on each side, which consumes all cinder and enables the heat to be kept up night and day without any stoppage whatever from cleaning or renewing the fire. Any number of hearths thus arranged may be placed side by side; but it is preferred to arrange them in groups of two for the purpose of welding the blooms in the furnace clear of scale, for the production of large masses for armour, slab, girder, or rail direct, and thus save the cost of filing. Each hearth is surrounded with air flues, and air-flues are also formed beneath the hearths, which are all regulated by inside and outside dampers supplying the same from the external air, and allowing them to discharge heated air into the furnace a little above the boshes of the hearths, as required. In the middle wall, dividing the two lines of hearths, the inventor forms flues for discharging in a heated state air admitted to the furnace through openings at the base of a common vertical shaft which serves to carry off the gases of combustion. In the bottom lining of this shaft, just below the metal mantle-plate carrying the top part of the shaft from top of cast iron pillars, air is admitted which circulates along each roof of the fire chamber for discharging in a heated state into the rising gases, and then igniting them over the fire bridge which effects complete combustion and gives off any kind of flame required.—Patent abandoned.

67 W. E. GEDGE, Strand. *Closing boxes.* (A communication). Dated January 9, 1869.

This consists in clasping and setting together the edges of the lid and of the body of the box so that they form, as it were, but one piece, the operation of soldering them together being thus dispensed with. This clasping leaves nothing to desire as regards adhesion and hermetic closing, which are so thoroughly effected that no leakage can occur when the boxes are submitted to the operation of boiling. The whole of the clasping is effected by this machine, which by means of compressing or milling tools, wheels, or rolls set as hereinafter described, so bends and folds together the tin of the lid and of the body of the box so that these become united in an inseparable manner.—Patent completed.

68 R. LEGG, Clerkenwell. *Motive power.* Dated January 9, 1869.

This consists in the utilization of the resistance offered by surface friction, internal projections, bends, or other obstructions to the free passage of steam or fluids through pipes or other passages, and in the application of this resistance as a fulcrum or abutment for the steam, in order to obtain motive power without the use of a piston. This is accomplished by compelling the steam to pass through a considerable length of cranked or tortuous passage in its way from the generator to the atmosphere or condenser, and by forming this passage in coils or folds about an axle which is thus forced to revolve with a power about equal to the amount of free energy lost by the steam in struggling through the passage.—Patent abandoned.

69 F. S. THOMAS, Islington. *Railways.* Dated January 9, 1869.

This principally relates, first, to railway passenger carriages; second, to the carriages of railway locomotives. The invention consists in constructing the carriage portion of the locomotives in such a mechanical form as to make them flexible longitudinally by being jointed transversely between each pair of wheels so as to convey the rigid portion of the steam machinery upon flexible carriages. For this purpose, each compartment of the carriage is provided with an axle which revolves at its centre and is controlled by guide arms and wheels, so that the locomotives are not disposed to run off the rails nor to grind against them at the curves, but to render easy obedience thereto. The invention, third, relates to railway travelling buffers. The inventor constructs buffers of two descriptions. He constructs for each train two travelling preparative buffers which take the form of separate carriages, one of which is placed in the front of every train and one in the rear thereof.—Patent abandoned.

70 M. SAUNDERS, Tipton, and H. FORREST, Oldbury. *Refrigerators.* Dated January 9, 1869.

This consists in providing a coil or series of continuous coils of metal or other suitable double tubing, that is to say, two tubes, one contained within the other, the inner tube being for the purpose of containing the flow of liquor, the outer tube or jacketing surrounding the inner tube and containing the stream of water or cooling medium. The water and the liquor are caused, by preference, to flow in opposite directions, the water tube being connected to a reservoir or main at the one end or junction of the coils, and the inner or liquor tube is connected to the vat or other suitable vessel at the other end, containing the liquid requiring to be cooled. The flow of the water or the liquor may be regulated by means of suitable regulating taps or valves, and it is proposed in some cases to form in the outer tube outlet valves with taps communicating to small cisterns in any part of a building for slop purposes, the supply being obtained when a suitable degree of force is exerted upon the water flowing through the outer tube. By the construction of refrigerators as described a great saving of the cooling medium with more certain results are obtained, the apparatus being also produced at a less cost than those in general use.—Patent completed.

71 E. GRAY, Sheffield. *Plough coulters.* Dated January 9, 1869.

This consists essentially in welding together bars of wrought iron and steel, which welded bars are by rolling or hammering tapered from back to edge and subsequently forged into plough coulters, or they may be rolled or hammered into flat bars and made into coulters. The welding of the iron and steel together is accomplished either by pouring melted steel on one side or end, or on both sides or ends of the wrought-iron bar, or in the middle of or between two iron bars, whilst it or they are in a heated state and contained in a suitable mould, or the iron and steel bars may be welded together by hammering or rolling.—Patent completed.

72 T. MOORE, Southwark. *Rotary engines.* Dated January 9, 1869.

An outer cylinder or bored cylindrical casing is employed with two end covers suitably constructed to receive a shaft or axis through their centres, the passage of the shaft or axis being made watertight. On this shaft or axis is fixed a cylinder, drum, or piston, leaving an annular space between its circumference and that of the outer cylinder or bored cylindrical casing. The periphery of this cylinder, drum, or piston is suitably formed to receive two, three, or more hinged buckets, fans, or flap valves, which hinged buckets, fans, or flap valves are actuated by means of a cam or cams of forms convenient to the purpose. The cam or cams are placed in a recess formed in one of the end covers, and through the intervention of rollers and levers cause the hinged buckets, fans, or flap valves, during part of a revolution of the machine, to obstruct in a watertight manner the annular space left between the outer cylinder or bored cylindrical casing and the cylinder, drum, or piston, and during the other portion of a revolution to lie in recesses formed in the periphery of the cylinder, drum, or piston for this purpose. It is by the action of water properly introduced by an inlet pipe on to these hinged buckets, fans, or flap valves that a rotary motion is imparted to the cylinder, drum, or piston, and motive power obtained, the waste or used water being of course permitted to run away through an exhaust passage or outlet pipe.—Patent abandoned.

73 A. BAUMANN, Strand. *Hydraulic cranes.* Dated January 11, 1869.

For the purpose of supporting the apparatus hereinafter mentioned, a bedplate, carrying a crane jib, is provided, the bedplate being so arranged as to turn round a crane post fixed to a carriage, so as to form a travelling crane. On the bedplate is placed a steam boiler, with one or more steam pumps connected to it, which pumps are so constructed as to throw water as soon as the cock or valve of the water delivery pipe is opened, as is the case with many direct-acting steam pumps now in use. When the delivery cock or valve is open, the steam pumps throw the water, which is drawn from a tank placed on the bedplate into one or more cylinders, provided with pistons or rams working therein, and which are moved by the pressure of the water, and have rods connected directly or by means of pulleys to the chain which passes over the jib, and to which the weight to be lifted is attached. By preference, one or two steam pumps of sufficient dimensions to throw in one stroke the quantity of water necessary for one lift, is or are employed, the same not being worked at a great speed.—Patent abandoned.

74 J. HOLDING, Manchester. *Temples for weaving.* Dated January 11, 1869.

This consists in forming a transverse slot in that portion of the "temple" bracket in contact with the temple bar. This slot terminates in a hole passing through the end of the bracket, the outside surface of which is faced. The bolt retaining the temple upon the bar is formed with an eye, which is received by a transverse slot and through which the bar is inserted, the screw shank projecting from the eye being caused to pass through the bolt hole forming the termination of the transverse slot. Thus the nut, when placed upon the screw shank, can be got at with the greatest ease by the operative for the purpose of adjusting and fixing the temple upon the bar.—Patent abandoned.

75 F. N. GISBORNE and H. ALLMAN, West Strand. *Signals.* Dated January 11, 1869.

The inventors employ a flexible cord, made either of vegetable fibre, such as hemp, or of metallic wires, or wire used singly or in the form of a twisted cord. This cord communicates at one end with a steam whistle or other sound-giving apparatus on the engine, the other end being fixed to a large drum in the guard's van, which keeps the rope tight by the action of a weight. At intervals the cord is supported and kept in place by spring clips fitted with friction rollers. The spring clips the spring frames to rollers, which open on the upper side so as to allow the cord to be pushed in. The invention comprises, first, the peculiar construction of whistle or other sound-giving instrument, which allows an interval of time to elapse after being put in motion before giving any sound. This interval is necessary to prevent signals being given by a momentary slack in the cord. Second, the form of friction roller spring clips as hereinbefore described, which enables the cord to be very quickly strung in gear after the train is made up. Third, a peculiar form of cutting apparatus of the same form and construction as a cutting pliers used in cutting wire, for cutting the cord fixed to each carriage, which cannot be moved or used without destroying an envelope. Fourth, an apparatus fixed to the weight pulley in guard's van for ringing a bell by the fall of a weight on the cord being cut. Fifth, an electric apparatus, used for the similar purpose of making signals, consisting of an apparatus on the engine, being a permanent magnet, and a soft iron electro-magnet, which, by their adhesion together, keep the whistle cock shut. But when a current of electricity is sent from the guard's van, which contains a battery, through the conducting wire, magnetism is induced in the electro-magnet on engine, which, being repelled from the permanent magnet, opens the whistle. Sixth, the employment of wire, cord, and suitable cutting apparatus, as hereinbefore described. Seventh, an india-rubber air ball, which delays the action of the steam whistle.—Patent abandoned.

76 J. KNOWLES, Droylsden. *Weaving terry, &c.* Dated January 11, 1869.

This consists principally in floating the terry or thick threads for forming the loops of the pattern or figure in the following manner:—When making the plain or ground cloth, the terry or thick thread (or threads) is floated three picks on the under side or back part of the cloth, and one over or on the front side of the same, but when required for the figure or pattern it is floated two picks above and two below. This method of weaving makes the plain cloth or ground much smoother than the ordinary method, and causes the figure or pattern to stand out much more prominently, and gives a much superior appearance to the article woven. In carrying out this invention, instead of using the jacquard apparatus as a slackening motion for drawing the yarn (required for the loops) off the creel, the inventor places the jacquard apparatus nearer to the front of the loom and between the healds and the back of the reed, using it only as harness to float the threads required for the pattern, and then causes the beating up of the "slay" in knocking up the weft to the cloth to draw the terry or thick threads from the creel and throw up the loops.—Patent completed.

77 J. JORDAN and J. JORDAN, jun., Liverpool. *Propelling vessels.* Dated January 11, 1869.

The inventors attach by any known means to the sides and bottoms of vessels a parallel, or nearly parallel, casing, extending for a required distance fore and aft, such distance being determined by the nature of the inlet and outlet passages. This casing may be set at any required distance from the sides and bottom of the vessels depending upon the area required for propelling effect. The casings are to be open at the forward and after ends for the entrance and exit of the water used in propelling the vessel. Into this chamber a series of conveniently arranged nozzles, suitable for steam jets, are introduced, when, upon turning on steam generated in any way, currents of water will be drawn in at the fore end of the casing, and driven out at the after end of the casing with any required velocity. The inventors propose to make the casing before mentioned extend from the keel to the light or load-water line, and the series of steam jet nozzles to be placed in sections, so that one or more can be used. For reversing the motion of the vessel, the direction of the current will be reversed by suitable means outside the vessel.—Patent abandoned.

78 T. A. WARRINGTON, Kentish Town. *Clips for window blinds.* Dated January 11, 1869.

The inventor secures the blinds to their rollers by means

of clips made of sheet metal, and peculiarly formed, so as to render them capable of being easily pushed on to or withdrawn from the roller by the use of one hand whilst the blind is held by the other, so that the removal of the roller from its place to take off or put on the blind is not required. The blind is first placed against the roller, and then the improved clips are sprung or pushed on at suitable distances apart, by which means the blind will be held securely in position. Each clip consists of a peculiarly formed spring, constructed somewhat in the form of the lyre of the ancients, or of the letter U, having its upper parts situated nearer to each other at their tops than in the body of the clip, the top edges of such upper parts being curved outwards, and rolled up so as to facilitate the operation of placing the clip in position, while, at the same time, it will remove all such risk of injury to the blind as might otherwise occur from its contact with the sharp edges of the metal.—Patent abandoned.

79 J. B. Palmer, Handsworth. *Firearms.* Dated January 11, 1869.

This consists substantially in the use of an elongated metal cap, having an aperture drilled through the centre of its apex. Around the base of the cap is fitted a movable metal ring, which works between the sight protector hereinafter described and the rim at the extreme base of the cap, and which is for the purpose of securing the cap upon the nose of the barrel when adjusted thereon. The sight protector is a piece of metal projecting from the side of the cap, having an aperture sufficiently large to cover and protect the foresight when adjusted thereon. The aperture through the apex of the cap is closed, either by means of a suitable cover, or, if preferred, a muzzle stopper of an ordinary kind may be inserted inside the elongated cap, but in this case it is preferred that there should be attached to the upper part of the said stopper or screw which goes through the aperture of the apex of the cap, and is secured thereon by a stopper head of any suitable kind.—Patent abandoned.

80 J. Petrie, jun., Rochdale. *Washing wool.* Dated January 11, 1869.

This relates, first, to those machines for washing wool and other fibrous materials in which a swing rake, as it is commonly called, is used, and consists in a method of balancing the said rake. Second, in a method of altering the throw or vibratory movement of swing rakes. Third, to the lifting apparatus, and consists in a method of raising the material from the trough and delivering it on to an endless apron, or into a suitable receptacle.—Patent completed.

81 W. H. Penning, Hertford. *Signalling.* Dated January 11, 1869.

The mechanism consists of a reservoir fitted with valves, in which the compressed air is contained, and of one or more reservoirs, to be used as may be necessary. A communication tube, extending in one or several lengths, which can be attached to or detached from each other at pleasure, is led from the air reservoir to the place or places at which the signals are to be given. A whistle or other alarum at each or either end of the tube of communication has a stopcock for turning off the air at such times as may be necessary. At every place from which signals will be transmitted a lever, handle, knob, or other arrangement, acting on the outlet valve of the air reservoir, is connected therewith, by which the valve can be opened, and all or any portion of the compressed air allowed to escape.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated July 26, 1869.

2270 R. Shaw, Higher Walton, near Preston, Lancashire, and R. Lakin, Manchester. Certain improvements in carding engines.

Dated July 27, 1869.

2271 J. Miller, Victoria Park, Middlesex. Improvements in or in addition to the mariners' compass.

2272 C. Henderson, Gracechurch-street, City. Improvements in girders used in the construction of arches or otherwise combined with iron, timber, stone, or brickwork.

2273 M. J. Frisble, Birmingham. Improvements in carriage axles.

2274 J. Winship, York. Improvements in the preparation and application of medicaments for internal and external use.

2275 I. Barker, Stourbridge, Worcestershire. Improvements in the manufacture of coffered spades and shovels.

2276 T. Parsons, Massachusetts, U.S.A. A new and useful mechanism, apparatus, or engine, to be used either in measuring water discharged from a conduit or for various other useful purposes.

2277 D. T. Bostel, Ship-street, Brighton, Sussex. Improvements in what are known as dry earth closets.

2278 J. Windle, Sheffield. Improvements in rolling hoops or tyres of iron or steel.

2279 W. R. Lake, Southampton-buildings, Chancery-lane. An improved apparatus for shearing or clipping animals and skins.

2280 A. M. Clark, Chancery-lane. Improvements in the manufacture and refining of sugar.

Dated July 28, 1869.

2281 W. A. Lyttle, The Grove, Hammersmith, Middlesex. Improvements in electro-telegraphic apparatus.

2282 D. A. Fyfe, Bolton, Lancashire. Improvements in the manufacture of paper, and in the machinery or apparatus connected therewith.

2283 H. Gillan and G. Crawford, Glasgow. Improvements in apparatus for spinning or twisting and rolling tobacco.

2284 F. Crossley, Princes'-terrace, Bonner-road, Victoria Park. An improved method or means of preventing metals from rusting or corroding.

2285 A. V. Newton, Chancery-lane. Improved apparatus for facilitating the grinding of the knives of harvesting machines.

2286 A. Burdess, Coventry, Warwickshire. An improved method of winding up watches and other timepieces, and of moving the hands thereof.

Dated July 29, 1869.

2287 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in weaving looms.

2288 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in weaving looms and in their shuttle boxes.

2289 H. S. Heyman, Manchester. A process by which the waste of flax and hemp is converted into substitutes for cotton, wool, and flax.

2290 A. Smith and D. Cunningham, Stonehouse, Lanarkshire. Improvements in treating and refining crude mineral, petroleum, and other hydrocarbon oils, and in the means or apparatus employed therefor.

2291 J. Tate, Portadown, Armagh. Improvements in machinery for scutching, breaking, and preparing flax, hemp, jute, and other fibrous substances, and for thrashing corn or grain.

2292 D. R. Kilpatrick, Glasgow. Improvements in the application of springs to chairs, couches, or other seats and beds.

2293 W. E. Gedge, Wellington-street, Strand. An improved apparatus for lubricating parts of locomotive and other engines.

2294 T. F. Taylor, Southampton-buildings, Chancery-lane. Improvements in machinery for manufacturing metal tubes.

Dated July 30, 1869.

2295 J. S. Kipping, Manchester. An improved method of fixing colours on textile fabrics.

2296 T. W. Lockyer, Monkwell-street, City. Improvements in ladies' parmiers or bustles.

2297 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in block calendars and other similar articles.

Dated July 31, 1869.

2298 G. Allibon, Rosherville Iron Works, Northfleet, Kent. Improvements in steam engines.

2299 A. Patene, F. Bardoux, and G. Jurie, Rue du Filles du Calvaire, Paris. Improvements in the process of reproducing on wood all engravings through aqua fortis.

2300 J. B. B. Pinchon, Amiens, Department of the Somme, France. An improved apparatus for condensing steam.

2301 C. and T. Watts, St. Mary's-terrace, Paddington-green, Middlesex. Improved means or apparatus for indicating stations to passengers by rail or tramways.

2302 D. Stewart, Glasgow. Improvements in apparatus for concreting sugar-cane juice.

2303 F. Jackson, Wigan, Lancashire. Improvements in lubricators for steam engines.

2304 J. M. Clements, Birmingham. Improvements in sewing machines and their appliances.

2305 C. N. Eyland, Walsall, Staffordshire. Improvements in buckles for articles of dress.

2306 B. Goddard and W. Finley, Stockport, Cheshire. Improvements in machinery or apparatus for mixing substances for pills, ointment, and other purposes, and for making pills and globular articles of plastic substances.

2307 J. O. Milnes and J. Sandiford, Stand-lane, near Radcliffe, Lancashire. Improvements in pins, pirns, or bobbins for shuttles, and in shuttles for pins, pirns, or bobbins used in looms for weaving.

2308 H. S. Edward, South Shields, Durham. Improvements in gearing for auxiliary screw engines.

2309 T. Ramsay, Sherburn Tower, Gateshead, Durham. Improvements in apparatus for the manufacture of gas.

2310 J. Beckett, Llandudno, Carnarvonshire. Improvements in self-acting brakes for railway carriages.

2311 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in direct-acting steam engines.

Dated August 2, 1869.

2312 S. M. Smith, Horton Dye Works, Bradford, Yorkshire. Improvements in dyeing certain textile fabrics.

2313 P. R. Hodge, Adam-street, Adelphi, Strand. Certain improvements in the manufacture of luminous and heating gas from hydrocarbonaceous fluids, and in the methods of using and applying such gas for illuminating and heating purposes.

2314 J. Sharrocks, Red Brook Mill, Bury-road, Rochdale. Improvements applicable to locomotive engines for the purpose of removing obstructions on railways.

2315 L. W. Wright, Brooklyn, New York, U.S.A. Improvements in paddle-wheels.

2316 W. Hosack, Buchanan-street, Glasgow. Improvements in mills for extracting saccharine juice from sugar cane.

2317 F. A. Yeo and H. Hanna, Swansea, Glamorganshire. Improved machinery for the manufacture of artificial fuel.

2318 M. Henry, Fleet-street, City. Improvements in apparatus for ventilating mines, drains, and other places, and extracting noxious gases, smoke, and vapours therefrom, such apparatus being also applicable for communicating sound.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," August 3, 1869.

815 J. Carter	1072 J. A. Chaufourier
828 W. R. Lake	1137 F. Erskine
852 W. L. Wrey	1231 W. Robinson
864 W. G. Crossley	1312 L. Isaac
878 G. Blanche	1316 J. Frolich
879 C. Longfield	1400 G. T. Bousfield
881 L. A. Israel	1508 S. W. Clark and W. R. Sykes
890 R. W. Page	1846 J. Tangye
892 C. M'Dermott	1905 W. Clarke and E. Walker
893 F. J. Manceaux	2043 F. Walton
894 V. Chemery	2064 H. H. Murdoch
906 F. Hurd	2092 J. Dewar
909 T. Champion	2102 W. R. Lake
913 J. T. Calow	2107 T. Restell
916 W. Meakin	2114 S. E. Crispe and J. West
921 J. Macintosh	2138 C. D. Abel
933 B. J. B. Mills	2140 J. Bernard
935 E. H. Huch	2142 J. Bernard
971 H. Davey	2149 J. W. Ormiston
973 B. J. B. Mills	2158 E. F. Jones
978 R. Jones	2166 J. H. Johnson
979 W. E. Gedge	2234 J. Hayward
998 H. A. Fletcher	
1001 J. Cruttenden and T. Wells	

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed July 30, 1869.

324 V. Baker	1007 R. Allan
325 J. Slater	1014 G. F. Griffin
331 F. Vanderaey	1077 W. A. Hunter
334 W. Maddick	1097 W. Ashton and J. H. Storey
335 R. B. Frohock	1572 W. H. Dupre
352 H. Jones	1575 C. W. Siemens
354 J. Jobson	1642 J. Bronner and H. Gutzkow
360 J. Taylor	1660 J. Sturgeon
368 H. A. Dufrene	1686 T. R. Clarke, W. Bywater, T. Lawson, and C. L. Lister
425 W. R. Lake	1711 C. Ostlund
458 W. R. Lake	1715 J. Lloyd
468 W. Smartt	1721 J. H. Johnson
483 J. Atkins	1797 W. R. Lake
561 R. W. Farey	
575 R. Morton	
634 J. Farrington	
849 J. D. Morrison	

Sealed August 3, 1869.

356 W. Blundell	573 B. Hunt
357 J. Page	730 W. R. Lake
367 C. S. Dawson	779 J. Thomas
369 J. S. Offord	843 A. V. Newton
378 B. Walker and W. Tilson	858 W. H. Phillips
388 B. Hunt	1015 D. J. Hoare
423 J. Carter	1021 W. Johnson
445 W. Summers	1057 W. H. Douglas
469 L. N. Legras	1158 J. G. Jennings
500 T. H. Martin	1345 E. and T. Waltham
514 S. Myers	1468 T. G. F. Dolby
530 H. W. Whitehead	1563 R. Orley
697 J. A. Jaques, J. T. Oakley, and J. A. Fanshawe	1589 S. Thomas
	1811 G. W. Howe
	1847 B. Wartski
	1864 A. Destouy

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1959 J. Adams	1986 S. Chatwood and J. and T. Sturgeon
1960 W. Richards	1992 W. Furness and W. Bray
1963 J. M'Kenzie, T. Clunes, and W. Holland	1994 J. T. H. Richardson
1964 T. Greenwood and W. Keats	2001 S. T. Armstrong
1970 J. J. Bodmer	2010 P. Murray
1984 J. Parry and R. Morris	2029 W. Smith
	2039 H. Holland
	2312 C. E. Brooman

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2169 J. W. Woodford	2193 G. Coles, J. A. Jaques, and J. A. Fanshawe
2175 A. V. Newton	
2181 G. A. Biddell	

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

815	2086	2138	2151	2167	2181	2193	2212
1350	2089	2139	2152	2168	2182	2194	2214
1722	2107	2140	2154	2170	2183	2196	2216
1761	2125	2141	2156	2171	2184	2197	2218
1764	2126	2142	2158	2173	2185	2199	2220
1959	2126	2144	2159	2174	2186	2200	2224
1972	2130	2145	2160	2175	2187	2202	2226
1980	2131	2146	2161	2176	2188	2204	2228
2005	2132	2147	2162	2177	2189	2206	2230
2053	2135	2148	2163	2178	2191	2208	2234
2064	2136	2149	2164	2180	2192	2210	2236
2072	2137	2150					

LIST OF SPECIFICATIONS PUBLISHED

For the week ending July 31, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3594	1 8	3706	1 0	3744	0 10	3783	0 8	3885	0 4	3918	0 4
3606	1 10	3711	1 2	3745	1 6	3787	0 10	3886	0 4	3919	0 4
3611	0 10	3713	0 8	3746	0 10	3791	0 8	3888	0 4	3924	0 4
3622	1 4	3715	1 4	3747	2 2	3797	1 4	3890	0 4	3927	1 4
3635	1 10	3719	0 10	3749	0 10	3799	0 8	3891	0 4	3928	0 4
3662	0 8	3723	1 0	3751	0 10	3805	0 8	3896	0 8	3930	0 6
3666	1 4	3725	1 0	3765	1 0	3806	0 8	3897	0 4	3932	0 4
3667	0 10	3727	0 10	3766	0 8	3808	0 10	3899	0 4	3938	0 4
3672	1 4	3728	1 6	3768	0 8	3812	0 8	3900	0 4	3940	0 4
3673	1 6	3729	0 6	3769	1 0	3815	0 10	3901	0 4	3943	0 4
3675	0 10	3734	1 0	3770	0 10	3817	0 10	3902	0 4	3944	0 4
3693	0 10	3735	0 10	3771	0 10	3838	0 8	3903	0 4	3945	0 4
3694	0 8	3736	1 4	3772	0 8	3877	0 4	3907	0 4	3946	0 4
3698	0 8	3737	0 8	3775	0 10	3880	0 4	3909	0 4	3947	0 4
3702	0 8	3741	0 8	3778	0 10	3882	0 4	3911	0 4	171	0 8
3705	0 6	3742	0 8	3780	0 8	3883	0 4	3912	0 4		

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

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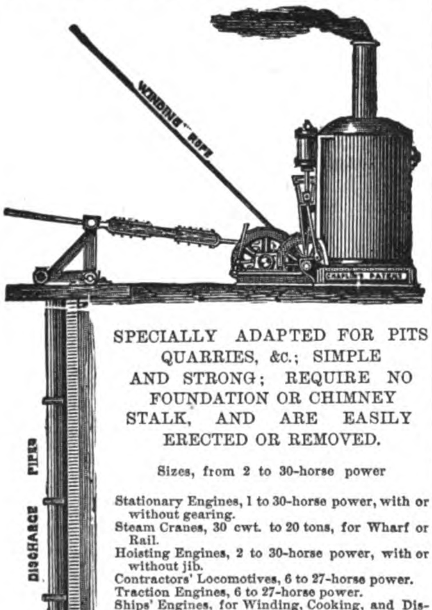

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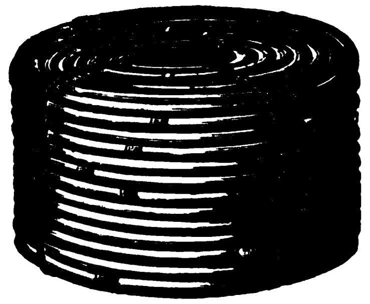

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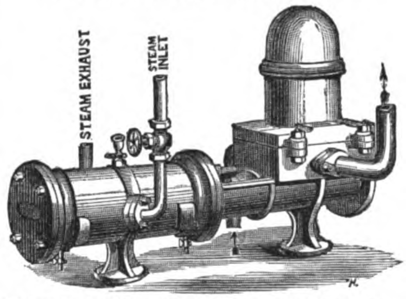

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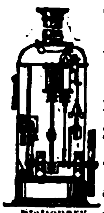

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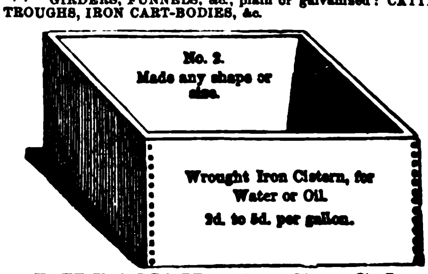

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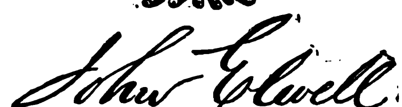

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THE

MECHANICS' MAGAZINE.

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BARKING AND THE LONDON SEWAGE.

FROM London to Barking, from Barking to Gravesend, and from Gravesend to some more remote locality—some "ultima Thule"—appears to be the past, present, and future destination of the metropolitan sewage. After undergoing a severe scourging from the neglect of obvious sanitary regulations, and losing year after year a good percentage of its overcrowded population, London transferred the contaminating cause of its endemic sufferings to Barking and Crossness. In the opinion of many, this was regarded as a master stroke, a *tour de force*, deserving all praise, and a complete solution of the difficulty. Furthermore, by prohibiting the influx of sewage matter into the Thames above the metropolis, and by the construction of the noble granite walls adorning its banks, it was expected that the term, "pleasant waters," might once more be applied to the river. Probably, but for the incessant disturbing action of the paddle-wheels of the steamers that ply upon its surface, the term might be appropriately used. So far, however, as the discharge of sewage is concerned, the Thames, in the immediate vicinity of London, is free from all such noxious infusions. But it is only thus locally purified, at the cost of what is stated to be a more serious and more extended pollution in another part of its course. It is true that the source of disease may have left the metropolis, but it cannot be said to be conquered; it cannot be considered to be effectually removed, so long as it carries the fever and the pestilence to other towns and localities. If the reduction of the death rate in one town is to be accompanied by a rise in that of another, there will be no diminution in the average return of national mortality. A partial remedy is frequently but an aggravation of the evil. The question at present to be decided is, whether London is to be purified at the cost of the infection of other towns. There is a legal maxim which expressly forbids one man to benefit himself by injuring another, and it remains to be proved whether it may not bear a more extended application. It is written "There is a tide in the affairs of men, which, taken at the flood, leads on to fortune." We are not in possession of sufficient evidence to determine whether the members of the Board of Works regarded this as applicable to sewage and the flood tide of the Thames, but, if so, they appear to have made a most unfortunate mistake. The idea entertained—that the transporting action of the tide would carry the sewage "out to sea," where it would be absorbed and lost in extreme dilution—has eventuated an utter delusion. A large portion of the sewage floats in a vacillating irresolute manner up and down the stream, in the neighbourhood of the outfall, gradually sinking down to the sides and bottom of the river, in a state of almost impalpable subdivision, where it remains in the form of fine black redolent mud. The shores of the river in the neighbourhood of Erith and Greenhithe are evidence of this fact.

At the time that this first transference of London sewage was contemplated, thus distinguishing it from the second transference, which it is now proposed to effect lower down the river, there were some warning voices raised against the scheme—there were some protestations offered against its adoption. In spite of these, the project was carried out, and the results are now apparent in the inquiry which has just been terminated. Although a small place, in comparison with London—a very small place, indeed—yet the inhabitants have at last been roused to action, and may be said to have taken "up arms against a *river* of troubles." There are two points in which the subject has to be considered at Barking. One is the actual sanitary effect produced upon the inhabitants of the town by the discharge of the sewage; and the other, the effect it is producing upon the bed of the river, and the serious consequences that may result to our inland navigation. Were it not for the latter evil and the powerful support that the inhabitants receive from the Thames Conservancy Board, it is somewhat problematical whether the investigation would have taken place. It is probable that the portion of the question relating to the health of the town and its inhabitants will be taken into consideration on some future occasion, as the present inquiry has been confined to the reception of evidence respecting the actual state of the river and the creeks leading into it. On this point, there has been an abundance of scientific evidence taken on both sides. A number of residents in the locality have been examined, and testified to the fact that since the establishment of the outfall works, large banks and accumulations of sewage had been gradually but incessantly forming at the mouth of their creek. Moreover, the depth of water had become so seriously decreased that vessels which formerly found no difficulty in getting in and out of the creek were no longer able to do so, and, what was more to the point, insurance offices would not insure them. It was also stated that sewage matter was found floating on the surface of the water up the creek. In order further to establish the fact that the discharge of the sewage at the outfall had occasioned deposits of mud in the river, the evidence of Mr. Leach, the engineer to the Thames Conservancy Board, was taken at the inquiry. He stated that a gunpowder hulk, which had 13ft. of water under her in 1863, was compelled to be removed about eighteen months ago, as the river had silted up to so great an extent that the barges could not come alongside of her. The fact was also deposed to that before the establishment of the sewage works, the Conservancy dredges met with nothing but clean gravel in their operations, whereas now they found considerable deposits of mud.

Against all this we have the statement of many eminent engineers, including Messrs. Hawksley, Gregory, Bidder, and others, that the whole evil, from first to last, is imaginary, and that the discharge of the sewage into the Thames has had rather a beneficial effect than otherwise upon the bed of the stream. Whether such is the case or not, ought not to be very difficult to prove. It must be borne in mind that it is not a question of opinion, or a matter of guesswork. The condition of the Thames with respect to the quantity, position, and quality of its different deposits and accumulations can be ascertained with minute accuracy from time to time, and the agent at work in producing them indicated with perfect certainty. The chemical evidence demonstrated most conclusively that the banks and foreshores of the Thames are all contaminated with sewage. As the report is no yet made, we shall not anticipate the result, but, in our opinion, not a single drop of the London sewage ought to be allowed to run into the river, and the Metropolitan Board of Works ought to look out for another outlet for it. The idea of effecting a further transference of it to Gravesend or any other locality, with the intention of discharging it into the same channel, is merely a repetition of the existing plan, and one which we trust we shall never witness the adoption of. The present offers an admirable opportunity of giving the only true principle of the utilization of sewage a fair trial, and developing the application of it to land, on a scale commensurate with the importance of the interests at issue. The beneficial results, in an agricultural point of view, accruing from the irrigation of land by sewage are now too patent to need either eulogy or comment. It cannot be forgotten, at the same time, that injunctions are at present hanging over parties for polluting rivers and watercourses by precisely the same course of action that is adopted with impunity by the Metropolitan Board of Works. Why should they be exempt and all other local boards unexempt?

THE CHANNEL PASSAGE.

A REPORT recently made by Captain Tyler to the Board of Trade forms an important step in the progress of this question, and presents, for the information of the public, a most valuable official statement of the present position of the matter. Nothing can be stronger than the opinion Captain Tyler offers of the necessity for improvement in the means by which communication is effected between this country and the Continent. This necessity has frequently been pointed out in this journal, and various plans for meeting it have been described. The testimony of all who have had occasion to experience the existing inconveniences unites in supporting the conclusions of Captain Tyler on this part of the subject. There is no doubt the importance of this communication cannot be over-estimated. In former times, when Europe was regarded mainly as a theatre of war, it was, perhaps, no disadvantage for this country to be separated from it; but since the introduction of steam has so completely changed the character of marine locomotion, any advantage formerly arising in this respect from our insular position has been materially diminished, and, in the present day, it is continental commerce from which we are separated, and not continental wars.

Captain Tyler states in his report that there are on an average only 90 days of calm weather in the year—that is, one out of every four days only. But notwithstanding it is the most important communication in the world, Captain Tyler states that "there is nowhere any sea service of equal importance which is so much in need of improvement." This does not arise from any fault in the vessels by which the service is effected, for he says that it is impossible, for want of sufficient harbour accommodation, to employ better vessels, and that even these cannot at times enter the French harbours or land their passengers on the French coast. Various projects have been designed by means of bridges, tunnels, tubes, and viaducts for avoiding the use of steam vessels altogether, and Captain Tyler states that "those which have of late made the most progress are the bridge scheme of M. Boutet and the tunnel scheme presented under the chairmanship of Lord R. Grosvenor," and he describes the history and present position of both of these. As to the first, he refers to experiments making by an association formed for that purpose, and states "that two small bridges have been built in France, and arrangements are made near St. Malo for a third, a mile in length, in two spans of half a mile each; that the Emperor visited the works on a site which has been granted by the French Government on the 8th June last, and is stated to have expressed himself favourably with regard to the project." The bridge is estimated to cost £8,000,000, and it will take three years to complete, and it is said that the experiments in progress give reason to expect that this estimate will not be exceeded.

Of the tunnel scheme, Captain Tyler says that it has been before two French Commissions appointed by the Emperor to inquire into the scheme, and the Councils General of Ponts and Chaussées, and of Mines, and that the latter, to whom it was last referred, "would not form any estimate either of the probable duration of the works or their cost"

until preliminary driftways "establish the possibility of the undertaking and the nature of the difficulties which may present themselves." It appears that the expense of this preliminary experiment is estimated at £2,000,000, and Captain Tyler's report shows that its success would depend upon whether or not fissures in the chalk are encountered, to avoid which Mr. Remington proposes to tunnel from Dungeness, in order to work in the Wealden formation.

It would be premature to discuss the scientific details of M. Boutet's project, which are not yet published, and, indeed, cannot be determined upon until the result of the pending experiments in Paris is known. We shall look with great interest for these details, as it is evident that a design, which is thought worthy of adoption for spans of half a mile at St. Malo, and the works for experimenting on which the Emperor has thought it worth his while unexpectedly to visit, must possess great merit, whatever span the result of these experiments may show it to be capable of. Captain Tyler, accordingly, necessarily avoids giving any opinion of the feasibility of the project for the Channel bridge, and recommends the English Government to refer the whole matter to the consideration of the French Government, with a view to the appointment of an international commission. We think few will be found to question that a bridge, if practicable, would be preferable to a tunnel. Captain Tyler mentions the following reasons on which it is advocated, and "as being, first, less costly than a tunnel; second, occupying less time in construction; third, giving no trouble in ventilation; and, fourth, avoiding the danger of sudden inundations." We may add, that when completed it would be perfectly reliable as long as it bore its own weight and stood; that it would not be likely to fall without ample premonitory symptoms, which would guard against its use in danger, and be open to the light of day; and during its construction its practicability would be tested as it progressed, whilst the water might break into a tunnel during the excavation of the last yard, or, when completed, during the last mile of the journey, and utterly destroy a train without warning and without hope of escape.

We observe that Captain Tyler considers the necessity of improvement of the Channel passage so urgent that he recommends an immediate expenditure of £500,000 on the extension of the west pier at Boulogne, or £200,000 on a new harbour near Boulogne, for the temporary relief of the traffic pending the consideration of the more important improvement which the bridge or tunnel, if practicable, would afford. We should doubt whether the French Government, which has devoted so much attention to the bridge and tunnel projects, would be likely to entertain the idea of falling back on the improvement of their harbours, on which they have already spent such vast sums in attempting, with such slight results, especially when the expenditure which they are invited to make is five times that proposed for our harbour of Dover, and involves the substitution for the ancient port of Calais the modern harbour of Boulogne, which Captain Tyler admits is considerably out of the route for continental travellers not bound for Paris and places beyond it. They would probably prefer to join in the more complete remedy which a continuous railway would afford, either by tunnel or bridge, more especially as the latter is estimated to cost only £8,000,000, and to require only three years in construction, and it would save the necessity for the double transhipment of goods, which is so fertile a source of damage, expense, and delay.

It is satisfactory to find that the question is at last receiving attention in this country, and that steps have been taken by the influential noblemen and gentlemen who formed the recent deputation to Mr. Bright to make known to him the interest which the Emperor of the French is known to take in the matter, and it is to be hoped that Captain Tyler's recommendation to the English Government to co-operate with him will not be lost sight of.

THE GOLD COINAGE OF ENGLAND.

On Friday last, Mr. J. B. Smith attracted the attention of the House of Commons to a recently published report of the Master of the Mint on our gold coinage, and drew from the Chancellor of the Exchequer some important statements in reference to it. Neither of the authorities in question appear to have a very definite idea of the actual number of gold coins in circulation throughout the United Kingdom, but it is probable that Mr. Smith's estimate of thirty-one millions is not far from the truth. Of this number, the same gentleman assumes that about five millions, or 16¼ per cent., have been so reduced by abrasion as to be below the legal minimum weight.* At the first blush, this appears to be a very serious, if not an alarming, conclusion, for it in reality affirms that of every six sovereigns in circulation one is, according to law, not fit for duty. There are, however, many points to be considered before joining with Mr. Lowe and his co-alarmists in reference to the magnitude and consequences of the evil—supposing it really to exist. If the public had as little protection against the presumed disadvantages of a deteriorated currency as the Chancellor of the Exchequer seems to imagine they have, there would be no ground for dissatisfaction. The process of deterioration or reduction of weight commences with all coins from the moment they pass into circulation, and the first year of their existence is always the most destructive. Then it is that the fine sharp lines of the engraved surfaces and the square edges of the milling are smoothed away and rounded off by attrition. This fact is well known to those practically acquainted with coining operations, and will be readily understood by those who are not. It is impossible to evade this evil so long as coins are decorated by artistic engravings, or protected from clipping by having serrated circumferences, or pass from hand to hand in the daily routine of commercial life. Mr. Lowe asserts that "we issue coins of correct weight to the public, but take no care to keep up the integrity and standard of our money." For this sweeping assertion it is difficult to find a truthful basis. We had always believed that the "integrity" of a coin included both its standard of weight and of fineness, and these, so far as emanations from the British Mint are concerned, have never been disputed since the days of King Henry VIII., who tampered seriously with the coinage, in addition to practising some other vices. Whether the expression of the Minister was intended to incite a desire for, and thus to pave the way to, a re-coinage of gold, or to assist in promoting an international coinage, we know not; but one thing is certain, and it is, that his insinuation as to the non-integrity of the English sovereign was undeserved. As to our "taking no care to keep up the integrity and standard of our money," it must be stated in contradiction that after the calling in of "light gold" some 25 years since, a precautionary measure was taken to ensure the future "integrity," as regards weight at least, of the gold currency. It was simply the only practical mode of accomplishing the object, either then or now available, namely, that of checking by weighment each sovereign or half-sovereign by whomsoever received. This rule is still in existence, but many of the private banks waive its application in favour of their customers, and generally it has fallen into disuse.

At the Bank of England, all the gold coined at the Royal Mint is received in its integrity of weight and of fineness, although the accounts between the two establishments is one of weight only. What is called a standard coinage, so far as the Bank is concerned, consists in a right number of pieces being received from the Mint in return for a certain quantity of gold ingots sent to the latter place. We have reason to know that, in a coinage of seven millions of sovereigns and half-sovereigns just completed at Tower Hill and delivered to the Bank, the "integrity" of the individual coins was so scrupulously maintained, as that tale and weight on the whole quantity positively agreed. Mathematically speaking, therefore, the Mint produced seven millions of coins all of equal intrinsic value. Practically, the variations on either side of the true standard (123·274 grains) were equal and thus balanced each other. The legal limit of such variations, it may be stated, is a quarter of a grain (one halfpenny in value) above or below the theoretical standard just indicated. The automatic balances in use at the Mint are next to being infallible in their action, and it is positive that no gold coin can, by any possibility, reach the Bank which is "out of remedy," either on the heavy or light side of the standard. A knowledge of this fact will enable our readers to estimate at its proper value a statement authoritatively made on Friday, viz., that "there is reason to believe that large masses of new British sovereigns are occasionally treated so as to separate out the heavy pieces, and these are disposed of as bullion; while the lighter pieces, which may all be of legal weight, are preserved and put into circulation." With all deference to the source whence this statement came, we take leave to doubt it entirely. The operation would not pay for itself, even if practised on an extensive scale and with the aid of appliances as delicate as those employed at the Mint. It would be cheaper to "sweat" the newly-minted coins, and thus deprive them of their surplus weight, and those who wished to be dishonest in the matter would be apt to find the simplest means of effecting their object. The fact is, moreover, that although the Mint cannot produce all coins of the true standard weight—owing mainly to the varying density of the metal used—yet very few are issued which reach the extreme legal maximum or minimum allowance of variation. At least eighty per cent. of the gold coins issued from the Mint come within those limits, and, though not exactly standard, they cluster closely to it, and do not differ more than one farthing's value from each other. When guineas were coined by rude mechanical means, many years since, and imperfectly sized, it might have paid to select heavy pieces and sell them as bullion; but with sovereigns and half-sovereigns, as produced at the present time, the idea of doing so is simply—it must be said—absurd. It is unfortunate that those who presume to speak of such matters—and with authority, too—are not practical, or do not enlist the assistance of those who are. As to the "manufactories" for manipulating in a nefarious manner the heavy gold coins of the country, and said to exist in Paris or Brussels, they are myths, and Mr. Aytoun did well in asking for proofs of their existence.

The Bank has its automatic weighing machines, and these are a constant check upon the productions of its sister establishment. There is reason to suppose that nearly a quarter of a million of sovereigns, drawn from the channels of circulation, are passed through the Bank balances every week, and from these the "too light" pieces are eliminated and relegated to the furnace. Is not this having "a care" for the integrity of the gold coinage? That any better plan for protecting the public interests than that of testing

* 122·50 grains.

each coin for weight can be devised, we doubt. From the Bank of England the golden streams flow as from a fountain, and they return, by the effects of the law of supply and demand, to the same place where their "integrity" is always being examined into and reported upon. There really appears to us to be no necessity for a re-coinage of gold, nor, therefore, the expenditure of £400,000 in accomplishing it. New coin is being continually supplied to replace the old and worn money, and it is only essential to coin sufficient year by year to keep pace with the deterioration going on under a natural law. As to the reduction in the standard weight of the sovereign, proposed by Mr. Lowe, and the consequent assimilation of its value to the 25-franc piece of France, we shall say more next week.

In conclusion, it may be remarked that the Chancellor of the Exchequer, in speaking of the annual expenditure of the Mint, omitted to state that the profit accruing to that establishment upon the conversion of the old copper into new bronze coin amounted to £400,000—just the sum named for the production of a new gold currency.

ON THE SURFACE TEMPERATURE OF THE SOUTH ATLANTIC OCEAN.

THERE has just been issued from Her Majesty's Stationary Office, by the authority of the Committee of the Meteorological Office, an atlas of charts showing the surface temperature of the South Atlantic Ocean in each month of the year. We avail ourselves of the introduction to place before our readers an account of this valuable addition to physical science. The region included in these charts extends in latitude from the equator to 60deg. S., and in longitude from 70deg. W. to 40deg. E., passing accordingly beyond the limits of the Atlantic Ocean for a considerable distance around the south point of Africa. The original materials out of which the charts are constructed were collected and discussed at the Meteorological Office before it was placed under the management of the Committee of the Royal Society. It will be seen that these materials consist of monthly mean temperatures for spaces of five degrees of latitude and longitude (five-degree squares). In the extraction of the observations from the registers kept on board ship no notice had been taken of the exact positions of the respective ships, beyond the fact of their being within the area of a certain five-degree square. Accordingly, it would have been impossible to have determined the precise part of the square in which any particular observation was made, without referring back again to the original registers,—a work of enormous labour. The Committee have therefore deemed it advisable to allow the data to appear in their present condition, rather than to delay their publication altogether until a more complete investigation of the subject had been effected.

In order, however, to place before the English public a large amount of additional information which was in a far more detailed condition than their own, they have decided on republishing the data as to the area under discussion, which are contained in the work entitled "Ondersoekingen met de Zee-thermometer," published at Utrecht in 1861 by the Royal Meteorological Institute of the Netherlands. The Dutch discussions have been effected with reference to bands of 5deg. of longitude, but for single degrees of latitude, so that five distinct means are given for the space which is only represented by a single mean in our own results. This is, of course, a very great improvement; but even this subdivision is far from being minute enough to enable us to trace satisfactorily the direction of ocean currents. It is evident that in order to investigate currents running in a meridional direction, each observation must be examined to the full as closely with reference to the longitude as to the latitude of the spot where it was taken. It deserves special notice that the South Atlantic Ocean is much colder to the east of the meridian of 20deg. W. than to the west of it. All the isothermal lines take a sudden bend southwards in the neighbourhood of this meridian. This change in direction takes place even in summer, but at that season its place lies more to the westward, near the meridian of 25deg. W.

There is a cold current flowing northwards along the coast of Africa, and a warm current flowing southwards along the coast of Brazil; we find from the monthly charts that the Brazilian current, which we may consider as a southern branch of the equatorial current, splits into two parts in the neighbourhood of the parallel of 30deg. S. One portion flows in a south-easterly direction and loses itself, after throwing off several branches, in the polar current; the other portion flows by Patagonia and the Falkland Islands, and exerts such a warming influence on the climates of these countries in spite of their high southern latitudes that the numerous heads of black cattle, horses, and sheep which roam over the plains can find abundant nourishment even in the winter time. The south polar water which we see flowing past the Gulf of Guinea is warmed on its way; the coast line forces it to assume a westerly course, and it is to this source that we are indebted for the warm water which we find flowing in a northerly and southerly direction along the western shores of both oceans, and not to the Agulhas current, which can only send its waters during a few months of the year to the west of the south point of Africa. The very low temperatures found in the eastern portion of the ocean prove this statement completely. Between the meridians of 20deg. and 15deg. E. we see that the warm current shows itself very distinctly at lat. 35deg. S., while its influence is no longer noticeable as soon as we come to the northward of 33deg. S.

In order to afford as accurate information with reference to districts where the temperature varies much, as it was in their power to do, the Committee have authorized the publication of detailed extracts from the registers of captains who have noticed remarkable changes in the surface temperature. To these we will now draw attention. The first locality in which considerable alterations of temperature are met with is almost exactly on the equator, about the 23rd meridian of west longitude. At this spot in the month of July, Captain Code, in the "Orient," reports that the temperature fell 5deg., and rose again in the space of 24 hours, the water appearing of a light green colour. Similar observations have frequently been made in this region, and Captain H. Toynbee has drawn attention to them in a paper "On the Specific Gravity, Temperature, &c., of the Seas Between England and India," published in the proceedings of the Royal Geographical Society, in which he gives an account of seven successive observations of a temperature of 70deg. Fah. The observations were made in the same year as Captain Code's, and only three weeks later. The circumstance shows itself plainly in the Dutch charts for the month, with this difference, that the place where the mean surface temperature is lowest is on the parallels of 2deg. and 3deg. S., and between the meridians of 15deg. and 20deg. W. Admiral Sir F. Grey noticed very remarkable changes of temperature on the coast of Africa between the parallels of 10deg. and 20deg. S. in the month of May. He observed the surface temperature below 60deg. on two occasions when he was about 25 miles off shore, and he remarks, "It would appear that the temperature of the water decreases as we approach the shore." The charts show a striking discrepancy between the mean temperature of the square in question, which is 60·8deg., while that of the squares to the north and south of it are 76·3deg. and 62·2deg. respectively.

In the district bounded by the meridians of 10deg. E. and 40deg. E., and lying between the coast of Africa and latitude 50deg. S., most sudden and remarkable alternations of temperature are met with at all seasons of the year. Changes of temperature have been observed by some homeward-bound vessels between the parallel of 35deg. and the coast when crossing the Agulhas Bank, and Captain Toynbee remarks that the temperature of the water is a good guide to show whether you are on the bank or not. By far the greater number of the extracts refer to a region lying one or two degrees on either side of the 40th parallel of latitude. In the northern part of this belt the observations all fall to the eastward of the meridian of 10deg. E., but in the southern part it will be seen that in a few instances considerable alternations of temperature have been noticed as far west as the 8th or 9th meridian of east longitude.

Throughout the whole of this area the alternations of cold and warm water are most striking, and the changes of temperature are nearly as sudden and as great as those well known to be experienced on the northern edge of the Gulf Stream, where it is bounded by the Arctic current. The greatest actually observed has been a fall of 19·5deg. in one hour, recorded by Captain Major in the month of February. His position was in 41deg. 38min. S. and 21deg. 30min. E., and the surface temperature was observed to be 69·5deg. at 9 a.m., 50deg. at 10 a.m., and again 59·5deg. at noon. Captain Fitzsimons in October, in latitude 41deg. and longitude 21deg. E., noticed a decrease of temperature of 14deg. (from 67deg. to 53deg.) in one hour, while the ship passed through some heavy tide-rips. Captain Wherland in November, in latitude 39deg. 56min. and longitude 17deg. 20min. E., noticed an increase of 14deg. (from 53·5deg. to 67·5deg.) in two hours. In almost all the registers the fact of the sea being very high and confused is recorded, as well as the frequent occurrence of tide-rips or ripplings, and of great changes of colour in the water. Another region where sudden changes are noticed is off the coast of South America, from the 20th parallel of S. latitude southwards, and there are several well marked areas, notices of which will be found in the extracts from the registers. Colder water is to be met with off Rio Janeiro inside the line of soundings than outside. This would appear to show that the branch of the equatorial current of warm water which flows southwards along the coast of Brazil is usually unable to force its way into the shallow water on the bank of soundings, along which a narrow stream of colder water flowing northwards is met with. The difference is greatest in February, when it exceeds 4deg. However, in July and August the conditions are quite changed, for then the temperature outside soundings is lower than inside.

South of the parallel of 30deg. S. the changes of temperature which are noticed, though not so striking as those observed off the African coast, are yet very remarkable. The entire area in which the observations are made lies west of the meridian of 50deg. Between the parallels of 35deg. and 40deg. S. changes of temperature of 20deg. within 12 or 14 hours have been repeatedly observed, with great variations in the colour of the water. As regards the relation of the currents to the depth of the water, Captain James Gales states, "The warm water is on the bank of soundings, the cold along the edge of it." This is a marked difference to the state of things noticed off Rio Janeiro. However, this cold water forms only a narrow strip, for to the eastward again the water is decidedly warmer. When we pass the parallel of 40deg. S. the charts show that

the mean temperature in latitude 40deg. to 45deg. S. is higher between 50deg. and 55deg. W. than in either of the squares situated east or west of it. The mean annual difference of temperature is 1·8deg. to the eastward, and as much as 5·4deg. to the westward. One observer, Captain James Brack, cuts across this warm water in September going westward. In latitude 41deg. to 44deg. S. and longitude 54deg. W. he finds an increase of 13deg. in 14 hours, succeeded by a decrease of 14deg. in 10 hours. The same observer had previously passed through a cold current in latitude 40deg. S. and longitude 53deg. W.

Another area frequently referred to in the extracts is that bounded by the parallels of 45deg. and 50deg. S., and the meridians of 47deg. to 53deg. W. Here the differences of temperature are not very great, but there appears to be evidence of the existence of two currents, a cold and a warm one close to each other. The edge of a warm current is frequently noticed at about the 51st meridian between the above-named latitudes, while the cold current appears to extend, at least in lat. 49deg., from that meridian eastwards to that of 46deg. W., as many observers report a sudden fall of temperature about long. 47deg. W. Off Cape Horn a warm current close in shore has been commonly noticed. Captain Jas. Gales, in March, remarks, when the sea temperature rose 2·5deg., "Standing northward, and temperature of sea increasing. In dark or thick weather that increase in the temperature of the sea would be a hint to tack ship." The observation was taken about 40 miles south of Cape Horn. The whole of this coast of South America seems, even from the small amount of information which has been attainable relating to it, to present features of interest as regards the sea surface temperature observed along it, which are perhaps equal in importance to those of the Agulhas current. Several extracts are given tending to show how far the surface temperature is affected by heavy rain. It appears that in some extreme cases a fall in temperature of 4deg. or 5deg. may be attributable to the cooling action of a heavy fall of rain.

HOLMES' STONE-DRESSING MACHINE.

TO supersede manual labour in dressing stone by mechanical means has been for many years past the aim of Mr. J. E. Holmes, who has made this question his special study. The result has been the production of a machine in which the working tools are applied to the surface of the stone in the same direction and with the same effect as the chisel in the hands of the workman. A machine upon this principle, worked by hand, was described and illustrated by us at page 156 of our last volume. Since our notice of that apparatus, Mr. Holmes has improved some of its details, and has adapted it for working by steam power. The machine thus improved was inspected by us on Friday last on the Thames Embankment at Westminster, where it was at work. The apparatus consists of a travelling plate carrying the stone to be dressed beneath the cutters. These cutters are carried in a transverse bar, and consist of either a series of chisels or a single knife, according to the work to be done. The bar is actuated from a cranked axle, which imparts an oscillating motion to it, imitating very closely the action of a workman's hand and mallet. On the occasion of our visit, two blocks of Portland stone were provided, measuring about 6ft. in length by 21in. in width and 14in. in depth. One of these blocks had been dressed by hand by two workmen, who completed their task in sixteen hours. The other was dressed by the machine during our stay in two hours. The machine dressing was superior in finish to that done by hand, with the exception that an accidental notch in the blade caused a continuous ridge on one of the surfaces. A block of granite was afterwards placed in the machine, and dressed in a very short space of time, with an equally satisfactory result. We are glad to record the progress of mechanical invention in this direction, and to give Mr. Holmes credit for the production of a machine which appears destined to supersede stone dressing by hand. We may add that the machine was exhibited by Mr. Shearer and Mr. Freeman, on behalf of the Dalbeattie and of the Penryn Granite Quarries, the offices of which are at 21, Great George-street, Westminster.

THE WEST INDIA AND PANAMA TELEGRAPH COMPANY.

THE successful completion of the submarine cables between Cuba and Florida, in 1867, appeared to open up at once a new field for telegraphic enterprise, and attention was called to the fact of the importance of the undertaking. So successful has telegraphic communication been between Havana and the United States, that a second cable was submerged last year, and we are assured that the revenue alone for these cables is £60,000 per annum, after eighteen months' working. Communication being thus established between America and the largest of the West India Islands, it became simply a question of time when the telegraph should be extended throughout the Islands. Under ordinary commercial circumstances, this would have of necessity followed in a few months, but the Cuba cables were laid at a time of great depression, and when telegraph schemes were little thought of; since then, however, times have changed for the better, and submarine telegraph enterprises are now looked upon with better favour than they ever were, within the last twelve months several millions of capital being found for the prosecution of but few schemes. It is now, exactly two years since the laying of the first Cuba cable, that a company has been brought out for the extension of telegraphy through the West India Islands and to Panama, and it is announced that "the company is formed for the purpose of extending telegraphic communication throughout the West India Colonies, and, at the same time, of forming the central link of the telegraphic communications of Brazil, Peru, Chili, Buenos Ayres, and the other States of South America, with London, New York, and the whole of the Continent of Europe and North America."

At the beginning of last year, in glancing at future telegraphic prospects, we remarked that "the extension of the telegraph from Cuba to Jamaica and Panama may be confidently looked forward to as one of the enterprizes of the year. The late successful completion of the Florida and Cuba cable has made this extension a necessity, the carrying out of which again will lead enterprize on to the South American continent, and bring us within easy communication with many important points." The extension foreshadowed by us and now proposed will consist of 2,550 miles of submarine cable, and 350 miles of land line, and "will commence at the Island of Cuba, and be continued through the West India Islands to the continent of South America, with a branch cable to Panama." Concessions have been obtained for a term of 40 years for establishing and working telegraph cables from Havana, through Cuba, to Porto Rico, Mexico, and Panama, and from Porto Rico to the continent of South America, through the chain of the West India Islands; and important rights, including subsidies (estimated at about £14,000 per annum have been obtained from the colonial governments of Jamaica, St. Thomas, Barbaboes, Trinidad, Demerara, &c. The proposed route of the line will be a land line through Cuba from Havana, the terminus of the American cable, to the coast, from whence a cable will be laid to Jamaica. This island will become an important point, for from thence a cable will be laid to Aspinwall, in Panama, and another to Porto Rico, thence to St. Thomas, Barbadoes, and Trinidad, to Surinam, on the north coast of the South American continent. The longest of these cable sections will be 600 miles, the principal being short.

Negociations are in progress for the extension of telegraphic communication to Peru, Chili, and the Argentine Confederation, and the "Brazilian Government are also taking active steps for the extension of the line from Surinam to Rio Janeiro, with stations at Bahia, Pernambuco, and other ports in the route, by which means the company will be in connection with lines now completed or in course of construction, from Rio to Buenos Ayres, Monte Video, and Valparaiso." The capital of the company is £650,000, in £10 shares, and a contract has been entered into with the India-Rubber, Gutta-Percha and Telegraph Works Company, for the sum of £587,000, to make and lay the submarine cable. The cable will be of the best quality and of the same class as the Cuba-Florida cable—a single conductor well insulated, sheathed with solid iron wires, and protected externally with hemp covered with a silicated bituminous compound.

The cables are to be constructed within eight and to be submerged within eleven months. The statements as to revenue are as favourable as prospectuses usually show, but there is sufficient information known to warrant the conclusion that the enterprise will be as remunerative as successful. The local amount of traffic in the West Indies may be calculated as considerable, added to which we have the business arising from transactions between the Islands and America and Europe, and, lastly, the large additional amount that may be expected from the various commercial relations with the countries of South America. Our communications with the United States are firmly established, telegraphic extension is largely on the increase in South America, and, when by inserting the middle link in the chain of telegraphic communication by establishing these West India cables, uniting telegraphically North with South America, we may expect a very large amount of business.

The manner in which the India-Rubber, &c., Company manufactured the Cuba cables gives every promise that the proposed cable will be equally successful, and, with the amount of appliances at their command at Silvertown, we may fairly hope to see an excellent cable. The various submarine cable works are now busily engaged in manufacturing large amounts of cable, and, in the interest of submarine telegraphy, we shall be glad to see the machines at Silvertown hard at work. The Company is brought out under favourable auspices, the direction is solid, and we trust to hear that the Company have obtained the necessary capital for an enterprise that must sooner or later be carried out.

A CIRCULAR FROM THE GAS REFEREES.

THE last dodge (there is no other word for it) of the gas referees, unlike many of their proceedings, displays remarkable cuteness, and, indeed, indicates a praiseworthy desire on their parts to become acquainted with the details of the manufacture of gas. They have addressed a circular to the country gas companies, asking for information. They wish to know as follows:—

1. Description and name of coal used.
2. Amount of gas realized from one ton of coal.
3. Quantity of gas annually made.
4. Greatest daily make in winter.
5. Illuminating power of the gas produced.
6. What apparatus is used for ascertaining the illuminating power.
7. Description of material used for purifying the gas from sulphuretted hydrogen.

8. Means adopted for freeing the gas from ammonia.
9. Number of purifiers in use, with their size.
10. Number and size of scrubbers.
11. What liquid is used in them.
12. What number of grains of sulphur per 100ft. is left in the gas.
13. By what apparatus is this ascertained.
14. What number of grains of ammonia per 100ft. is left in the gas.
15. By what means is this ascertained.

Now, the three "competent and impartial" gentlemen who have just sent out this circular, have to prescribe how three London companies are to purify their gas, and if some country engineer will kindly inform them what to prescribe, both they and the companies will be greatly obliged to him. We see some proceedings analogous to this occasionally in the medical papers. A doctor has a case he does not know how to cure, and he writes to ask if any of his professional brethren can tell him how to do it. The proceeding is candid, as a confession of ignorance; but the wrong party gets the fees and the credit of the cure. If anything comes of this circular, it will be some country engineer who has taught the referees and the companies what they ought, and are supposed, to have known. When replying to these questions it must be remembered that information supplied to a public board is public property; and, as soon as Parliament re-assembles, a motion will be made for the publication of the answers.

THE MELBOURNE MINT.

A ROYAL proclamation has just made its appearance, legalizing gold coins which may be hereafter issued from the above-named establishment. The document has certainly been published in good time, for the mint in question does not, as yet, exist, and is not likely to do so before the end of 1870! It is to be hoped, moreover, that the Melbourne coins, when they do appear, will prove to be superior to the unhappy specimens of mintage which have resulted from the Sydney presses. The Australian sovereigns and half-sovereigns at present in circulation are quite unworthy the honour of intermingling with those of Great Britain. They are badly designed, imperfectly struck, soft, brassy in appearance, and well calculated to incite activity among counterfeit coiners. There is no good reason why the gold coins struck at the branch mints of Sydney and Melbourne should not bear the Imperial stamp upon their surfaces. If it be necessary to give them a distinctive character at all from the pieces struck at Tower-hill—which is doubtful—a small letter, S or M, indicating Sydney or Melbourne, as their birthplace, might readily be imprinted upon them. It is of the highest importance that our gold currency should possess the characteristic of uniformity of design. The Sydney coins violate this wholesome rule, and it is to be feared that the Melbourne money will—unless strong protests be entered against the perpetration of such a blunder—increase the irritating nuisance. It is to be hoped that the Governments, British and colonial, will interpose and prevent so flagrant an act fo folly being consummated.

NOTES ON RECENT SCIENTIFIC DISCOVERIES, AND THEIR PRACTICAL APPLICATIONS.

THE PROTECTION OF IRON SHIPS—A REPORTING MACHINE—A NEW PYROMETER.

THERE is nothing novel in the idea of preventing the oxidation of iron ships by the use of zinc. Several modes of applying the zinc have been suggested by various inventive minds, but, for some reason or other, shipowners still rely on paint to preserve their ships, and do not seem to have faith in the protective power of electrical action. The latest invention for the protection of iron ships by this means is that of MM. Demance and Bertin, who distribute about the inner side of the shell, tubular reservoirs, made of zinc, which are riveted to the plates, to place the metal in perfect communication with the iron hull. These reservoirs are charged with sea water, which is changed every day. Bands of zinc carried in all directions over the inner side of the hull connect the various reservoirs, and strips are here and there brought to the outer side, and made to communicate with the sea. We need not here explain the action which takes place. If the authors can be relied upon, the success obtained is perfect. Experimental boats kept in very salt water for a year, they say, do not exhibit a trace of oxidation in any part.

A "stenographic press" has been invented by M. Gensoul. The reporter sits at something like the keyboard of a pianoforte, and by applying his fingers to the keys, prints the words as they drop from the lips of the speaker, syllable by syllable, on a strip of paper which rells along underneath. When we say this, we do not of course mean that the words are printed in letters. The keyboard appears to be divided into three parts of eight keys each. The left side, worked by the four fingers of the left hand, prints signs which represent initial consonants; the right, worked by the fingers of the right hand, prints final consonants; and the middle, acted on by the two thumbs, prints the mediam vowels. We gather that something like a phonetic system of signs is employed. A few months' practice is said to enable any operator to follow the most fluent speaker with ease. We ought to say that M. Gensoul's system renders it unnecessary to transcribe the copy. Just as with the phonetic system, if legibly written, the compositor can set up the speech in common type, from the printed strip furnished by the machine. As to the comparative ease of writing characters with a pen, and printing them in the way here described, we can give no opinion. What we should certainly miss, if the machine came into use in the galleries of our Houses of Parliament, would be the happy skill with which the reporters condense the speeches from their notes. We have very few speakers who could bear to be reported by a machine.

Everybody knows the difficulties which stand in the way of exactly estimating high temperatures. The best pyrometers we have had hitherto can only be supposed to give approximate results, and some of them may be very wide of the truth. We notice, then, with pleasure, one devised by M. Lamy, which shows within two or three degrees Centigrade the temperature of a furnace gradually heated up to redness, and gives its indication at a distance from the furnace, so that at a porcelain factory, for example, a manager can sit in his office and see the temperatures of all the furnaces in his establishment. The instrument is as simple as it seems to be efficient. It is merely an iron retort, containing marble, the neck of which communicates, by means of a narrow tube, with a needle moving over a dial plate. As the heat rises, the marble is decomposed, and carbonic acid is set at liberty. A special contrivance measures the tension the gas arrives at, and as this has a direct relation to the temperature, the measure of the one is made the measure of the other. Up to a certain point, we have little doubt this instrument may be relied upon.

PARLIAMENTARY NOTES.

IN the House of Commons yesterday week, Mr. Bentall (in the absence of Mr. Howard) asked the Under Secretary of State for the Colonies if his attention had been directed to the new Patent Law Act passed by the Senate and House of Representatives of Canada, and to which the Governor General gave his assent on the 22nd of June last; if he was aware that by the terms of this Act the rights hitherto enjoyed by British subjects and foreigners were abolished, and that, unlike the patent laws of England and all other countries, the benefits of its provisions were limited to persons permanently resident in its own dominion; and whether the Colonial Office was prepared to recommend the Government to advise her Majesty to withhold or postpone her assent to the bill, with a view to give an opportunity to the Canadian Legislature to reconsider its provisions.

Mr. Monsell was understood to say that they had received no copy of the Act, and for the reason that this Government had no power to approve or disapprove of the law. It appeared to be an assimilation of the different laws on the subject of patents that had formerly existed in the colonies of Nova Scotia, Canada, and New Brunswick. Mr. Monsell's reply is discussed by Mr. Fordred in our "Correspondence" columns.

Mr. Macfie said that next session he would call the attention of the House to the propriety of having at the Colonial Office a set of all the Acts of the colonial parliament.

On Friday, Mr. Muntz asked the Secretary of State for War if it was intended to proceed with the manufacture of the Martini-Henry rifle otherwise than for trial; and if he was aware that very great doubts were entertained by competent parties as to the durability of the mechanism of the presumed improvement.

Captain Vivian said that it was not intended to proceed with the manufacture of the Martini-Henry rifle till they had been tested in the hands of the troops; therefore, 200 rifles would be distributed among small portions of the troops quartered in various parts of the world, so that the efficiency of the weapon might be tested in all ways and circumstances. As to the second part of the hon. gentleman's question, the authorities were not aware of any doubts as the permanency of the weapon, and those whose duty it was to test it saw no reason to entertain such doubts.

Lord Elcho asked if any tests were to be used for the cartridge as well as for the rifle.

Captain Vivian said that it was intended to apply further tests to the efficiency of the cartridge, so as to obtain the best possible cartridge for the rifle.

At the same sitting, Mr. Childers brought forward a motion on the subject of the transit of Venus. He observed that in 1874 there would be an opportunity of observing or ascertaining one of the most remarkable experiments that could be made. The only method of ascertaining the distance between the sun and the earth, or, more correctly speaking, the horizontal parallax, was by observing the transit of Venus across the sun's disc. That transit would occur in the year 1874, and astronomers were most desirous that the utmost care should be taken in observing this remarkable event. The Admiralty had been at pains to ascertain the expense of the observation in the various parts of the world where it would be seen. They had come to the conclusion that it would cost £10,500, to be spread over five years, and as this was a prospective vote they had thought it better to ask the consent of the House at once, as the expenditure would go on for some years. The amount was small, and the object to be gained was of great value. He, therefore, moved that a humble address be presented to her Majesty, praying that her Majesty would be pleased to direct that steps should be taken for making the observation of the transit, and assuring her Majesty that this House would make good the same. The resolution was agreed to.

On Monday last, on the order for the second reading of the Steam Boilers Inspection Bill, Mr. Sheridan said it would be impossible to proceed with the measure this session, but as he would reintroduce it next year he might state briefly what its object was. The bill proposed a system of registering and testing steam boilers as they came from the manufacturer. That process would be very easy and simple, and it could be conducted very inexpensively, and the advantage to be gained would be found in the larger number of boilers which would then be sold in consequence of the increased confidence which the public would have in them. The bill also proposed that there should be a periodical inspection of the boilers, and accidents from boiler explosions would necessarily be very much diminished by that. Within the last ten years 500 persons had been killed by boiler explosions, and he believed that by a proper systematic inspection a great portion of the mortality might have been avoided. The hon. member concluded by moving that the order for the second reading of the bill be discharged.

Mr. Bazley said he hoped that during the recess the Government would take that subject into their consideration, with the view of preventing, as far as possible, these explosions.

Mr. Bruce said the subject had not escaped the consideration of the Government, but it was one with which it would be very difficult to deal satisfactorily. The accidents from boiler explosions were usually of a most frightful description, and in number they nearly equalled those which took place in coal mines. The average number of the latter was about 100 a year, while the average number of the former amounted to about ninety

a year; so that there was but little disparity in their magnitude. It would, however, be very difficult for the Government to establish a system of inspection of all the boilers in the country. One of the deputations that had waited upon him in reference to the subject had recommended that whenever an inquest was held upon the remains of any individual who had lost his life in consequence of one of those explosions, some skilled person should be present for the purpose of assisting the jury. Another deputation recommended that whenever death ensued from the negligence of the owner of a boiler, he should be compelled to make some compensation to the relatives of the sufferers. That was a matter, no doubt, deserving of consideration, but it was one which could not be considered alone, because the same principle would apply to all other employers who had been guilty of negligence leading to a similar result. He would engage to give his consideration to the subject during the recess, with a view to provide for the evil the best remedy he could devise.

The order for the second reading of the bill was then discharged.

PATENT ONE-SHAFT LOOM.

BY MESSRS. MOORE AND GADD.

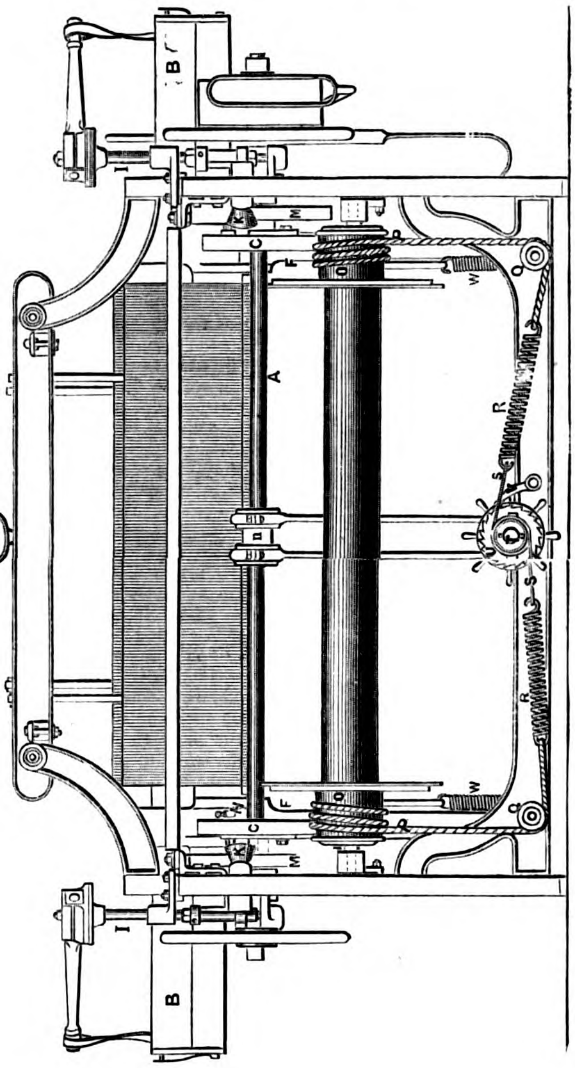


FIG. 2

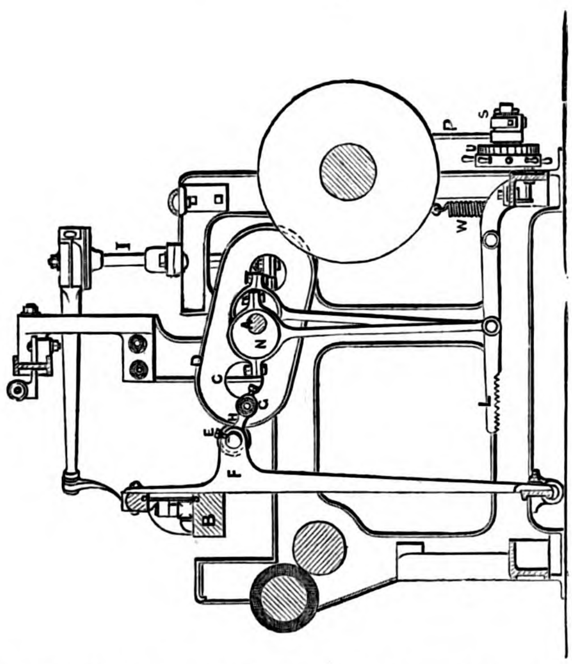


FIG. 1

MOORE AND GADD'S PATENT ONE-SHAFT LOOM.

WE recently gave a brief description of a new power loom, by Messrs. Moore and Gadd, two of which we saw at work in Brown-street Mill, Salford, others, to the number of about a hundred, being at work in the various mills. We now illustrate this apparatus in the accompanying engraving, in which fig. 1 is a cross section and fig. 2 a back elevation of the improved loom. It will be observed that instead of the ordinary crank for driving the sley a peculiar double cam is used with a drag link. In our engraving, A is the main driving shaft, B is the sley, and C is a cam mounted on the shaft A, and suitably formed to impart the desired motion to the sley. The shaft A revolves at one-half the ordinary speed, that is to say, the loom makes two picks during one revolution of the shaft, the cam C causing the sley B to perform two complete strokes during one revolution of the cam. The cam C is formed with a flange D, the outer surface of which operates upon an anti-friction bowl E, revolving on a pin fitted in bearings formed in the sley-sword F. The inner surface of the flange operates upon a second anti-friction bowl G, revolving upon a stud fixed to the radius or drag link H, the link oscillating to some extent around the centre of motion of the bowl E as the cam revolves, in order that the bowl G may accommodate itself to the movement of the cam. As the cam C revolves, the bowls E and G are acted upon alternately, and the sley B is caused to vibrate, moving forwards to beat up the weft when the bowl E is acted upon, and backwards, to admit of the passage of the shuttle when the bowl G is acted upon. The form of cam shown in the engraving is such as will impart a movement to the sley similar to the movement which would be imparted to it by a crank and connecting rod acting in the ordinary manner. The picking shafts I I are actuated by tappets fixed upon the shaft A, and acting on the arms K K of the picking shafts. The healds are actuated by the levers L L, a vibrating motion being imparted to the levers by means of the eccentrics M M, mounted on the shaft A. It will be seen that as each one of the two bowls revolves constantly in the same direction when the loom is at work, greater smoothness of action is attained, with less wear of the bowls and cam, than when only one bowl is used to each cam.

The tension of the warp is regulated by the apparatus next to be described. The warp beam is fitted at each end with an ordinary drum or pulley O O, upon which the ropes P P are coiled, one end of each rope being attached to a spiral spring R, the other end, after being passed partly around the carrier pulley Q, which revolves on a stud fixed to the rail, being attached to the end of the spiral spring W. The ratchet wheel U is mounted on a stud fixed to the rail, and is formed with a long boss T, to which the ends of the straps S S are attached, the opposite ends being connected with the spiral springs R R. When the ratchet wheel is rotated in one direction the straps S S will be wound upon the boss or pulley T, and the two springs W W will be simultaneously extended to an equal extent, and thereby the ropes P P will be tightened upon the pulleys O O, and the tension of the warp will be increased. A contrary effect is produced by rotating the ratchet wheel in a reverse direction.

The method of operating with the apparatus is as follows, viz.:—When a full warp beam has been placed in position in the loom, and the ropes, springs, and straps connected together, the ratchet wheel is rotated until a suitable amount of tension is imparted to the warp, and the strain upon the ropes P P is maintained so long as is desirable by the pawl V preventing the backward rotation of the ratchet wheel. At such times during the process of weaving as it may be thought desirable to reduce the strain upon the ropes P P, the pawl V is raised out of gear with the ratchet wheel, and the wheel is allowed to rotate to some extent in a reverse direction, and the pawl is then placed in gear with the ratchet wheel, and the strain upon the ropes thus reduced is maintained until it is thought advisable to effect a further reduction in the strain.

It is important to know that the improved loom runs very much lighter than the ordinary loom.

Upon the discovery of this fact it was decided to ascertain the exact amount of power required to drive one of the new looms as compared with one of ordinary construction. A series of dynamometrical experiments were therefore carefully made by Mr. Edward K. Dutton, C.E., of Smithy Door, Manchester, to whom we are indebted for the following interesting report thereof. To ensure correctness, and to give the results their proper value, a loom was obtained, made from the same patterns and by the same makers as the improved loom, and differing only in those parts affected by Messrs. Moore and Gadd's patents, both looms having 45in. reed space. A No. 28 warp, 40in. wide, was put into each loom, the work to be performed being thus equal in amount.

The apparatus employed was specially constructed, an ordinary dynamometer being ineffectual for the purpose. A heavy flywheel, with its axis running on anti-friction rollers, was fitted at one end with a pulley to drive one of the looms, and at the other with a differential motion, consisting of four mitre wheels, the arrangement being similar to that of a lever dynamometer, with the exception that instead of the intermediate wheel and lever a circular pulley carrying two intermediate wheels was employed. A scale pan was suspended from a strap attached to the circumference of the pulley. This apparatus has been found to be very sensitive, so that when the engine has been running steadily the weight required to drive either loom could be ascertained within two ounces. The diameter of the strap pulley was 10¾in., and the radius from the centre of the intermediate wheel to the centre of the strap from which the weights were suspended was 6¾in. The weight suspended when the apparatus was running without driving either of the looms was 7½lb. The result of ten tests is given in the following table:—

Number of Test.	Date.		Description of Loom.	Number of Picks per minute.	Speed of Strap Driving Dynamometer.	Speed of Strap Driving Loom.	Weight held in Suspension in lbs.	Horse Power to Drive One Loom.	Saving in Power per cent. as compared with Test 8.
1	July	26	Patent	182	258·9	240·7	70	...	...
2	"	"	Ordinary	176	253·27	465·6	82¼	...	...
3	"	28	Patent	176	253·27	235·5	62½	·26239	...
4	"	"	Ordinary	176	253·27	471	87¼	·3843	...
5	"	29	Patent	176	253·27	235·5	58¼	·24456	24·7
6	"	"	Ordinary	176	253·27	471	80¾	·35219	...
7	Aug.	2	Patent	174	250·4	222·8	58½	·24179	25·5
8	"	"	Ordinary	178	253·27	471	75½	·32487	...
9	"	3	Patent	230	255	471	123½	·56383	...
10	"	5	"	180	256	238	62½	·26303	19·

REMARKS:—

No. 1. Loss of power through the pulley driving loom chafing against framing.

No. 3. Loom not working satisfactorily; defect afterwards found out and rectified.

No. 6. Loom considered by attendant to be working well.

No. 8. This gives the best result obtained during two hours' working. In order that the patent loom should have no advantage, an independent man, experienced in loom adjustment, was obtained to mind the loom during this test, and to adjust the same, and after making all the bearings and working parts as free in their action as possible, the weight required to drive was reduced to the point given in the table.

No. 9. The ordinary loom would not work at this speed, so no corresponding test could be obtained. The calculated speed was 240 picks, but, owing to the straps being only 1¼in. wide, there was much slip and, of course, loss of power.

These experiments show, that owing to the great increase in the amount of power required to drive looms, as the speed of the looms is increased, any increase above a fair working speed will be of doubtful advantage. For this width of loom 200 picks may be considered as the maximum of speed which may be attained with advantage. Further experiments would fix this with more exactness. Taking the best result obtained from the ordinary loom, viz., No. 8, for comparison, it is found that the patent loom shows a saving in power of 25·5 per cent., when making four picks less than the ordinary loom, of 24·7 per cent. when making two picks less, and of 19 per cent. when making two picks more. A comparison of these figures gives a calculated result of about 22 per cent. saving in power when both looms are making 178 picks per minute. It will be observed that the driving strap of the old loom moved with double the velocity of that of the new loom. This was an advantage to the old loom, so far as slip of straps was concerned. It is satisfactory to us to be able to state that in addition to these great recommendations the loom possesses yet another—that of being nearly 20 per cent. cheaper than the old one. This, combined with the saving of power, makes the invention very valuable, and must, we think, lead to the general adoption of this loom by manufacturers as circumstances admit.

ON THE THERMAL ENERGY OF MOLECULAR VORTICES.*

By W. J. MACQUORN RANKINE, C.E., LL.D.

IN a previous paper presented to the Royal Society of Edinburgh, in December, 1849, and read on the 5th of February, 1850, the author deduced the principles of thermodynamics, and various properties of elastic fluids, from the hypothesis of molecular vortices, under certain special suppositions as to the figure and arrangement of the vortices, and as to the properties of the matter which moves in them. In subsequent papers, he showed how the hypothesis might be simplified, by dispensing with some of the special suppositions. In the present paper, he makes further progress in the same direction, and shows how the general equation of thermodynamics, and other propositions, are deduced from the hypothesis of molecular vortices when freed from all special suppositions as to the figure and arrangement of the vortices, and the properties of the matter that moves in them, and reduced simply to the following form: that thermometric heat consists of a motion of the particles of bodies in circulating streams, with a velocity either constant or fluctuating periodically. This, of course, implies that the forces acting amongst those particles are capable of transmitting that motion.

The principal conclusions arrived at are the following:—

1. In a substance in which the action of the vortices is isotropic, the intensity of the centrifugal pressure per unit of area is two-thirds of the energy due to the steady circulation in an unit of volume. The centrifugal pressure is the pressure exerted by the substance in the perfectly gaseous state.

2.* If there be substances in which the action of the vortices is not isotropic, then in such substances the proportion already stated applies to the mean of the intensities of the centrifugal pressures in any three orthogonal directions.

3.* The proportion which the whole energy of the vortices, including that of the periodic disturbances, bears to the energy of the steady circulation alone, may be constant or variable.

4. Absolute temperature is proportional to the energy of the steady circulation in unity of mass, and to the specific volume in the perfectly gaseous state.

5. In substances which are nearly in the perfectly gaseous state, experiment shows the proportion in which the whole energy exceeds that of the steady circulation to be sensibly constant; and its value may be found by computing in what proportion the dynamical value of the specific heat at constant volume exceeds once and a-half the quotient found by dividing the product of the pressure and volume by the absolute temperature. *The following are examples:—air, 1·634; nitrogen, 1·630; oxygen, 1·667; hydrogen, 1·614; steam-gas, 2·242.

6. The known general equation of thermodynamics is deduced from the hypothesis of molecular vortices,* freed from the special suppositions made in the paper of 1849-50.

The new conclusions obtained in the present paper are marked *. Those not so marked were arrived at in the paper of 1849-50.

[The general equation of thermodynamics is here stated for convenience; let dQ be the thermal energy which must be given to unity of mass of a given substance, in order to produce a given indefinitely small change in its temperature and dimensions: then— $dQ = \tau\, d \cdot \phi$;
in which τ is the absolute temperature, and ϕ the thermodynamic function. The value of that function is—

$$\phi = Jc \operatorname{hyplog} \tau + \chi(\tau) + \frac{dU}{d\tau};$$

Jc being the dynamical value of the real specific heat; U, the potential energy of the elasticity of the body at constant temperature; and $\chi(\tau)$, a function of the absolute temperature, which is null or inappreciable in a substance capable, at that temperature, of approximating indefinitely to the perfectly gaseous state, and is included in the formula, in order to provide for the possibility, suggested by Clausius, that there may be substances which have not that property at all temperatures].

* Abstract of a paper read before the Royal Society of Edinburgh, May 31, 1869.

THE MANCHESTER STEAM USERS' ASSOCIATION.

THE last ordinary monthly meeting of the executive committee of this association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, June 29, 1869, Mr. William Fairbairn, C.E., F.R.S., LL.D., &c., President, in the chair, the previous meeting having been held on Tuesday, June 1, Mr. Charles Heaton, of Bolton, in the chair. On both these occasions, Mr. L. E. Fletcher, chief engineer, presented his usual report, but on account of the amount of business before the committee on the first occasion the meeting was adjourned, and, therefore, an abstract is now given of his report for the past two months. During that time 446 visits of inspection have been made, and 934 boilers examined, 558 externally, 11 internally, 4 in the flues, and 361 entirely, while, in addition, 6 have been tested by hydraulic pressure. In these boilers 438 defects have been discovered, 13 of them being dangerous. Furnaces out of shape, 14; fractures, 73—1 dangerous; blistered plates, 31—1 dangerous; internal corrosion, 53; external ditto, 66—5 dangerous; internal grooving, 60—2 dangerous; external ditto, 2; feed apparatus out of order, 1; water gauges ditto, 6; bow-out apparatus ditto, 9—1 dangerous; fusible plugs ditto, 2; safety valves ditto, 4—2 dangerous; pressure gauges, 36; boilers without glass water gauges, 15; ditto safety valves, 1—dangerous; ditto pressure gauges, 14; ditto blow-out apparatus, 19; ditto feed back pressure valves, 32. On the present occasion, Mr. Fletcher reports nine explosions, by which 26 persons have been killed and 45 others injured. Eight of these explosions occurred to boilers not under the inspection of this association, while the ninth, which was only of a minor character, consisting of the collapse of a furnace crown, and by which fortunately no one was either killed or injured, occurred to a boiler under the inspection of this association. The following is a statement of explosions, from April 23, 1869, to June 25, 1869, inclusive:—April 29, double-furnace, water tube, internally fired; May 12, particulars not yet fully ascertained, 1 killed, 1 injured—total, 2; May 13, plain cylindrical, for steaming rags, no fire, 1 killed, 2 injured—total, 3; May 29, plain cylindrical, egg-ended, externally fired; May 31, plain cylindrical, flat-ended, externally fired, 4 killed, 4 injured—total, 8; June 9, two-flue "Lancashire," internally fired, 15 killed, 33 injured—total, 48; June 14, single-flue or Cornish, internally fired, 1 injured—total, 1; June 16, plain cylindrical, egg-ended, externally fired, 3 killed, 1 injured—total, 4; June 23, single flue or Cornish, internally fired, 2 killed, 3 injured—total, 5. Total—26 killed, 45 injured.

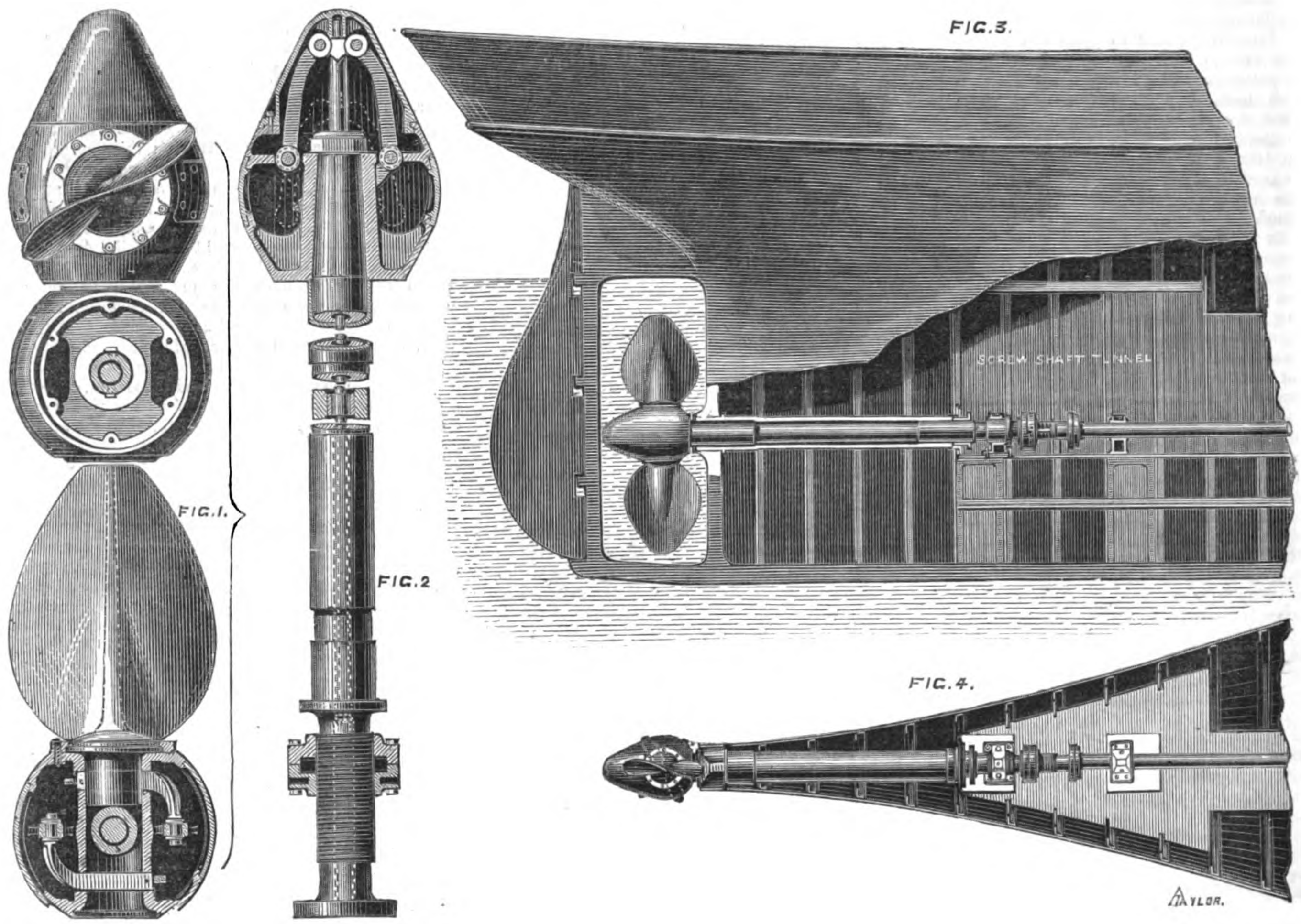
Mr. Fletcher's report contains some interesting remarks upon the subject of the overheating of furnace crowns and other boiler plates when covered with water, which will appear in our next issue.

HARRISON'S SYNCHRONOUS CLOCKS.

IN a notice of the exhibits at the last conversazione of the Institution of Civil Engineers, and which appears at page 398 of our last volume, we described Mr. Harrison's synchronous clock. Since the time of our notice, a committee has been formed to thoroughly test their principle, and during the past week several clocks were exhibited at the British Horological Institute, Northampton-square, and gave considerable satisfaction to those who examined them. Although we have already described this invention, it may not be out of place here briefly to recapitulate its main points. The advantages claimed for Mr. Harrison's clocks are that they will be corrected for any error, fast or slow; that the hands are set by the motive-power of the clock, and not by the electric current, as formerly. By this arrangement, great power can be obtained to insure its perfect action, while the discharging force of the current may be feeble or strong. No electrical break in a line of clocks, however distant or numerous, is required, thereby obviating the difficulties arising from oxidation of contact points. By a special arrangement of the mechanism, residuary magnetism is impossible. In the striking clock, the first blow of the hour will be given within a single beat of its pendulum to the true time. These clocks may be powerfully constructed, and used with either weight or spring, and with any length of pendulum; it will not be necessary to open the cases for any purposes but repairs. Any person can wind them, thus dispensing with the clock-maker, except for repairs.

BEVIS'S FEATHERING SCREW, AS FITTED TO THE "KATHLEEN."

BY MESSRS. LAIRD BROTHERS.



BEVIS' FEATHERING SCREW.

AT page 206 of our last volume we noticed a new feathering screw by Mr. R. R. Bevis, which had been introduced by Messrs. Laird Brothers in the "Kathleen" yacht, built for the Marquis of Downshire. We now give an engraving and detail particulars of this invention. It has long been thought that an efficient means of altering the pitch or feathering the blades of a screw in a fore and aft direction would be a great advantage to screw steamers, rendering them less dependent on their steam power, by making them faster and more handy under sail, as a screw of the ordinary kind, whether fixed or revolving, is a heavy drag against speed and handiness for sailing, and a lifting screw is somewhat complicated and costly. Mr. R. R. Bevis, managing engineer to the firm of Messrs. Laird Brothers, of Birkenhead, has patented the arrangement for effecting this object, which is free from many of the objections which have been made to feathering screws previously tried. The gear for feathering the blades is well protected, being worked in the screw-shaft tunnel by a sliding rod passing through the centre of the shaft, and the levers that move the blades are enclosed within the boss of the screw propeller. This system will be admirably adapted for ships of war or sailing ships with auxiliary power, where it is as important to have a good result under sail alone as under steam; and we fully expect that it will soon be applied to vessels of this class.

The result of its application to the "Kathleen" has been most satisfactory, as it was found on the trial trip that the blades of the screw were readily varied in pitch or feathered into a fore and aft line, and when so feathered the advantage in speed and handiness under sail was very marked. This has been fully borne out by the trials made on the voyage to the Mediterranean, during which, when the wind was favourable, the blades of the screw were feathered, and sail made, and on the wind falling light the blades were set at a suitable pitch and steam put on. The engineer reports the gear for feathering to work easily and without trouble, and that he can feather the blades in two or three minutes from the time of stopping the engines. The "Kathleen" flies the burgee of the Royal Yacht Squadron, and is of the following dimensions:—Length between perpendiculars, 140ft.; width, 22ft.; tonnage, 326 tons. She is fitted with a pair of inverted cylinder surface condensing engines of 60-horse power, and has capacity for about 70 tons of coal in her bunkers, and burns about five tons a day at a speed of nine knots. Messrs. Laird are now fitting two pairs of 150-horse power engines with screws on this system.

In our engraving, fig. 1 shows the boss of a screw with one blade and the levers by which the blades are moved. Fig. 2 shows the hollow stern shaft with sliding rod and crossbar, and the nut on the shaft by which the sliding rod is moved from inside the ship, and the mode of attaching the same by links to the levers within the boss to the shanks of the blades. Figs. 3 and 4 show the elevation and plan of this apparatus as applied to the yacht "Kathleen." The plain lines show the blades feathered into a fore and aft position for sailing, and the dotted lines as it would be when set to a pitch for steaming.

M. GIFFARD'S CAPTIVE BALLOON.

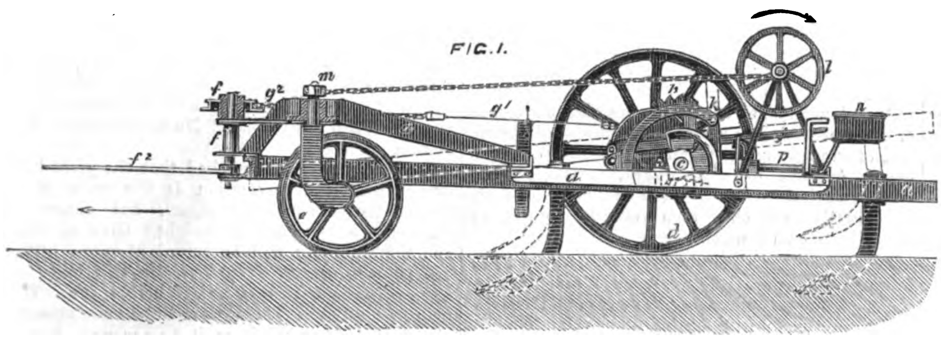
THE captive balloon at Ashburnham Park Chelsea, is again in working order, as, in fact, it has been for some time past. This balloon was fully described by us on page 361 of our last volume; we also subsequently recorded its untoward flight into Buckinghamshire on the afternoon of May 25. Since its re-capture it has undergone a thorough overhauling, which was rendered necessary by the damage it sustained from the trees among which it descended. It is now in excellent working order, and may be seen daily in fair weather high above the earth, with a car of scarcely perceptible observers. It was an unfortunate thing for the *prestige* of this splendid machine that it should have broken away as it did, and the circumstance is more annoying in that it arose from a preventible cause. It will be remembered that the balloon was ascending at a considerable angle, and the rope slipped over the flange of the main pulley, upon the edge of which it was cut. The simple addition of a guide block would have prevented the rope leaving the pulley. This addition has now been made, and ensures the perfect safety of the rope at any angle. We made another ascent in the captive balloon a few evenings since, in company with several ladies and gentlemen, all of whom thoroughly appreciated the pleasure afforded by a survey of the country at a height of 2,000ft. from the ground. We are glad to find that although confidence in the balloon was shaken at the time it made its escape, yet it has since been restored, and that the public are taking advantage of an opportunity seldom offered of seeing a really beautiful panoramic view of London as it lies spread out beneath them, with the surrounding country stretching away for miles. We were informed at the time of our ascent, that the evening previously, an old lady residing in Chelsea, and who had attained the remarkable age of 100 years and 2 days, made the ascent in company with a medical man. She enjoyed it greatly, and drank success to the enterprise in a glass of wine, when the balloon had attained its maximum height. This circumstance should encourage the timid to take a turn in the balloon, the view from which will amply repay them. MM. Godard and Aymo, the two experienced aeronauts, continue to have charge of the ascents, the management generally being under the superintendence of M. Yon.

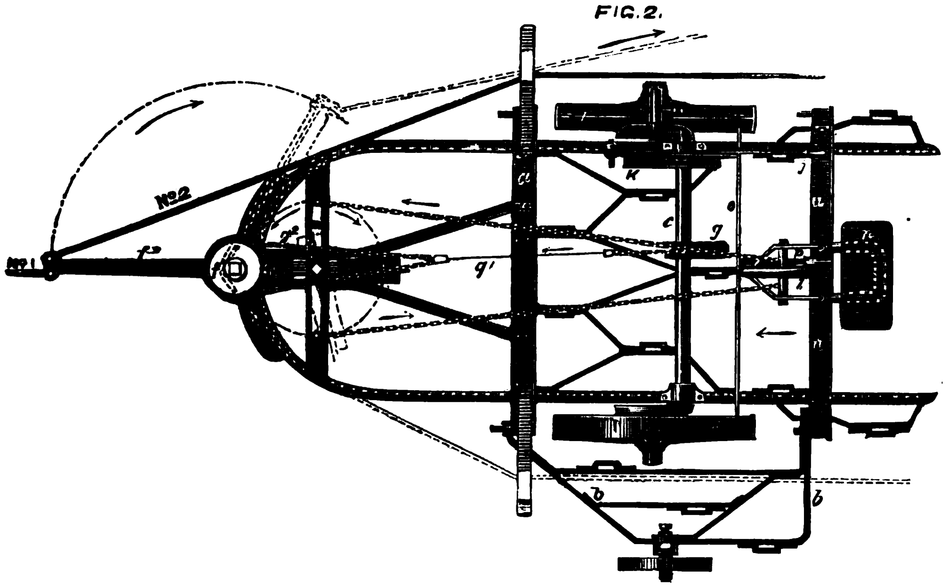
THE GASOPHANER.

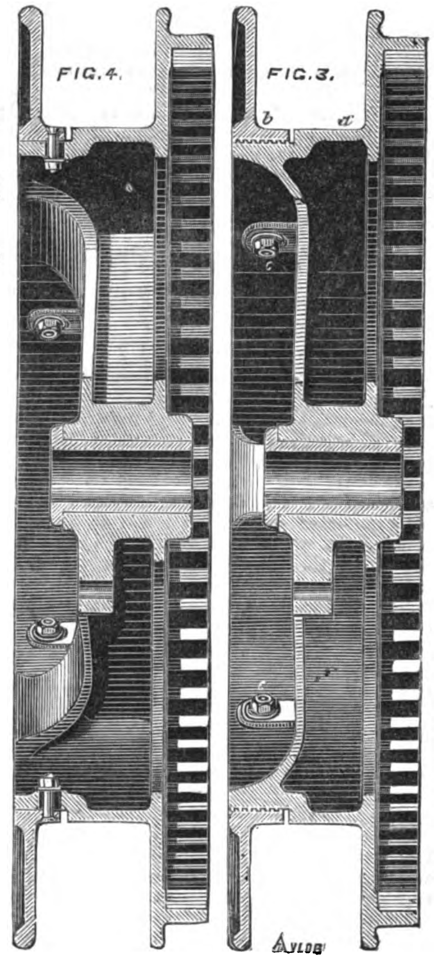
THE "Pioneer" states that a discovery has been made by an officer which, if the results on a large scale are at all commensurate with the experiments made on a small one, may prove of great value in giving a timely indication of the approach or presence of that poisonous state of the atmosphere which is generally believed to precede cholera and other epidemic diseases. The gasophaners, or poisonous gas indicators, as the discoverer calls them, are easily and cheaply made. A piece of fused

STEAM CULTIVATING MACHINERY.

BY MESSRS. FOWLER AND CO.







boracic acid, the size of a walnut, from which the water of crystallization has been expelled, is heated to redness in chlorine, or has dissolved in it while hot a small quantity of common salt, care being taken that there is not sufficient soda—16 per cent.—to convert the boracic acid into borax, which would spoil the effect. The red-hot lump of boracic acid thus charged is blown with a common glassblower's tube into a thin glass ball or bulb, about the size of a small hand lamp shade, and the gasophaner is ready for use. When first made, the glass is clear, with beautiful iridescent colours, due partly to the thinness of its sides; but left for a time, shorter or longer, according to the amount of moisture in the atmosphere, in normal breathing air, it becomes covered or clouded with a light blue film (due chiefly to the carbonic acid gas of the atmosphere), which, combined with the iridescent colours beneath, has an opaline or pearly lustre. On bringing the clouded gasophaner carefully to the flame of a spirit lamp, this film instantaneously vanishes, leaving the glass of that part again clear and shining. The delicacy of this test is so great that, although by breathing on the newly-made glass, the film may be much more rapidly formed than by mere exposure to the atmosphere, an approach to the spirit lamp flame will no longer drive off the carbonated compound formed, on account of the impure gases contained in the breath. At the same time, carbonates thus formed from the breath of a child, or of an extremely healthy person, vanish precisely as the aerial ones do on application of gentle heat. Held over a solution of ammonia, the air carbonate will not form, except on the upper part, where the ammoniacal gas has less action; but if held so that the breath may mix with the ammoniacal gas, a thick white cloud of carbonate of ammonia without opaline lustre, covers the gasophaner. This cannot be driven off by heat, but froths up on an approach being made to the lamp flame. But the most remarkable indication given by the gasophaner is when it is held over a solution of sulphuretted hydrogen. The gasophaner immediately becomes pitted, as it were, with small-pox, on the surface next the gas; and these spots, on being examined with a microscope, are found to be round radiated crystals, the centre or nucleus of which soon bursts into a hole. They are white by transmitted and dark brown by reflected light. Nitride of boron gave exactly similar crystals as the chloride, and so did pure boracic acid. These crystals, therefore, are presumed to indicate a combination of boron with hydrogen—a fact hitherto unknown to chemists. The gasophaner can be reheated and reblown as often as required.

STEAM CULTIVATING MACHINERY.

SOME improvements in the construction of steam cultivating machinery have recently been patented by Messrs. Fowler and Co., of the Steam Plough Works, Leeds. In order to lift the tines out of the ground, to enable the implement to turn, and also in order to turn the implement, they mount upon it on an axis a lever to which, at its free end, the hauling ropes for drawing the implements to and fro are attached. When the implement has arrived at the end of its course, and what was the slack rope becomes the draft rope, the first action is to cause the lever to move round, and a pulley upon its axis then winds up a chain passing to a quadrant on the axle of the carrying wheels of the implement. The axle is thus turned partly round, and, being cranked at the ends where the wheels are carried by it, they are thus depressed in respect to the frame of the implement, or, in other words, the frame with the tines is raised. By the same motion of the lever, the acting rope is thrown to one side of the implement, and, consequently, the continued draft upon it causes the implement to turn round. When the turn is complete, the lever will have regained its original position, and the tines will be able to again enter the land. In order to prevent the tines commencing to penetrate the land before the turn is complete, a toothed arc is mounted on the cranked axle of the implement, and a catch takes into it when the tines are raised so as to prevent them descending until the catch is lifted by a hand lever.

Figs. 1 and 2 of our engraving show a side view and plan of a steam cultivating machine constructed on Messrs. Fowlers' improved plan. *a* is the main framing of the machine to which the tines are fixed; this frame has wings *b b* hinged to its sides, and these wings also have tines fixed to them, so that the implement may act upon a greater width of land; *c* is the main cranked axle carrying the road wheels *d*; *e* is the front castor and steering wheel; *f* is a chain wheel secured to a vertical spindle f^1 upon which is the draft and turning lever f^2, to the end of which are attached the hauling and slack ropes, Nos. 1 and 2; *g* is a quadrant fixed to the axle *c*. This quadrant is by a chain and screw coupling g^1 connected to the ends of a chain g^2 which passes around the chain wheel *f*, so that, if the draft lever be turned to one side or the other of the machine, the chain g^2 will be drawn forward, as shown by the arrow; *h* is a toothed arc fixed to the axle *c*; *j* is a catch lever carrying a tooth which enters into one or other of the teeth of the toothed rack *h*; *k* is a guard through which the rack *h* moves. In this guard are a number of holes through one of which a pin is passed to limit the extent to which the axle *c* can turn, and so regulate the depth of work; *l* is a steerage wheel, around the axis of which are wound two chains, one in one direction and the other in the opposite direction. These chains at their opposite ends are fixed to the two ends of a steerage lever *m* attached to the vertical axis of the castor *e*. The steerage wheel is worked by the man seated at the back of the machine on the seat *n*. The ends of the steerage lever carry eye bolts, so that a pair of horse shafts may be affixed when necessary.

A locking bar *o* is provided for locking the inside wheel when turning at the end of a bout; this bar can be moved endwise either to one side or other of the machine by a crank shaft *p* on which is a handle within reach of the man on the seat. The bar can thus be passed between the spokes of either one or other of the side wheels and so prevent its turning. When the machine is at work and has arrived at the end of a bout, as soon as the rope which before was the slack rope is hauled on, the draft lever f^2 turns to one side of the machine, carrying with it the draft rope. The tines are at the same time lifted out of the ground by the turning of the crank axle *c* which carries the side wheels, and the machine is free to turn. The tines are held up at this time by the catch *j*, so that they shall not again enter the ground until this catch is released by the attendant. During the turning of the implement, the attendant also locks the inside wheel by means of the bar *o*. When the implement has completed its turn, the draft lever f^2 will have regained its original position, and the tines will again enter the land so soon as the catch *j* is raised.

Fig. 3 shows a transverse section of an improved winding drum. *a* and *b* are the two parts or sections of the drum, each carrying a side flange. The part *a* has an external screw thread cut upon

it, whilst the part *b* is formed with a corresponding internal screw thread; *c c* are countersunk bolts passed through holes in the part *b* to enter slots in lugs cast on the part *a*, and the bolts are secured by nuts screwing on to them. If the bolts *c* are removed, the part *b* is free to turn around the part *a*, and the flanges on the two parts of the drum can thus be brought nearer to or further from one another, and then be again fixed by the bolts *c*. Fig. 4 shows a section of a winding drum in which the movable flange is secured to the drum by bolts and nuts. If the bolts are slackened, the movable flange can be set near to or further from the fixed flange, as desired.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

(Concluded from page 97.)

As to the speed which might be attained by aerial machines, nothing but practical experience can ever decide that point. Five hundred and two hundred miles an hour has been talked of; that, as the Americans would say, is "tall talk:" it can never be realized. When the wind sweeps along at the rate of one hundred miles an hour, we have, not a hurricane simply, but a terrific hurricane, blowing the masts from vessels, the roofs from houses, and the houses down themselves. When it decreases to eighty miles an hour the hurricane still blows, and even when it falls to sixty the storm continues. Now, it matters not whether it is the body of air sweeping past a fixed object, or the object sweeping through a quiescent body of air: the results are the same. If the rate of speed of either or both be one hundred miles an hour, a hurricane is the consequence. If this results in effects so destructive to a strongly-built vessel, what would they be on an aerial machine, which, from the very nature of the case, must be made light, and so comparatively speaking weak. That sixty and even eighty miles an hour might ultimately be found attainable is not at all improbable, when once the lessons of practical experience are capable of being brought to bear upon it, as there must be a great difference between moving in the midst of a conflict of elements, as is invariably the case on the surface of the earth or ocean, and moving rapidly along in a uniform quiescent mass of moving air (if I may be permitted so to speak), as is the case with the upper strata of our atmosphere. However, till such practical experience has been attained, we may be quite content with fifty; and this, when we do master the difficulty, as master it man will, the physical conditions of the case justly entitle us to hope to attain, and to attain it with ease, comfort, and perfect safety.

It can hardly be said that these views are at all extravagant or far-fetched, as the main principle upon which they are based is one with which we are already familiar, one which we see in successful operation amongst ourselves every day. The turbine wheel is an exhibition of it. Small working models of boats may be seen in shop windows running round and round for hours, driven only by two small jets of water on each side. Even steamboats of considerable size have been constructed and successfully worked on this principle, using water as the agent. These had to force their way not through a comparatively non-resisting fluid like air, but through sea water; and though they have failed to compete successfully with the paddle and screw, it was not because they did not work but because they did not pay. As for the weight that it would be requisite to take up, that dwindles to nothing when we learn that balloons have already been constructed capable of taking up to the extent of 16 and 22½ tons, the former referring to the captive balloon now in London, and the latter to an American balloon—a Mr. Lowe's.

The benefits to be derived from aerial navigation are not to be looked for so much from excessive speed, though their average may be expected to exceed the average of locomotives, as from the fact, first, that beyond the original cost, upkeep, and working of the machine, there will be little or no further expense; and, second, they will at once proceed from point to point: they will require to make no deviations, nor long rounds of any kind, to cross this valley or stream, or to clear that rugged cape or headland, as have the locomotive and the steamer. Then the danger will always be less. The risk of collision, *nil*; to compare them with railway carriages in that respect would be absurd. On the wide or open ocean the risk of collision in regard to vessels is small, and yet vessels afloat are all sailing on the same plane, and this a limited one—limited by the millions of square miles of land that rise above the ocean's surface. The plane, on the contrary, on which an aerial machine would move would be limited or curtailed in no such way, and even then it would very likely be the only object on that particular plane, vast as it might be, as, in all likelihood, every individual aerial machine would move in a plane peculiar to itself. There would be no fear of running off the rail, of landslips, or of miscreants putting stones or other obstacles on the line. There would be no fear of an angry sea, or of any of the dangers of the deep. A storm of wind might, however, sweep past on each side, but it would be a storm of their own creating, and one which would be completely under their own control.

Before closing, we might consider again for a few minutes the proposal to work aerial machines by means of the screw or wing principle, as there are phases in the working of the same which deserve very careful attention. The steam engine in its simplest form should give out all the power generated, and as long as that exceeds the resistance the engine should work very well. For instance, if the force generated is 5lb. to the square inch, and if the aperture of exit represents a surface of 20 inches, then the power exerted would be 100lb., and as long as the resistance continues less than that, the engine will overcome it. If, however, the resistance should increase, say, to 102lb., the engine will stop, the steam will escape as fast as it rises, and the power thus generated will be entirely wasted; and all this from an inability to increase the force by only 3lb. You have just to lessen or shut off by a valve the escape of steam for a short time, when the force within will increase; and, when it rises to 103lb., the engine will again work. Now, the introduction of piston, cylinder, and all the connecting rods, &c., belonging thereto, could have done no more; but they would add very much to the weight, and so tend to retard instead of adding to the end in view. Now, in aerial navigation, anything like an increase of weight is to be deprecated—it requires an equivalent in floating power; this adds to the bulk of the machine, and so increases greatly the difficulties to be overcome. All this takes place when you attempt to work an aerial machine, either by the screw or wing principle, driven by the ordinary steam engine.

The locomotive work of steam which it is called upon to overcome on land or sea, may be subdivided into three classes:—1st. Resistance arising from the air (when forcing the object moved through that element. 2nd. Resistance arising from the friction of all the various parts of the machinery by means of which it is required to exert its power. 3rd. Resistance arising from gravity which causes the object moved to cling to the nearest surface with a force more or less powerful.

The power required to overcome the first of the three foregoing is comparatively small; consequently, nearly the whole of the force exerted is so in overcoming the two last. Now, an aerial machine, constructed on the principle referred to in this paper, has nothing to do with the resistance referred to in the 2nd and 3rd of the classes mentioned above, but only with the first; and, as the power required is comparatively but small; the simple form of steam engine proposed may be found quite sufficient to such an amount of forward motion as will enable the machine to be brought under perfect command. If such is accomplished, we may be well content in the meantime, as further improvements would be sure to follow rapidly.

Again, in regard to the screw and wing principle, does it not appear that the former is the better method of the two? Any kind of motion which may be adopted as an equivalent for wings must be a reciprocating one. That must always prove a jerking one more or less. This necessitates strength; this, again, weight; and weight is destructive to the object in view. The screw principle, however, is an equal motion, the blades or fans balancing each other. Again, is an error not committed in throwing away the balloon as a sustaining power, and relying almost, if not entirely, on that derived from great speed in passing through the air. If anything should go wrong with the machinery, the destruction of the machine and all connected with it would be certain! Another objection to such is that they cannot rise without first skimming the surface of the ground for some considerable distance, where the chances are as ten to one that the wind would dash them to pieces against some of the many objects around ere they would be able to rise clear. Suppose, in regard to ocean sailing, that some one should bring out a new idea for a vessel, one of the principal points being that it would require to skirt the shore for a good many miles before it dare strike out for mid ocean, would you not say that the improvement was a very doubtful one indeed? Just so with the balloon *versus* the wing sustaining principle. The floating power of the balloon permits it to rise at once into mid-air, clear of all the dangers of the surface; and yet it is proposed to throw this aside for a machine which cannot rise before it has exposed itself and all within it to almost certain destruction. No more need be said on that point.

It may just be remarked that the great hindrance to aerial navigation is the want of a motive power equal to steam, but generated from only a few pounds' weight. Give us that, and the difficulty will be solved at once; without it, you cannot even test the suitability of any appliance that may be laid before you. The plan suggested in this paper is but a rude attempt to turn steam as we have it to account; but it remains to be seen if even it will succeed. Gunpowder appears, at first sight, as if it were something like the thing required; but when you come to examine it, though only in the mind, you soon perceive how it can never be made to act. Its two faults are, first, that its explosive properties must be given to it before forcing it into the power generator; and, second, its condition as a powder, or, in fact, any other form. Another powerful agent, even greater than powder, has lately come into notice—nitro-glycerine; and, as its constituents are liquids, these might be forced, in the proper proportions, into the power generator (the equivalent for the steam boiler), and, exploded within that. Could this be accomplished, a motor such as is required would be attained.

Mr. Moy believed he was the first to mention 150 miles an hour, and he ought therefore to defend his statement. He explained that, by the construction of the lines, an extremely small resistance would be offered to the wind.

Mr. Wenham, with regard to what had been said on air cells in birds, said that some of the fastest flyers are completely destitute of them, while the pelican, penguin, and emu are completely enveloped with them. It was, therefore, clear that the air cells had nothing to do with flying.

After some remarks by Mr. Quartermain, suggesting the employment of more powerful agencies than steam, provided that the residuum which corrodes could be got rid of, Mr. Brearey stated that twenty years ago Mr. Stringfellow made a model which flew like a pheasant and carried its own steam engine and boiler.

Mr. Wenham suggested that experiments on the force of wind should be made by the use of a dynamometer.

The Chairman said that one of the suggestions made was tried more than twenty years ago by means of a spring. A model with 5 square feet of surface and a pair of wheels that moved in opposite directions flew 10 or 12 yards.

Major Phillips asked what sort of sustaining power was used.

The Chairman said there were two planes inclining towards each other at an angle, and driven by two screws which moved in opposite directions.

Major Phillips: And by what means was it sustained?

The Chairman: The resistance obtained by the rotation of the screws.

Mr. Olrick remarked that if any man had designed a ship to move in the manner of a fish by its fins and tail, it would have been an utter failure. On the same ground, he submitted that something different from the wing of a bird should be thought of for the purposes of flight. In the use of models inventors were working against themselves, because they got too much weight. A machine of a reasonable size and of a few horse power could be made quite as cheaply as a model. The model maker, as a rule, did not understand how to make a machine, and could not make it cheaply.

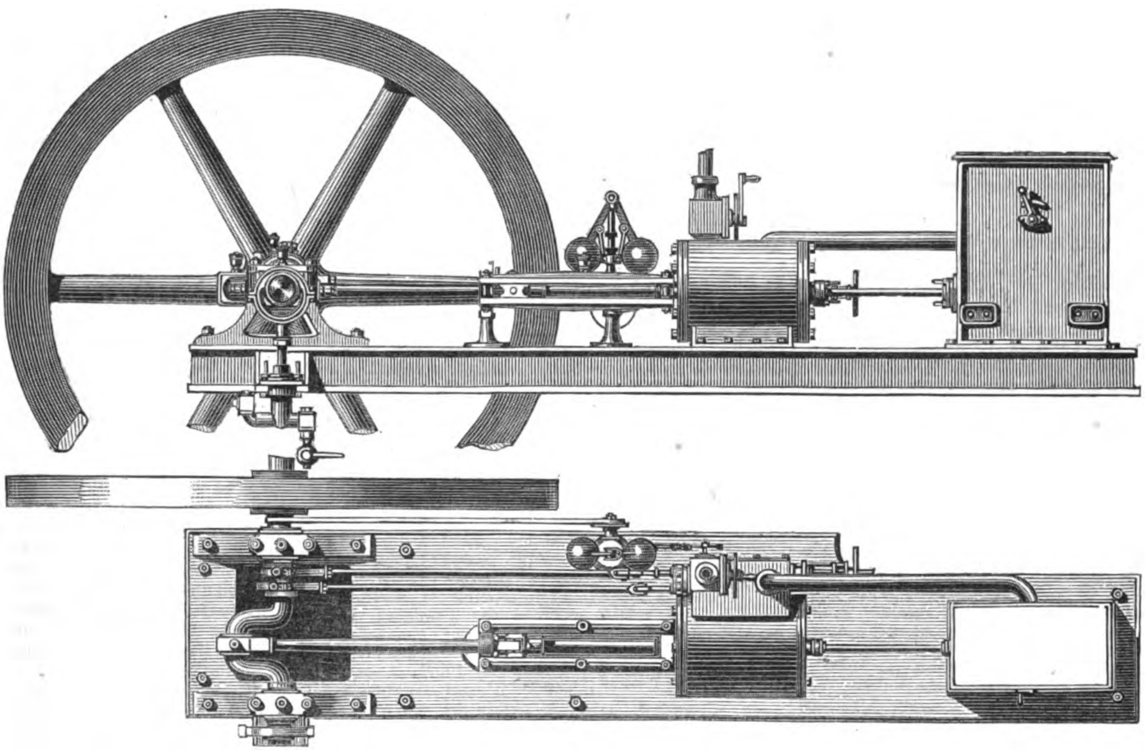
Before the meeting broke up, thanks were accorded to the authors of the papers, to the Society of Arts for the use of the room, and to Mr. Brooke for presiding.

THE LONDON AND COUNTY BANK.

THE half-yearly meeting of the proprietors of the London and County Banking Company was held on the 5th instant at the City Terminus Hotel, Cannon-street, Mr. Frederick Francis in the chair. From the report of the directors we are glad to find that, after paying interest to customers, and all charges, allowing for rebate, and making provision for bad and doubtful debts, the net profits amounts to £85,010 2s. 7d. This sum, added to

TWELVE-HORSE POWER STATIONARY ENGINE.

BY THE READING IRON WORKS COMPANY.



£5,817 4s. 10d. from last account, produces a total of £90,827 7s. 5d. The usual dividend of 6 per cent., with a bonus of 2½ per cent., for the half year, free of income tax (being at the rate of 17 per cent. per annum), will absorb £84,601 9s. 10d., and leave £6,225 17s. 7d. balance. In commenting upon the balance-sheet, which was very satisfactory, the chairman observed that the balances of the bank had increased £400,000 since this time last year. Acceptances were £200,000 less than last year. Interest paid to depositors was £20,000 more than last year. The rate of interest during the past six months was somewhat more than the whole of the preceding year, while the profit made by the bank was greater. In proportion to other banks, there was much cause for satisfaction with the progress of this bank. Another gratifying feature, as showing the prosperity of the bank, was that 2,500 new accounts had been opened at the head and branch offices since last year; and with 160 shareholders since the same period, there were now 2,900 partners in the concern. The chairman moved the adoption of the report; Mr. Champion Jones seconded the motion, which, we need hardly say, was carried unanimously. The proprietors have cause to congratulate themselves on their present satisfactory position.

THE METRIC SYSTEM.

THE second report of the Commissioners appointed to inquire into the condition of the Exchequer (now Board of Trade) standards, that bearing on the question of the introduction of the metric system of weights and measures into the United Kingdom, has been published. The Commissioners have unanimously agreed upon the following resolutions :—

1. Considering the information which has been laid before the commission, of the great increase during late years of international communication, especially in relation to trade and commerce, of the general adoption of the metric system of weights and measures in many countries, both in Europe and other parts of the world, and more recently in the North German Confederation and in the United States of America, of the progress of public opinion in this country in favour of the metric system as a uniform international system of weights and measures, and of the increasing use of the metric system in scientific researches and in the practice of accurate chemistry and engineering construction, we are of opinion that the time has now arrived when the law should provide, and facilities be afforded by the Government, for the introduction and use of metric weights and measures in the United Kingdom. That for this object metric standards, accurately verified in relation to the primary metric standards at Paris, and deposited in the Standards Department of the Board of Trade, should be legalized, and hat verified copies of the official metric standards should be provided by the local authorities for inspectors of such districts as may require them.

2. Considering the advantages of adopting in an international system not only of uniform weights and measures, but also uniform names; and that although there may be well founded objections to the inconvenient length and occasional similarity, both to the eye and ear of the French nomenclature, yet it is probable that these names will become familiar by custom, and obtain popular abbreviations. We think that the French nomenclature, as well as a decimal scale of the metric system, should be introduced in this country.

3. Considering that there is no immediate cause requiring a general change in the existing system of legal weights and measures of the country for the purposes of internal trade; that the statuteable values of the fundamental imperial units are adopted in use without the slightest variation throughout the whole of the British Isles; that the primary imperial standards are as perfect as can be made by modern skill and science, and that the whole series of official standards are now most accurately verified in relation to the primary standards; that a very large number of copies of the official imperial standards, accurately verified, are now in use by the local inspectors of weights and measures; that it is estimated there are nearly 30 millions of ordinary weights and measures of the existing imperial system now in common use; that at the present time there is no evidence to show that any considerable portion of traders and their customers in this country are dissatisfied with the imperial system now in use, or that they desire to substitute the metric system for it; we are of opinion that the general introduction of the metric system should be permissive only, and not made compulsory by law after any period to be now specified, so far as relates to the use of metric weights and measures for weighing and measuring goods for sale or conveyance.

4. Considering that during the concurrent use of the metric and imperial systems, it will be expedient to prevent as far as possible imperial and metric weights and measures from being accidentally or fraudulently substituted for each other. We are of opinion that authoritative regulations should be established, under which each series may be readily and easily distinguished, by the adoption of conspicuous distinctive forms or marks for the several weights and measures, and by such other mode as may be determined upon after due inquiry.

5. We are of opinion that it is expedient customs duties should be allowed to be levied by metric weight and measure, as well as by imperial weight and measure; that the use of the metric system, concurrently with the imperial system, should be adopted by other public departments, especially the Post Office, and in the publication of the principal results of the statistics of the Board of Trade, as well as for the admeasurement and registration of the tonnage in shipping.

6. And that mural standards of the metric system, as well as of the imperial system, be exhibited in public places.

7. Considering that the metric system, as adopted in other countries, includes the relation of coinage to weights and measures, particularly in its uniform decimal scale. And that the advantages of the introduction of the metric system into this country, as an international system of weights and measures, would be much increased by establishing a corresponding international system of coinage, in regard to a unit and to a decimal scale. We are opinion that, even if the difficulties of establishing an international unit of coinage cannot be at present overcome, yet the decimalization of our system of coinage, which is in the power of the Government, would be very useful to the public.

8. Considering the great national importance of the question of the introduction of the metric system of weights and measures into this country, it appears to us essential that any measure for this object should be proposed to Parliament by the executive government.

9. Considering that the commission will very shortly enter upon the questions referred to them relating to the system of local inspection of weights and measures throughout the United Kingdom, we are of opinion that it is expedient that no legislation should take place with respect to the metric system until the whole subject of the weights and measures of this kingdom be brought before Parliament in one bill.

The Commissioners signing the report are:— G. B. Airy, Chairman; Colchester, Stephen Cave, John George Shaw Lefevre, Edward Sabine, Thomas Graham, W. H. Miller, H. W. Chisholm.

THE READING IRON WORKS STATIONARY ENGINE.

IN the accompanying engraving we illustrate an excellent type of stationary engine which we met with at the stand of the Reading Iron Works Company at the late Manchester Show. The engine is of 12-horse power, and is one of a class specially designed to insure economy in the consumption of fuel. The cylinder is made in one casting with the valve chest, and steam jacketed throughout. The engine is fitted with variable expansion valves, so arranged as to be capable of the most minute adjustment while working at full speed. All the wearing surfaces are got up with the greatest care, so as to produce the least possible friction while running. When supplied with steam from a suitable boiler, the manufacturers can guarantee a consumption of fuel of about 2¼lb. per horse-power per hour in engines of 12-horse to 20-horse power, and in higher power a more economical consumption. The Reading Iron Works construct their engines from 4-horse to 40-horse power, the one illustrated being their nominal 12-horse.

The cylinder, condenser, crank shaft, bearings, and all different parts, are erected on a cast-iron

bedplate, which alone is secured to the masonry foundations. The air pump is double-acting, the air pump valves being of india-rubber. The force pump is supplied with water from the condenser. The governors are adjusted to allow the engine to work at a speed of 90 revolutions per minute. The following are some of the principal dimensions:—Diameter of cylinder, 12½in.; length of stroke, 16in.; diameter of air pump, 4in.; stroke of air pump, 16in.; diameter of force pump, 2¼in.; stroke of force pump, 2¼in. The space occupied by the engine in plan is 12ft. 11in. by 2ft. 9in.

ANNUAL INTERNATIONAL EXHIBITIONS OF SELECTED WORKS.

HER MAJESTY'S Commissioners for the Exhibition of 1851 announce that the first of a series of annual international exhibitions of selected works of fine and industrial art will be opened in London, at South Kensington, on Monday, May 1, 1871, and be closed on Saturday, September 30, 1871. The exhibitions will take place in permanent buildings, about to be erected adjoining the arcades of the Royal Horticultural Gardens. The productions of all nations will be admitted, subject to obtaining the certificate of competent judges that they are of sufficient excellence to be worthy of exhibition. The objects in the first exhibition will consist of the following classes, for each of which will be appointed a reporter and a separate committee:—

I. Fine Arts.—1. Painting of all kinds, in oil, water colours, enamel, porcelain, &c. 2. Sculpture in marble, wood, stone, terra cotta, metal, ivory, and other materials. 3. Engravings, lithography, photography, &c. 4. Architectural designs and models. 5. Tapestries, embroideries, lace, &c., shown for their fine art and not as manufactures. 6. Designs for all kinds of decorative manufactures. 7. Copies of ancient pictures, enamels, reproductions in plaster, electrotypes of fine ancient works of art, &c.

II. Scientific Inventions and New Discoveries of all Kinds.

III. Manufactures.—(a.) Pottery of all kinds, including that used in building, viz., earthenware, stoneware, porcelain, parian, &c., with machinery and processes for the preparation of such manufactures. (b.) Wool and worsted fabrics, with the raw produce and machinery for manufactures in the same. (c.) Educational—1. School buildings, fittings, furniture, &c; 2. Books, maps, globes, &c.; 3. Appliances for physical training, including toys and games; 4. Specimens and illustrations of modes of teaching fine art, natural history, and physical science.

IV. Horticulture.—International exhibitions of new and rare plants, and of fruits, vegetables, flowers and plants, showing specialties of cultivation, will be held by the Royal Horticultural Society, in conjunction with the above exhibitions.

In Classes II. and III. producers will be permitted to send one specimen of every kind of object they manufacture, such object being distinguished for novelty or excellence. Detailed rules, applicable for each of the above classes, and lists of the separate trades engaged in the production of objects of manufacture, will be issued. Special rules for horticultural exhibitions will be issued by the Royal Horticultural Society. The arrangement of the objects will be according to classes and not nationalities, as in former international exhibitions. One-third portion of the whole available space will be assigned absolutely to foreign exhibitors, who must obtain certificates for the admission of their objects from their respective governments. Foreign countries will appoint their own judges. The remaining two-thirds of the space will be filled by objects produced either in the United Kingdom, or, if produced abroad, sent direct to the building for inspection and approval of judges selected for the British exhibitors. Objects not accepted for exhibition must be removed according to the notices given, but no objects exhibited can be removed until the close of the exhibition. All exhibitors, or their agents, must deliver at the building, into the charge of the proper officers, the objects unpacked and ready for immediate exhibition, and free of all charges for carriage, &c.

Her Majesty's Commissioners will find large glass cases, stands, and fittings, free of cost to the exhibitors, and, except in the case of machinery, carry out the arrangement of the objects by their own officers. Her Majesty's Commissioners will take the greatest possible care of all objects, but they will not hold themselves responsible for loss or damage of any kind. Prices may be attached to the objects, and exhibitors will be encouraged to state their prices. Agents will be appointed to attend to the interests of exhibitors. Every object must be accompanied with a descriptive label, stating the special reason, whether of excellence, novelty, or cheapness, &c., why it is offered for exhibition. Due notice will be given of the days for receiving each class of objects; and, to enable the arrangements to be carried into effect, strict punctuality will be required from all exhibitors, both foreign and British. Objects delivered after the days appointed for their reception cannot be received.

Reports of each class of objects will be prepared immediately after the opening, and will be published before June 1, 1871. Each foreign country will be free to accredit an official reporter for every class in which objects made in such country are exhibited, for the purpose of joining in the reports. There will be no prizes, but a certificate of having obtained the distinction of admission to the exhibition will be given to each exhibitor. A catalogue will be published in the English language, but every foreign country will be free to publish a catalogue in its own language if it think fit.

THE NEW PATENT LAW FOR CANADA.

CANADA has found a short and ready means of dealing with the question of patents. While we are discussing the whole principle of the Patent Law, the Parliament of the Dominion has not only settled the principle of such a law, but has fixed the practice. We regret to state, however, that both principle and practice may be concisely summed up in the word "spoliation." Our great transatlantic dependency has shown its independence by abolishing patents so far as outsiders, whether British or foreign, are concerned, and limiting the protection of inventors to residents in the Dominion. Under this law no foreigner, not even an English fellow-subject, can hold any patent in Canada; nor can any Canadian hold one in his behalf. The patent can only be granted when the discoverer or inventor has lived in Canada for the twelve months preceding the application or, in case of his decease, for the twelve months immediately preceding that decease. By this Act, which received the assent of the Governor-General on June 22, Canada at once helps herself to all foreign discoveries. Canadian inventors, if there are any, are protected both at home and abroad, but English and American inventors are denied all reciprocal benefit within the area of the Dominion. We are not concerned for American patent-holders; the policy of confiscation has been taught the Canadians by the copyright law of the States; but we have a right to protest against the injustice which Canadian exclusiveness inflicts on patentees in the mother country. Our colonies want to have all the benefit of their connection with us, and not only to inflict upon us all the expense, but every conceivable disadvantage. We pay large sums to protect them against invasion or affront, and they show their gratitude not only by "protecting" themselves against our manufactures, but in this Canadian case by robbing our inventors. Has the Colonial Office nothing to say to this policy? It is perhaps too much to ask, as Mr. Bentall did last night, that the Queen should be advised to refuse her assent to the bill; but it would be no interference with Canadian independence to point out its impolicy and injustice. We are glad that since the Under-Secretary answered Mr. Howard's question on Tuesday the office has heard of the bill, though only through Mr. Howard and the newspapers. But might it not at least know what the colonies are doing, and keep them in mind of their duties to the mother-land, which fosters and protects them? The Colonial Office is, at least, a home institution; and it is as much its duty to remonstrate with our undutiful children against their ill-treatment of their mother, as it is to look after the interests of young sprigs of nations which are so well able to look after themselves.—"Daily News."

ECONOMIC PUMPING ARRANGEMENTS.

DURING the last twelve months a system of pumping has been in use at the Botany Bay pit, belonging to the Clifton and Kersley Coal Company, Manchester, which is worthy of notice from the peculiar circumstances it was designed to meet, and the success which has attended it. According to the "Mining Journal," in the down brow, about 150yds. from the shaft, a feeder of water was unexpectedly cut, which yielded nearly 750 gallons of water per minute, and caused considerable inconvenience in the pit. The down brow having an inclination of 10in. in the yard, the point of irruption was about 125ft. below the sump. All the workings speedily become entirely flooded, upwards of 20 miles of workings being under water, and for more than a week there was a regular flow into the sump itself. By keeping the ordinary lifts at full work, and by continuous winding, the water was just kept to the sump level for seven months, when temporary direct double-acting steam pumps were put in to relieve the winding—the water was pumped from the down brow into the sump by a Gwynne's centrifugal pump, running 200 revolutions per minute, and the direct-acting pumps made about 60 revolutions per minute. The entire system was kept at work night and day for two years, and raised by measurement 493 gallons per minute. Upon the pit coming into the possession of Mr. Josiah Evans, of Haydock, it was determined to substitute for the four 6-inch pumps two horizontal 13-inch pumps, with 34-inch steam cylinders, 2ft. stroke, and to substitute for the centrifugal pump an improved system of plunger. The quality of the work usually turned out by Messrs. Routledge and Ommaney is already so well known in the Manchester district that more need not be said in favour of the machinery at Clifton than that it is constructed in their usual style, and works admirably. A pair of 20-inch cylinder engines, 4ft. stroke, is placed on the incline of the down brow at the bottom of the shaft, and these are used to work a pair of Messrs. Routledge and Ommaney's 17-inch plunger pumps off continuations of the engine piston rods. The pumps are placed on a heavy cast-iron truck, running on a suitable tramway. As the water is pumped out, the pump rods are from time to time lengthened and supported on sheaves resting on the delivery pipe. The inclined pumps raise the water a height of 125ft. through a column of pipes nearly thrice that length. The advantage which this arrangement secures is that the work is done with the minimum expenditure of force, and that the previously existing arrangements of the pit are not in any way interfered with.

Correspondence.

THE NEW CANADIAN PATENT LAW.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In your leader of last week on the New Patent Law of Canada, you refer to a question asked in the House of Commons by Mr. James Howard, on the previous Tuesday evening. This question was repeated on the Thursday evening by Mr. Bentall, and unfortunately elicited a still more unsatisfactory reply from Mr. Monsell; at least, as far as can be gleaned from the reports in seven of the morning newspapers, every one of which differs in the account of what he said.

The substance of Mr. Monsell's reply appears to have been as follows:—"That no copy of the new Act had yet reached the Colonial Office; that all the knowledge of it he possessed was derived from a copy given in a Canadian newspaper; that the Act appeared to be an assimilation of the different laws on the subject of patents that had formerly existed in the colonies of Canada, Nova Scotia, and New Brunswick; that the Home Government had no intention to advise her Majesty to withhold her assent to the Act; in fact, such a refusal was impossible, as the power of the Crown so to do had been taken away by a *recent* Act of Parliament, to wit, the Imperial Act, 15 and 16 Vic., cap. 83, sec. 18."

If this last assertion had been true, the suggestions made in your leader of last week, and in my letter also, would be of no avail; but I am informed that such is not the case. The general power of the Crown to deal with and review the Acts passed in our various colonies is a question of public policy and of large application, and is in nowise affected by the clause in the Act cited by Mr. Monsell, which is, in fact, our present Patent Act of 1852. This authority of the Crown was exercised lately in the case of a money grant to Governor Darling in Australia, and also in the matter of the Indian Patent Law. The Indian Patent Law was enacted and put in force in India for some months, when the Home Government, for certain reasons, interfered and cancelled what had been done.

I trust that others abler than myself to deal with this question will take the matter up, as it affects not only inventors but patent agents also.—I am, Sir, yours, &c., JOHN FORDRED.

Blackheath, S.E., Aug. 10.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribe of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—R. C.—O. and Co.—H. S.—G. W. H.—W. B—F. and J.—L. Bros.—R. T.—B. H.—E. K. D.—S. M.—C. G.—E. R.—J. F. and Co.—R. T.—A. H. and Co.—R. S.—H. L.—W. D. F.—T. P.—H. and Co.—J. N.—G. C. E.—H. F.—R. I. C.—W. M. W.—H. S.—H. W. H.—G. E. P.—R. M.—J. N.—R. W.—E. B.—W. M.—H. T. R.—R. M.—E. S. J.—J. H.—R. S. A.—L. S.—F. N.—W. T.

Naval, Military, and Gunnery Items.

An account has just been issued, showing the receipt and expenditure or naval prize, bounty, salvage, and other moneys between April 1, 1868, and March 31, 1869. The total amount awarded was £81,866 9s.

It is stated to be the intention of the Lords of the Admiralty to inaugurate the basin and dock at Haulbowline, at the end of September next. The mayor and corporation of Cork are to be invited to meet their lordships.

At the last meeting of the Mersey Docks and Harbour Board, it was reported that the earnings of the Mersey pilot boats during the year ending the 30th of June last were £65,058, showing a decrease of £3,531, compared with the previous year.

A new fog trumpet has lately been erected on Thacker's Island, off Gloucester, Massachusetts, which is operated by an Ericsson caloric engine, rotates through an arc of 180deg., and gives a blast of seven seconds' duration, at intervals of forty-three seconds.

The result of the firing of the "Hercules" guns with 60lb. charges, and projectiles varying from 380lb. to 400lb., at the highest and lowest elevations, has been a complete success. The working of the carriages is stated in private letters to have all the ease with which the lightest naval guns have been hitherto worked.

The yellow fever has made sad havoc on board the "Eclipse." Her captain, first lieutenant, and sixteen of her crew have fallen victims to the scourge. Captain Harvey (one of the Walmer Harveys) has left a widow and family in this country to regret the loss they have sustained.

The "Sirius" was put through the official trial of speed on Friday last, over the measured mile in Stokes Bay, near Portsmouth, and under full boiler power realized a mean speed of 13·1 knots per hour. With half-boiler power she attained a mean rate of 11·3 knots. She will sail immediately from Spithead for her term of service on a foreign station.

Lieutenant-Commander H. B. Seely, of the United States steamer "Fawnee," has been arrested at Portsmouth, New Hampshire, on two warrants, charging him with unwarranted cruelty to several of the seamen of that vessel, by tying them up by the wrists, and thus inflicting punishment on them so severe that one of them fainted from exhaustion, and another lost the use of both hands.

The "Cerberus" turret ship was recently taken down the Channel, outside the Nore, for the purpose of testing the working of her balance rudder since the alterations made in the steering arrangements of the vessel. During the trial the vessel was found to steer in a far from satisfactory manner, and she will be again docked for the purpose of having some further improvements effected in her rudder.

Although predictions of disaster as to her voyage out were plentiful, the great Bermuda dock has arrived safely at the island. The passage was made, it would appear, under favourable circumstances. The absence of suitable dock accommodation at Bermuda has long been felt, and now that this want has been so well supplied, war ships on the North American and West Indian stations can be overhauled and repaired, instead of being sent home for those purposes.

Yesterday week, Messrs. Laird Brothers launched from their yard at Birkenhead a small screw steam yacht, which they have built for Earl Grosvenor, for use on the lochs adjoining his estate on the coast of Sutherlandshire. She was christened the "More Vane," by Miss Annie Laird, daughter of Mr. John Laird, jun. The accommodation for passengers is in a raised house forward, with large ports, the crew being provided for in a small house at the after end of the engine space. The engines being on board the "More Vane" at the time she was launched, the yacht was at once tried, the machinery working most satisfactorily.

Nearly the whole of the coal required for the use of the dockyard and for consumption on board the ships of war in port at Pembroke is now brought by rail direct from the collieries in the Aberdare and Monmouthshire Valleys. Formerly, the coal had to be shipped at Cardiff and Newport, or if sent by the Great Western Railway it had to be transhipped at New Milford at considerable expense. The new arrangement will effect an important saving in the cost of the coal, and if the contemplated branch line from Pembroke and Tenby into the dockyard is made, a further reduction in the cost of fuel and in the carriage of all other articles required for the dockyard will be the result.

From the Clyde we learn that Messrs. Caird and Co., of Greenock, have launched a steamer, named the "Hanover," for the North German Lloyd. The "Hanover" is intended for the Bremen and New Orleans trade. The "Palmyra," screw, built for Messrs. Salledo and Co., a Spanish firm, by Messrs. W. King and Co., has made a favourable trial trip. The "Palmyra" is of the following dimensions:—Length, 96ft.; breadth, 19ft.; depth of hold, 9ft.; burden, 200 tons, builders' measurement. She is fitted with inverted cylinder condensing engines of 30-horse power.

H.M. turret-ship "Monarch" proceeded from Spithead to Portland on Thursday morning week, and tested her 25-ton guns and carriages *en rout*. A large number of battery charges were fired with complete success, the guns and carriages answering admirably under the severe test of continuous discharges of a 600lb. projectile with 70lb. of powder. The carriages, which are compound pivotting, are four in number (two in each turret), were made at Chatham Dockyard, under Mr. Eames's immediate superintendence, from designs furnished by Captain Scott, R.N., and the guns, which weigh 25 tons each, are of the land service pattern.

We ("Cork Herald") understand that it is the intention of the official authorities to have H.M.S. "Scorpion," now lying in this port, immediately dismantled. It appears that on a recent trip to sea she proved herself a most dangerous craft, in consequence of her extraordinary low freeboard. Many times she was almost submerged in the sea, and she occasioned such panic to her crew that they have protested against proceeding again to sea in her. The "Scorpion" was originally built for the Confederate States, but in order to avert another "Alabama difficulty" she was purchased by the English Government out of the builder's hands, together with her consort, the "Wyvern," an equally disreputable sea-going vessel.

The introduction of Adams's breech-loading revolver into the service having been decided upon, the Deane and Adams' pistols already in use are now being converted by Mr. Adams. A number have been already finished. The converted pistol differs from the new in having five chambers instead of six. A central-fire cartridge has been designed for it by Colonel Boxer, R.A., superintendent of the Royal Laboratory Department, Royal Arsenal.

A rifle contest, of a kind of which there might well be more, was held the other day at the rifle range of the Eccleshill company (included in the Bradford corps) of Rifle Volunteers in Culverley Wood, near Bradford. The competitors were ten of the 40th Regiment, now quartered at the Bradford Barracks, and ten men of the Eccleshill company The Regulars used a Snider rifle and the Volunteers an Enfield. The Regulars made 332 points at 200. 300, and 400 yards, five shots at each, and the Volunteers 349. The honours of the contest, therefore, remained with the Volunteers, but there will be a return match.

Mr. E. J. Reed, C.B., the Chief Constructor of the Navy, is ill from the result of his close attention to his duties at Whitehall, and has gone to Paris, where he will remain for several weeks. Within the last few days the Lords of the Admiralty have forwarded two letters to Mr. Reed, in which their Lordships express their unqualified satisfaction with the results of the recent performances, under steam, of the ironclad turret-ship "Monarch," 7, 1,100-horse power, just completed at Chatham, and the "Inconstant," iron wood-cased frigate, built at Portsmouth. Their Lordships have likewise informed Mr. Reed that, in consequence of the great saving to the country which has resulted from the adoption of his system of constructing ironclads, and as a mark of the value they attach to his services, they have been pleased, with the full concurrence of the Chancellor of the Exchequer and the Treasury, to increase his salary by £500, making it £1,700 per annum, an event upon which we congratulate the Chief Constructor.

Miscellanea.

The quantity of amber lately found in the Kurischen Haff, to the north of Konigsberg, is said to be so great that the market price of the article has fallen.

A new auriferous strata has been discovered in that part of Siberia traversed by the affluents of the Angara, at a distance of about 250 miles from Teneissisk.

We understand that Lord Stanley has consented to distribute the prizes to the students of the Birkenhead Government School of Science and Art at a meeting to be held about the end of October.

The total number of passengers using the Metropolitan, the Metropolitan District, the St. John's Wood, and the Hammersmith and City lines, during the half-year ending June 30, 1869, was 20,087,809.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending August 7, was 4,311. Total number since the opening of the Museum, free daily (May 12, 1858), 1,616,665.

An enthusiastic party of antiquarians lately made a laborious excavation at Ossian's tomb, at Glen Almond (or what is supposed to be the grave of the ancient bard), and, according to the "London Scotsman," were successful in discovering some fragments of—a champagne bottle.

We are requested to state that the improvements in Golay's Millstone Dressing Machine, which was exhibited by Messrs. Bryan Corcoran and Co., and described in our last issue, were invented and patented by Mr. Corcoran, of that firm, and Mr. Dunham, of the firm of Clarke and Dunham.

A deputation, consisting of Mr. J. W. Probyn, Mr. Thomas Paterson, and others, had an interview with the Right Hon. J. Bright, at the office of the Board of Trade, yesterday week, to bring under his notice the defective state of the law regarding the protection of inventions at industrial exhibitions.

The number of visitors to the South Kensington Museum during the week ending August 7, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 12,900; Meyrick and other galleries, 2,714; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,713; Meyrick and other galleries, 183; total, 17,510. Average of corresponding week in former years, 12,266. Total from opening of Museum, 8,675,801.

The Wire Tramway Company have contracts at present in execution in France for about 25 miles of wire tramway, all for beet sugar makers. Mr. Hodgson, the inventor, is at present engaged constructing the line for the Pestarena Company in the Alps; besides this, the company have contracts in Spain, Sweden, and Austria, and are shipping lines to New Zealand and Peru. Several short lines are in course of construction in England, and the difficulty of obtaining right of way is alone preventing them doing a large business in this country.

We ("Athenæum") regret to announce the death, at Lisbon, on the 8th ultimo, of a veteran both in literature and science, Dr. John Martin. So far back as 1817 he was the editor of "Mariner's Tonga Islands," a work which has been always held in high estimation. Dr. Martin laid down meteorological charts representing the varying aspect of months, seasons, and years from daily observation. He also made careful observation with reference to ozone, as well as on the characteristics and circumstances affecting cholera and yellow fever. Dr. Martin died at the advanced age of 80.

The competition for the practical work for the ten Whitworth scholarships of £100 each, will be conducted by Colonel Rich, R.E., Mr. Manby, secretary of the Institution of Civil Engineers, and Mr. Marshall, secretary of the Institution of Mechanical Engineers. In addition to these scholarships tenable for the present year, Mr. Whitworth has just offered to the Science and Art Department 80 exhibitions of the value of £25 each, to be awarded to students in the universities, colleges, and schools, public and private, in the United Kingdom. These exhibitions are to be held for one year, and the students must show an aptitude for mathematics, mechanical science, and drawing.

The beer bottles are getting worse and worse in India, and the sherry bottles are following their pernicious example. According to the "Madras Mail," the pint bottle, from England, capsuled and labelled *a la mode*, now contains but a few drops more than half an imperial pint. Possibly the brewers have satisfied themselves that copious draughts of iced beer are bad for the liver, and on purely benevolent grounds are diminishing the supply. If they would reduce the price in proportion as they reduce the capacity of their bottles, no one would object to the solicitude that they show for Anglo-Indian stomachs.

The following is a return of the quantity of coal exported from Grimsby,—July, 1869.—To Belgium, 610 tons; to Canada, 688 tons; to Denmark, 3,408 tons; to Egypt, 1,513 tons; to France, 3,359 tons; to Hanseatic Towns, 702 tons; to Holland, 605 tons; to Moldavia and Wallachia, 576 tons; to Norway, 1,044 tons; to Prussia, 3,010 tons; to Russia, 6,744 tons; to Sweden, 2,776 tons; to Spain, 476 tons; to Turkey, 145 tons—total to foreign ports, 25,824 tons; coastwise, 3,942 tons; total, 29,766 tons. Corresponding period, 1868,—to foreign ports, 29,660 tons; coastwise, 8,480 tons; total, 38,140 tons, showing a decrease of 8,374 tons.

Last week a party of town councillors and others in New Hall-street, Birmingham, were inspecting a steam roller, when an unlooked-for accident occurred. There is a considerable declivity, about 1 in 40, at the spot where the affair occurred, and when the ponderous machine, some 25 tons in weight, was going slowly down, doing its work well, a pin in the braking apparatus gave way, and the engine started off at a rapid pace down hill. The two men in charge did their best to bring it to a stop, but it got completely beyond control, and, running on to the pavement, dashed into the factory of Messrs. Elkington and Co. Two windows and part of a wall were smashed in, but fortunately no one was injured. The men jumped off before the collision occurred.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

82 C. W. SPONG, Clapton Park. *Railway carriages.* Dated January 11, 1869.

The inventor proposes to employ sliding doors instead of swing doors, to avoid the possibility of accidents arising either from the doors not being properly fastened or becoming accidentally opened whilst a train is in motion. The door may either be suspended from a fixed rod or run on rollers on a rail or bar at the bottom or top of the door, or both. The side of the carriage is suitably formed to receive the door when it is required to be drawn or pushed back to admit persons. He also proposes to pad the meeting edges of the door and door frame, to lessen injury in the event of persons' hands or fingers being in the way of the closing of the door. The door may be kept securely closed by a swivel hook, fixed between the linings of the carriage, taking hold of a pin or eye on the edge of the door, the hook to be disengaged by a handle fixed at the outside of the carriage. A disc or ball may also be connected with the lock of the door, to show when it is open. The inventor further proposes to make the window of the door to slide sideways instead of up and down, as is now the case; and, as regards hand rails, he proposes to fix a rod to the outside of the carriage the entire length or height of the door frame at one or both sides thereof, to afford greater facility to persons to catch hold of than the means at present employed; and, as regards the steps of railway carriages, which are now formed of long planks of wood, the width whereof is such as to leave considerable space between the edge of the step and the edges of the platforms at the several stations on a line of railway, and by which many serious accidents have happened to persons about to enter and alight from a train, the inventor proposes to obviate this by making the step sufficiently wide to project over the edges of the platforms, sufficient space being left between the surface of the platforms and the under side of the carriage steps for the weight springs of the carriages to act.—Patent abandoned.

83 J. H. JOHNSON, Lincoln's Inn. *Pulp boxes, &c.* (A communication). Dated January 11, 1869.

This consists, essentially, in forming boxes and similar articles by forcing a plunger down into a mould containing the pulp, after which an outer or annular plunger surrounding the former one is brought down between the external sides of the inner plunger and the internal sides of the mould, in order to form the end or top of the box, and to compress the sides longitudinally or in a downward direction. The first-mentioned plunger works in connection with an internal piston, which is provided with an air inlet valve, which allows air to enter beneath the lower end of the plunger just previous to its withdrawal from the cavity of the completed box, whereby such withdrawal is greatly facilitated, and no tearing of the box is produced. The first descent of the central plunger into the mould is effected by a sudden and quick motion, in order that the pulp may be displaced and run up the sides of the plunger, so as to form the sides of the box, and not to be consolidated at the bottom of the mould, which would be the case if the plunger descended slowly. This displacement of the pulp having been accomplished, the plunger may complete the rest of its descent by a slow motion. Two duplicate moulds are employed made in a sliding block which traverses to and fro along guideways underneath the plunger on the bed or table of the machine, so as to make one mould to be supplied with pulp whilst the box or hollow article is being made inside the other mould, and *vice versa* the completed article being expelled by the action of the annular cylindrical plunger which forces the box out through the bottom of the mould, when it drops into an endless travelling apron of cloth or wire gauze. To allow of this action, the moulds are each provided with removable bottoms. In order to admit of the drainage and free escape of the water from the pulp in the moulds, their sides and bottoms are channelled and covered with a permanent or fixed perforated or permeable lining, the bottoms being, moreover, perforated underneath such lining. This machine may be driven either by hand or by any convenient prime mover.—Patent completed.

84 F. C. MATTHEWS, York. *Treating Indian corn.* Dated January 11, 1869.

The Indian corn or maize is thoroughly saturated with water (which may be slightly acidulated), and, by preference, it is steeped in the water for a period of about seven days. It is then taken out and allowed to commence to grow. When the growth has progressed sufficiently, the Indian corn or maize is dried at a moderate heat sufficient to kill it and stop the growth, and it is then the new product, suitable for use in brewing and distilling, and as food for cattle.—Patent abandoned.

85 C. N. NEWSOME, Coventry. *Milk cans.* Dated January 11, 1869.

The inventor prevents the shaking of the milk by the construction of a can which is capable of being quite filled with milk, and he carries out this part of his invention by means of two lids, the large lid covering the mouth of the can, and the small lid covering a small cup which is fixed upon the top of the large lid. Through the large lid and entering into the small cup there is a tube, through which the milk can pass out of the can into the cup, and out of the cup into the can, thus ensuring the can being quite full of milk, whether the milk be shrinking or expanding from the effects of cold or heat. The large lid is made to fit watertight, by means of a washer of india-rubber fixed upon the collar of the cam or upon the under rim of the lid. The lid is pressed firmly down on the washer by spring catches, hinged on the rim of the lid, and biting under the collar of the can. When used, the can is filled with milk, and the large lid fastened on, the cup is then nearly filled with milk and the smaller lid put on.—Patent abandoned.

86 C. MCDOUGALL and C. H. EDEN, Manchester. *Umbrella and dress suspender.* Dated January 12, 1869.

The inventors take a piece of elastic cord or other similar and suitable material, rather longer than would be required for a dress suspender merely, and provide any ordinary suitable fastening to connect the ends together when placed round the waist. They next provide a plate of metal (or other suitable material) and form therein four, six, or more holes in a line near to each other, and of such diameter that the elastic cord can pass through, but not too easily. They then pass the elastic cord backwards and forwards through these holes alternately, leaving a loop of the same between the two centre holes. This loop forms the umbrella suspender, and may be lengthened or shortened by drawing the elastic cord through the holes. A button or tassel is attached to the loop for facility of drawing out or expanding the loop when the umbrella is to be removed therefrom.—Patent completed.

87 W. E. GEDGE, Strand. *Power looms.* (A communication). Dated January 12, 1869.

This consists in the application of a movable rotary tappet, with single or double hinged stoppieces for preventing milling in power loom weaving.—Patent abandoned.

88 A. HENRY, Edinburgh. *Firearms and cartridges.* Dated January 12, 1869.

The sliding piston which passes through the breech is formed with a bevelled shoulder, which may be either on the side, front or rear of the piston, and which fits into a corresponding recess formed in the breechpiece, of a certain and requisite depth, so that when the shoulder of the piston touches or bears at the instant of firing against the bottom of the recess, the striking or igniting end of the piston is thrown sufficiently far forward to ignite the cap. A bolt or lever passes through the side, front or rear of the breech having a bevelled end corresponding to the bevel on the shoulder of the piston, and the head of the bolt or lever (which is also bevelled) protrudes from the breech when the latter is closed, and passes into a slot in the side, front or rear of the breech cavity. When the breech is withdrawn or lowered, for the purpose of recharging, the side, rear or forward end of the breech cavity acts upon the head of the lever or bolt, pushes it forward, and causes the point to act upon the shoulder of the piston, by which means the piston is drawn or pushed back into the breech into position for firing the next cartridge. The lever or bolt may be arranged either with or without a spring (spiral or flat) upon it.—Patent completed.

89 A. P. PRICE, Lincoln's Inn. *Treating naphthaline* (A communication). Dated January 12, 1869.

This consists in acting upon naphthaline with concentrated sulphuric acid, so as to obtain naphthalic acid. Sulpho-naphthalic acid or salts of the same is then to be subjected to the action of an alkali, such, for example, as caustic soda or potash, at a high temperature, and from the resulting product of the addition of an acid, such, for example, as sulphuric acid, naphthalic alcohol is obtained. The naphthalic alcohol obtained either by this or by other methods is submitted to the action of sulphuric and nitric acids, so as to transform it into duntro-naphthalic alcohol, which product may be employed for the purposes of dyeing and printing. The process is as follows:—About one part by weight of naphthaline is taken, and about one part by weight of concentrated sulphuric acid, and they are heated together at a temperature of about 100deg. Cen. until the greater proportion of the naphthaline has been converted into sulpho-naphthalic acid. This product is then to be dissolved in water, and the solution saturated with an alkali. The salts of sulpho-naphthalic acids thus obtained are evaporated to dryness, and all fused with an alkali, such as caustic potash or soda, or with mixtures of the same, so as to obtain compounds of naphthalic alcohol, which, upon the addition of dilute acid to the aqueous solution, the naphthalic alcohol or naphthol is precipitated and may be obtained in a crystalline form.—Patent completed.

90 B. HUNT, Lincoln's Inn. *Water meters.* (A communication). Dated January 12, 1869.

This consists in so constructing a valve piston or sleeve resting on a ring provided with double inclines that as the water is let in above, the piston or sleeve will be pressed downwards, thus causing a downward spiral movement of the sleeve. The piston or sleeve is provided with slots or ports on its sides, so arranged in relation to ports in a hollow shaft or in an outside cylinder as to change the direction or current of the water from one side to the other of the movable wing in the lower cylinder, whereby a semi-rotating motion is imparted to the shaft, in turn acting upon the cone ring, so as to cause a change in the position of the cone ring relatively to the sleeve or piston.—Patent completed.

91 Sir F. SYKES, Ivenhurst. *Defending forts, &c.* Dated January 12, 1869.

The invention comprises the defending floating or land structures by a curtain or curtains of chain armour, suspended or supported by the structures and clear of the same, and with or without the intervention of packing. An ordinary armour-plated ship when struck by a projectile has to sustain the concussion and entire weight of the same, and, by its non-yielding resistance, to stop the velocity and momentum of the projectile. It is the object of the invention to overcome these disadvantages by the buffer-like effect of the apparatus employed; the resistance employed of itself is or by its suspension or support being of a somewhat yielding character. The attachment and suspension of the armour may be made in any convenient manner. It is preferred to suspend it from davits fixed on hinges to the ship's side, and aided by the ship's rigging (but other means may be employed) in such proportion that should the one half of the davits be damaged in action, the remainder may suffice to sustain the load and strain upon them. In the event of a shot striking the outer suspended curtain of the improved flexible chair armour, the part struck would at once yield to the force expended on it, and the projectile would lose probably half of its effective force, and should it even penetrate the first curtain, it would even then have to encounter other curtains, whose powers of endurance for resisting penetration would prove effectual. The distance of the chain armour from the ship's side should be as far as is consistent with the allowing of three or even four tiers of suspended armour each part from the other. The curtains when not required for action can be stowed in special places in the ship's hold, acting there as ballast, and can be placed easily in position for action by simple machinery. When in action, water can be admitted into tanks in the ship's hold to supply the place of the missing ballast, and it can be pumped out at will when the armour is required to be placed below.—Patent completed.

92 A. V. NEWTON, Chancery-lane. *Knitting machinery.* (A communication). Dated January 12, 1869.

The needles being arranged in vertical recesses formed in the periphery of a fixed cylinder are free to slide up and down therein. At their extremities the shanks of the needles are bent outwards at right angles, and they bear upon a cam groove formed in a rotating cylinder that surrounds the needles. At the upper end of this cylinder is a ring groove, and the cam and ring groove are brought into connection by a vertical groove formed in the inner face of the rotating cylinder. When, therefore, any needle is required to be thrown out of action, the vertical groove is brought opposite that needle, and then by hand the needle is lifted so that its stem may rest in the upper or ring groove. By bringing the vertical groove in succession opposite certain needles (after any desired length of circular knitting has been completed) and then lifting those needles out of action, backward and forward knitting on a limited number of needles may be carried on, the number of needles that are thrown in or out of work being increased or diminished at pleasure.—Patent abandoned.

93 D. L. COATES, Q. DUNLOP and W. ORR, Belfast. *Couplings and wheels.* Dated January 12, 1869.

This consists in imparting elasticity to the joints and wheels of shafting and gearing by means of springs or india-rubber, cork, or other similar elastic substance introduced into either half of the coupling and acted upon by the other half, or between the rim and arms or at the centre of the wheel, in order to equalize the strain, impart a more regular motion, and lessen any shock arising from suddenly increased or diminished velocity in the revolution of the shaft.—Patent abandoned.

94 C. E. BROOMAN, Fleet-street. *Velocipedes.* (A communication). Dated January 12, 1869.

This consists in the application to velocipedes having two, three, or more wheels of mechanism, for the purpose of enabling them to travel with greater rapidity than when the driving wheels are acted upon directly by the feet of the operator. This mechanism consists of a train of cog-wheels, of which, in the case of velocipedes of three wheels, one is fixed to the frame and the other to the axle of the driving wheels, whilst in the case of velocipedes having only two wheels the first cog-wheel is fixed on the frame and the second and smaller cog-wheel is fixed on the axle of the front wheel of the velocipede.—Patent abandoned.

95 G. V. OSBORNE and A. J. PEERLESS, Rahere-street *Ball cocks or valves.* Dated January 12, 1869.

This consists in so constructing a ball valve that the pressure of the water from the main shall assist in opening and closing the sand valve. The inventors propose to effect this in the following manner:—In a suitable casting they adapt a valve formed with a stem, the upper part of which works watertight through a hole in the casting, and the protruding part of the stem is connected to one end of a horizontal vibrating bent lever, to the other end of which a hollow ball of metal is fixed and operated upon by the water in the cistern, in which the ball valve is fixed in the usual way. The diameter of the aforesaid valve is somewhat less than the opening in the casting in which it works, and the valve, which is formed of vulcanized india-rubber, is kept tight by coming into contact with an annular seat at the top of a short outlet pipe, through which the water passes from the water main into the cistern for filling the same, the water entering the valve casting by another short pipe fixed thereto, and to the service pipe, at right angles, or nearly so, to the aforesaid outlet pipe.—Patent completed.

96 H. AITKEN, Falkirk. *Lamps.* Dated January 13, 1869.

This consists in covering the burner with a shade, globe, or box made wholly or partially of glass, and in exhausting the vitiated air and products of combustion therefrom, thereby producing a partial vacuum in the shade, globe or box into which the air necessary to support combustion flows by the pressure of the atmosphere. To effect this a tube or connection is attached to the top of the globe, shade or box, made wholly or partly of glass, in which tube or connection a draught is caused by means of a jet of steam, water, air or gas, or by connecting it to a chimney, condenser, stalk, or boiler, flue, or any other means for producing a draught, may be employed. A metal case is situated on the top of the shade, globe or box in which the air contained is heated, and the heated air is conveyed by tubes to the bottom of the lamp, where it enters the interior of the lamp by a tube or tubes to mix with the gas evolved from the oil and with which it is burnt. The oil for combustion is contained in a reservoir, which is connected by a passage to a secondary reservoir in the bottom of the lamp, from which part it is burnt. The flame of the lamp is conveyed by the ordinary cone hitherto employed.—Patent abandoned.

97 S. JELLYMANN, Cannock. *Reaping machines.* Dated January 13, 1869.

This consists of a horizontal platform or frame, supported

by the road or driving wheel or wheels, and a knife or guide bar at right angles to the platform, in which guide bar the serrated knife or cutter works. The guide bar is supported by a small wheel at its extreme end. The platform or frame described carries the mechanism for giving the reciprocating sliding motion to the serrated knife or cutter. The inventor constructs and arranges the parts for working the serrated knife or cutter from the road or driving wheel or wheels of the reaping and mowing machine in the following manner:—The road or driving wheel supporting the platform or frame of the machine is provided with an external or internal toothed or spur wheel, which gears with a pinion on a shaft or axis parallel with the shaft of the road wheel. On the end of the axis of the pinion is a crank. A connecting rod is jointed at one end to the crank and at its other end to a horizontal sliding bar working in grooves in the frame or platform of the machine, lateral motion in the bar being prevented by the shape of the bar and the grooves in which it works. The sliding bar is not straight, its middle part being inclined to the ends of the bar, that is, the ends of the bar are opposite one another and joined by the inclined part described. By the motion of the cranked and toothed wheels described, a reciprocating sliding motion is given to the bar, which motion is caused to give a reciprocating sliding motion to the serrated knife at right angles to the said bar.—Patent completed.

98 C. J. GUNTHER, Mark-lane. *Preserving meat.* (A communication). Dated January 13, 1869.

This consists in the use of the following formulæ for the preparation of the brine or salt water:—Salt water: Dissolve 36lb. of chloride of sodium (common salt) and ½lb of crystallized phosphate of soda in 10 gallons of water; the addition of phosphate of soda is made with the object of purifying the chloride of sodium from lime and magnesia. When employing sea salt, the quantity of phosphate of soda should be increased to 1lb.; allow the solution to stand until clarified, and then decant the fluid from the white earthy deposit. Brine: The above yields 11½ gallons of salt water, to which add 6lb. of extractum carnis, 1½lb. of chloride of potassium, 10oz. of nitrate of soda. The nitrate of soda serves to colour the meat.—Patent completed.

99 P. M. BARNETT, Aberdeen, N.B. *Securing wooden keys.* Dated January 13, 1869.

In the jaw of the chair between which and the rail the wooden key is placed a vertical groove or channel is formed, which is continued into or through the lower portion or bed of the chair, so as to form a socket therein. The wooden key having been placed in position, an iron key provided with a chisel point is driven into the before-mentioned groove or channel, until its point enters the socket in the lower portion or bed of the chair. As the iron key projects beyond the face of the jaw which contains the groove or channel, the wooden key is thereby compressed, and is, consequently, held firmly in position, and is not liable to displacement and derangement, as is the case with the modes of fixing such keys hitherto in use.—Patent completed.

100 J. STEEL, Glasgow, N.B. *Waterclosets.* Dated January 13, 1869.

A space is enclosed by walls outside the staircase, and is carried up the entire height of the building, or nearly so. This space is partially boarded over, and a closet with a seat is constructed at each flat, but the several closets are arranged so that the space below each seat is perfectly clear down to the bottom. Thus, if the space or shaft enclosed by the walls were continued with the same width up to the top, which could be done if preferred, then the top closet would occupy the whole horizontal area, the next below it would occupy that area diminished by a shaft from the seat above, and the lower ones would occupy spaces diminished by the other shafts, corresponding to the number of shafts above.—Patent completed.

101 L. STERNE, J. A. JAQUES, and J. A. FANSHAWE, Tottenham. *Elastic rubbers.* Dated January 13, 1869.

The inventors combine the soft, porous, spongy rubber with a skeleton or framing of some more solid or rigid substance which will maintain its shape, such, for instance, as solid vulcanized india-rubber or hard rubber.—Patent abandoned.

102 J. PARKER, Camberwell. *Propelling vessels.* Dated January 13, 1869.

This consists, first, in placing upon the surface of the water contained in the tanks or holders a float, by which the steam and air is kept from coming into direct contact with the water, thereby greatly diminishing the loss by condensation, which takes place when the steam and air is allowed to press directly upon the surface of the water. Second, in lining the tanks or holders with one or more substances of small conducting power, for the purpose of diminishing the loss by condensation, which takes place when the steam and air is allowed to come in direct contact with the metallic water tanks or holders. When wood or cork or other porous material is used for the floats, or for the lining of the tanks or holders, the pores thereof are to be filled up with varnish or other suitable substance, to prevent penetration or absorption of steam or water by the float or lining of the water tanks or holders. In some cases it may be desirable to have a thin airtight metallic covering to the lining of the tanks or holders, to prevent the direct contact of the steam and air and water with the lining of the tanks or holders, and also to have a thin metallic covering to the float, to prevent the direct action of the steam and air and water upon the float.—Patent completed.

103 L. HANNART, Clerkenwell. *Moulding dies.* Dated January 13, 1869.

The bottom of the tool constituting this invention consists of a circular flat plate of metal, upon which another circular plate of metal rests loosely, of smaller diameter than the former plate. This smaller plate is formed with a fillet about its upper edge, to serve as a shoulder for the engraved dies to be forced against, and thereby to bring the segmental dies close together, so as to form them into an entire circular die or mould. These segmental dies are each connected by a screw to the bottom plate of the mould, the heads of the screws each taking into an oblique slot or groove formed in the plate. Grooves or slots are also formed in the filleted plate above mentioned, radiating from the centre thereof, and into each of these radial slots a pin takes, one of such pins being fixed into the under side of each segmental die.—Patent completed.

104 J. SCHLOSSER, Frankfort. *Metallic packing.* Dated January 13, 1869.

The improved packing is contained in an ordinary box with its gland connected in the usual way by bolts and nuts. It is composed, in the first place, of an inner metallic shell, divided into two halves, and cast in a particular metallic alloy, which is called anti-friction. Internally, this piece is cylindrical throughout its entire depth, and bored to the same diameter as the rod it is intended to fit externally. Its upper part, which fits in the gland, is conical, whilst its lower part is cylindrical, except at its junction with the conical part, which is also conical. The lower cylindrical part of the shell extends below and beyond the shoulder usually employed to receive a metallic ring, which ring is suppressed in this system. This shell is divided in the direction of its height into two parts.—Patent completed.

105 W. R. LAKE, Chancery-lane. *Uniting ends of tubes.* (A communication). Dated January 13, 1869.

The inventor provides the ends of each pipe or each length or section of pipe with a movable flange, which is kept in place by collars or projections on the end or head of each tube. The collars extend only partially around the tube, and the loose flange is formed with recesses or apertures, which, when brought opposite the collars, will pass over them, and which may be turned partially around behind the collars, the flange being thereby securely held on the pipe. By this means, the flanges may be conveniently placed on the end of the pipe or removed therefrom, and may be adjusted to receive the bolts whereby the pipes are secured together. Between the two pipes or ends to be connected together, the inventor places an annular connecting piece or coupling, which is recessed on each side to receive a ring of india-rubber, or other suitable packing material, against which the end of each pipe is bedded. These connecting pipes are made with their faces either at right angles to the bore of the pipes, or with one face or with both faces oblique or inclined at any desired angle. When these connecting pieces are properly arranged between the ends of the pipes, the loose flanges are connected by the bolts and nuts, and by screwing down the nuts the two ends of the pipe are drawn together and made to bed closely on the packing rings, thereby making the joint perfectly tight and secure.—Patent completed.

106 C. P. COLES, Bonchurch, Isle of Wight. *Protecting ships' bottoms.* Dated January 13, 1869.

This consists in protecting the bottoms of ships or other submerged structures from fouling by the employment of copper or other appropriate metal filings, or a solution of copper or other metals applied to the surface of cements, paints, glues, and other adhesive substances with which the vessel or structure may be coated. The inventor proposes to apply the copper or other metal filings by sprinkling or dredging them on to the soft surface of the cement or paint, and afterwards, if necessary, rolling or pressing them on to that surface, and applies the solution when used with a brush or otherwise.—Patent completed.

107 G. D. KITTOE and P. BROTHERHOOD, Clerkenwell. *Valves.* Dated January 14, 1869.

On the valve, at or near its periphery, the inventors fix a ring or edging of caoutchouc projecting from the face of the valve. This ring or edging is of such a section that its base where it is attached to the valve has considerable breadth, while its summit or that part which, in closing, comes first in contact with the seat, is narrower and rounded. Thus, as the valve closes, the narrow apex of the elastic ring or edging in first meeting the seat yields to the pressure, and, as the valve closes farther, the compressed material presents an increasing breadth for resistance. The elastic edging may be fixed on the seat instead of the valve. The valve or the seat may be either of metal or of hard caoutchouc, such as ebonite or vulcanite. The edging may be fixed either by pitchy or resinous cement, or by suitable flanges, or by moulding it in its soft state into dovetailed recesses, formed in the valve or seat, but it is preferred to fix it during the process of vulcanization.—Patent completed.

108 W. M'DONNELL, Limerick. *Churns.* Dated January 14, 1869.

The inventor takes a pair of rails, the ends of which are turned upwards or somewhat curved, the distance apart being regulated by the width of the churn itself. He thus forms a sort of cradle or frame to support the chain, as hereafter described. These rails are united together by girders or rods having one rod or a framing at or about the centre of the rails, and on which the frame is balanced and free to oscillate. Springs are placed on the ends of a frame, or, in some cases, a spring at one end is sufficient, and in others they may be dispensed with altogether, supporting the rails against which the rods uniting the rails are free to act. In those cases where springs are used, but, where they are dispensed with, the cross rods act as stops to the cradle, a handle or handles is or are used for depressing the rails or for communicating an oscillating motion thereto.—Patent abandoned.

110 J. R. HODGSON, Limehouse, E. *Life buoys.* Dated January 14, 1869.

The inventor constructs a buoy or boat having a central space, the surrounding parts being so formed as to be buoyant, and so prevent the buoy or boat from sinking, and the buoy or boat being so formed as to afford the same means of rescue, whichever way it may be uppermost in the water. The transverse section of the sides and bows of the buoy or boat are preferred to be of a round or curved form. It is preferred to form the ends of the buoy or boat with cutwaters, and such cutwaters may be continued around both ends of the buoy or boat, so as to act as a keel or gunwale, whichever way the buoy or boat may be uppermost in the water. A keel may be continued from end to end of the buoy or boat, and form a central division having a space on either side between it and the sides of the buoy or boat, and such keel may be formed so as to admit water for ballast. Both surfaces of the buoy or boat are provided with ribs or gunwales, which act as keels or gunwales, according to whichever way the buoy or boat may be uppermost in the water. Compartments or receptacles are provided in the sides or other part of the buoy or boat in which to store provisions. These compartments or recesses are, however, simply a matter of convenience, which may be readily arranged according to circumstances. The buoy or boat is surrounded with a rope or chain, which may be flat or round in form, to be used either for the purpose of turning or hoisting the buoy or boat, and belts or ropes are attached thereto to aid in the rescue of persons in the water. In order to protect persons within the buoy or boat, network is provided, preferably in sections, and so arranged as to be capable of travelling fore and aft in "jackstays" and guides.—Patent completed.

111 T. MORTLOCK, Hoxton. *Dressing millstones.* Dated January 14, 1869.

The inventor employs a metal frame, truly planed and faced on the under side, which, when the apparatus is in use, rests on the stone to be operated on, and is there kept in place by its own weight. On the frame a carriage is mounted, and it is capable of sliding along it on guides from end to end, a motion which is given to it by manual labour. The carriage has upon it a toolholder, capable of being traversed across the carriage by a screw. In the toolholder is fixed a tool; it may be a diamond or steel point or cutter, and as the carriage is moved along the frame, the tool traces lines upon the face of the stone. The point or tool is set down to the depth required by a screw, and with the toolholder it is moved a minute distance across the carriage before each forward traverse of the carriage. This motion is given by the screw of the carriage, operated upon by a self-acting ratchet and pawl. Thus it will be seen that at each action the cutter forms a minute and perfectly true groove on the stone, either on the face or in the furrow, as the case may be, and these lines being repeated very close together and parallel the one to the other, the required level and roughened face is given to the stone, and the furrows are made and kept of the proper depth. When one quarter or part of the stone is complete, the frame is shifted on to the next quarter or part, which is similarly operated on, and so the operation goes on until the work on the stone is complete.—Patent completed.

112 E. P. NORTH, Birmingham. *Pocket lamps.* Dated January 14, 1869.

The inventor makes the case of the lamp of a cylindrical figure, an opening being made in one side, through which the light from the candle passes. Upon the cylindrical case a close-fitting cylindrical covering works, which has an opening in it of the shape and size of that in the cylindrical case. At the bottom of the case is a perforated collar, through the sides and end of which air is admitted to the lamp. This collar is situated below the bottom of the covering, which turns upon the collar. A short tube is fixed in the axis of the case, in which the candle tube slides with considerable friction. A disc at the bottom of the candle tube enables it to be raised or lowered in the lamp case to the required extent, and also serves as a foot. The lamp glass is made of a cylindrical figure, and is supported on flanges carried by the lamp case. A lid or cover closes the top of the lamp and carries a double hook, by which the lamp is suspended in the railway carriage. Between the lamp glass and the back of the case a reflector is fitted. When the lamp is in use the close-fitting covering described is so turned that its opening coincides with the opening in the cylindrical case of the lamp. The candle tube is adjusted opposite the opening, and the lid at the top of the lamp is raised. The lid, however, need not be raised when provision is made for the escape of hot air. When it is wished to close the lamp and fit it to be carried in the pocket or portmanteau, the cylindrical covering is turned, so that an unperforated part of it is brought over and made to close the opening in the lamp case and protect the lamp glass from being broken. The lid of the lamp is shut down, and the candle tube is raised in the case until its disc bears against the bottom of the lamp. The lamp now resembles a tube closed at both ends. It occupies little space, and may be carried in the pocket or portmanteau without inconvenience and without danger of breaking the lamp glass. A handle may be fixed to the lamp so as to allow of the lamp being used as a hand lamp or lantern.—Patent completed.

113 H. VAVASSEUR and C. M. WADE, Furnival's Inn, E.C. *Permanent way.* (A communication). Dated January 14, 1869.

The key or wedge is formed of sheet metal coiled or bent up into a suitable form to enter the space between the chair and the rails, and when driven up as an ordinary key or wedge to hold the rail firmly in position. This description of key or wedge is formed of metal of a width corresponding to the length or width of the desired key or wedge. By these means an elastic wedge or key is formed which is not injuriously affected by climate or insects.—Patent completed.

114 A. V. NEWTON, Chancery-lane. *Reaping and mowing.* (A communication). Dated January 14, 1869.

The main frame of the machine is constructed in one piece, having an axle on one side for the driving wheel, and on the other side a hollow cylindrical arm or projection which serves to support the gearing, and as a point of attachment for the tongue frame and crank or cutter frame. The bevel wheel shaft is supported by a pipe box inserted in the chamber of the cylindrical part of the main frame and retained in position therein by a single bolt passing through a flange in the box and through the main frame. The shaft is formed with a collar, which, with the bevel wheel on the other end of the shaft, serves to prevent end play in the pipe box. The pinion is placed loosely on the end of a shaft outside the collar, and is recessed on its outer face for locking with the pin in the end of the shaft. It has also a groove formed in the periphery of its hub in which a fork connected by a spring to the main frame is inserted, so that the recoil of the spring will keep the pinion against the collar at all times when not forced outward by the pivoted vibrating wedge through which the pinion is made to lock with the pin in the shaft at the pleasure of the operator. The pinion gears with the teeth of the gear rim on the driving wheel and receives its motion therefrom. The tongue frame has a recess on its under side to receive the tongue, and an eye or sleeve at its rear end embracing and uniting it to the cylindrical arm or projection of the main frame, forming a hinge connection therewith. On the side of the tongue frame is mounted a spur pinion secured in proper bearings, and having an axle projecting from its casing for receiving a lever or wrench for turning it. This pinion gears into a sector rack on the front end of the main frame, so that any motion given to the pinion imparts a corresponding motion to the main and tongue frames, the axial centres of movement of said frames being coincident with the centre of the bevel wheel shaft. A dog or button is provided for locking the two frames in any desired relation to each other.—Patent completed.

115 W. E. NEWTON, Chancery-lane. *Steam pumps.* (A communication). Dated January 14, 1869.

This consists in providing a cylinder and piston which are in communication with the air chamber, or with any pipe or vessel from which the pressure of the water produced by the pumping engine may be made to act on the piston of a small additional regulating cylinder. The rod of this piston is connected by a link motion to, and made to operate the induction valve of, the engine, so as to shut

off or let on the steam as may be required. A coiled spring will keep the regulating piston down, so that when the pressure of the water is removed from its under side the piston will be forced down, and will thereby cut off the steam from the engine, but when the pump is at work it will force up the piston and compress the spring, thereby opening the induction valve and allowing steam to enter the cylinder of the engine.—Patent abandoned.

116 J. H. Kitson and J. Kirby, Leeds. *Movable grates.* Dated January 14, 1869.

This consists in adapting to steam boiler and other furnaces movable grates composed of separate transverse firebars which are caused to travel along the furnace from end to end on an upper tier or guide at an uniform speed depending upon the rate of combustion required. When such bars have travelled the whole length of the upper tier or guide they are caused to fall on to a lower tier or guide on which they are returned to the end from which they started, and when there they are lifted up to the upper tier so as to be carried forward a second time. All the bars will thus be made to perform an endless circuit and be constantly moving forward.—Patent completed.

117 T. Cook and J. Watson, Victoria Chambers, S.W. *Oil presses.* Dated January 14, 1869.

This consists in certain novel and improved mechanical arrangements and combinations constituting a press suitable for expressing oil from seed or other oil-yielding substances. The inventors form a deep but narrow box with strainers of novel and peculiar construction of the entire width and depth of the box. To the bottom of the box they adapt a sliding or false bottom so arranged as to be capable of being easily removed after the seed or other oil-yielding substances have been sufficiently compressed to allow the compressed residuary matters or cake to be forced out of the box into a receptacle below. Above the box they place a steam cylinder of considerable dimensions, resting on two or more columns, and fitted with a piston rod or plunger formed of a flat piece of steel or other metal exactly fitting into the aforesaid box. The piston rod or plunger works through a slot formed in the cylinder bottom, and the said piston rod or plunger should be so arranged that it can be passed into and through the aforesaid box at the will of the operator.—Patent completed.

118 A. M. Clark, Chancery-lane. *Firearms and cartridges.* (A communication). Dated January 14, 1869.

The improvements in firearms consist, first, in making the end of the extractor groove extending the whole length of the breech chamber, at one side to terminate in a recess to receive the end of the spring acting cartridge extractor. The recess being made in the shoulder formed at the junction of the bore and breech chamber, no space is required for receiving the extractor at that point, which space is liable to burst the cartridge in firing. Second, the inventor makes on the opposite side of the breech chamber a shallow recess to receive a portion of the rim of the cartridge case when drawn back by the extractor. The improved metallic cartridges consists, first, of a head of copper thinned round the edge in order to prevent its cutting the case containing the powder from the internal pressure produced by the explosion. The inventor forms the rim by the aid of pressure, so as to bring the two surfaces together and prevent the gases from entering and bursting the rim. Second, of a tube composed of thin sheet copper coiled on a mandril of suitable diameter, and then covered with paper pasted on to prevent the copper from uncoiling. Third, of a cylinder or wad of compressed pasteboard serving to close the end of the cartridge, and for connecting the copper cap and tube. The cap is sometimes of conical form, in consequence of which the pressure of the wad ensures a tight fit between the cap and the tube; but when the cap is cylindrical, in order to secure the parts together, the inventor pierces holes in the cap into which the tube and pasteboard wad are forced, forming so many tongues for connecting the parts.—Patent completed.

119 T. Birkett and H. Scott, Birmingham. *Breech-loaders.* Dated January 14, 1869.

This consists in providing two, three, or more separate spring bolts or catches, so arranged that the bolt or catch on which the hand lever directly acts, in turn acts upon the next bolt or catch, and so on throughout the series, if more than two bolts or catches be employed. The inventors prefer to use three bolts or catches arranged as follows:—The locking lump on the under side of the barrels is divided transversely into two parts, entering two separate corresponding recesses one behind the other in the body. The first spring catch or bolt is fitted into the body to work in a hole or passage formed for it in the metal which separates the two recesses already mentioned. The hand lever works on a transverse horizontal axis under the body, and a spring which acts upon it causes an arm with which it is provided to push forward the first bolt or catch, to cause its nose to enter a notch in the back of the front portion of the locking lump. The nose of the catch is inclined, so that it yields to the lump and lets it pass as the barrels are closed. The second catch is on the hindermost of the two parts of the lump on the barrels, and it locks into the partition between the two recesses in the body. The third catch is in the body at the back of the second recess; it is provided with a spring to throw it forward, and it catches into the back of the hindermost part of the lump on the barrels.—Patent abandoned.

120 H. L. Harris, Somerset-street, E.C. *Packing cases.* Dated January 15, 1869.

This consists in making the ends or sides of boxes, cases, or trunks deeper than usual, thereby causing the top and bottom to be fitted on and fixed in their place. The nails are driven transversely, that is to say, at right angles to each other in every edge of the case or box, but the mouth or opening of the trunk will be lined inside.—Patent abandoned.

121 C. H. Lea, Stafford. *Railway signals.* Dated January 15, 1869.

This relates to former letters patent, granted March 9, 1863, No. 651. The improved apparatus for opening and closing railway crossing gates consists principally of two levers, connected to a hand lever by a rod. The two levers meet at their inner ends in the centre of the railway line, and are connected together by a slotted eye and pin, or other equivalent; the outer end of each line is jointed to two connecting rods, each rod being in communication with an arm lever fixed on the gate heel, with which it communicates. The connecting rods have adjusting screws placed on them to regulate each of the gates; the lever in connection with the hand lever has its outer end lengthened, to which the rod leading to the hand lever is attached. By this apparatus all the gates are caused to act simultaneously. If it is a single line where the crossing is situated, one lever is all that will be required, instead of the two above mentioned in connection with the hand lever, the gates further away or nearer to each other as occasion may require, so as to prevent them from meeting in the centre. The top centre arm of the gate is also fitted with adjusting screws and plates (one of which is fitted in the post, and has indentations formed in it, the other having projections formed on it, which fit into the plate in the post) for raising and lowering the gates, and so prevent them from trailing on the ground. Guards are also fitted on the heels of the gates to keep them from damage, from stones, ballast, or dirt getting inside and preventing the free working of the gates.—Patent completed.

122 J. Steel, Glasgow. *Cleansing casks.* Dated January 15, 1869.

The machine consists of a large disc or chuck fixed on the overhanging end of a horizontal shaft, made to revolve backwards or forwards at any convenient speed by means of gearing. A series of cradles to receive the casks are arranged with their axes tangent to a circle on the face of the disc, and are mounted on journals connected by bevel wheels with each other. The casks are placed in the cradles with their axes coinciding with the journals, and when the machine is in action each has a rotation about its own axis combined with the motion due to being carried round by the rotating disc. There may be a single disc on the shaft, or there may be two such discs thereon, one on each end, and they may be provided with cradles for different sizes of casks. The gearing for imparting the axial rotation consists in the case of each disc of a bevel toothed ring encircling the main shaft, but fixed to the framing, and having in gear with it a bevel wheel on a radially disposed shaft carried upon the disc. This radial shaft rotates in consequence of being carried round by the disc and of the bevel pinion, consequently rolling round the ring, and it imparts motion by bevel gearing to one of the cradle journals. This gearing consists of a bevel wheel on the outer end of the radial shaft in gear with a bevel wheel on a short shaft, carried by the disc, and having on its other end a bevel wheel gearing directly with one of the bevel wheels.—Patent completed.

123 A. de P. Chance, Birmingham. *Step ladders.* (A communication). Dated January 15, 1869.

The sides are formed in pairs of bars of angle iron, or other suitable metal or metals, jointed together by means of a pin or otherwise, the bars on each side being connected together at their upper and lower ends by horizontal rods. The bars of angle iron or other metal or metals when opened out on their joints form an X at each side of the step ladder. To the horizontal rods at the upper part of the bars are connected by collars jointed metal straps, to which are fastened two boards, one on each side of the joints. By means of the metal straps and the before-named horizontal rods, a frame is constituted capable of supporting the said boards, which form the top of the step ladder, and when the sides are opened out afford a stand or top step. To the outside inclined bars are suspended (by means of metal straps with ears or lugs, capable of turning on pins in the said bars), two boards, one under the other, connected together by metal straps, moving on pins at their ends. By this means the two boards form the two lower steps of the ladder, and from the arrangement of the metal straps and the inclined side bars they are firmly supported, so as to become capable of bearing weights as required.—Patent abandoned.

124 J. T. Smith, Barrow-in-Furness. *Converting vessels.* Dated January 15, 1868.

This consists in making the bottom of the converting vessel of wrought iron or steel instead of fireclay or other non-metallic material, the bottom being flush with the fireclay lining of the sides of the converting vessel, and forming the top of a short hollow cylinder secured by riveting or otherwise to the outer metallic portion of the converting vessel. The blast of air is delivered through the metallic bottom by means of a series of metallic pipes fed through one of the trunnions of the converting vessel in the usual way. In order to keep the metallic bottom cool, and prevent its fusion or the attachment of the molten iron or steel in the converting vessel thereto, the inventor applies water to the under side of the bottom in the following manner:—A series of concentric tubular rings are supported at a short distance below the metallic bottom. These rings are connected through one of the trunnions of the converting vessel with a reservoir of water, which water is supplied to the said rings under considerable pressure. Through small holes in the upper sides of the said rings a series of minute jets of water are delivered on the under side of the metallic bottom, which is thus kept cool and uninjured by the heat to which it is exposed.—Patent abandoned.

125 H. Fowkes, Manchester. *Cleaning rod.* Dated January 15, 1869.

This consists in the novel employment and use of a stick or rod, the length of which is somewhat greater than the gun barrel it is designed to clean. The lower end of this rod is formed with a hollow cylindrical recess, into which is placed a spiral brush or other expanding material connected with a sliding rod passing up the centre or core of the first rod, and terminating in a knob or handle outside a distance equal to the length of the cylindrical recess formed in the bottom of the larger rod. Thus, when it is desired to clean the gun barrel, the rod containing the spiral brush or other suitable expanding material is inserted in the barrel up to the breech, at which time the central sliding rod, to which the spiral brush is attached, is held whilst the rod with its cylindrical end is withdrawn, the action of which forces the brush from the cylindrical recess, causing it thereby to expand and press upon the interior surface of the gun barrel containing it, which, when being withdrawn, thoroughly and effectually cleanses the barrel from all foul or extraneous matter.—Patent abandoned.

126 D. P. Wright, Birmingham. *Window blinds.* Dated January 15, 1869.

This consists, first, in making blind rollers of wood in two parts, that is to say, using a strip of wood of a semicircular or other convenient form, with a semicircular or other shaped groove on the flat sides, and by cutting off strips so formed in suitable lengths, using two of such pieces or lengths for a roller, and securing them together by glue or other means. The internal groove will be continuous and uniform from end to end, with an open joint sufficiently apart to allow the fabric or material of the blind to pass between in the following manner:—A broad hem is formed on the top of the blind, into which a strip of wood or other suitable material may be inserted, sliding the same with the blind into the groove of the roller from the end, an opening being formed in the single-flanged metal end for allowing the blind proper to pass in, and securing such end by screwing in the ordinary way, and the other metal end has a sunken groove or double flanges, which metal end it is preferred to put together in parts, produced partly by casting, drawing, and pressing, and fixed together with press tools, to which a single elevating blind cord is connected and wound around the same by the drawing down of the blind, the metal ends having projecting centres in the ordinary way, working in brackets formed on the window frame.—Patent completed.

127 W. Tijou and W. Whieldon, Westminster Bridge-road. *Getting coal.* Dated January 15, 1869.

It is proposed to break down the coal, stone, or other mineral after it has been undercut in the usual or other manner by inserting into a slot hole, drilled in any convenient or suitable part of the coal, stone, or other mineral, a contrivance consisting essentially of one or more series or rows of levers or arms having a toggle or knee-joint expansive action in a lateral direction, so as to exert a forcible pressure in opposite directions against the walls or sides of the "shot hole," whereby the mass of coal, stone, or other mineral will be effectually broken down. The expansive action of the levers or arms above referred to may be effected in various ways, as, for example, by moving longitudinally, either inwards or outwards, a rod or bar upon which such levers take their bearings, the requisite power being obtained either by hydraulic jacks, screws, or other well-known mechanical contrivance.—Patent abandoned.

128 A. Sehet, Paris. *Breech-loaders.* Dated January 15, 1869.

The breechblock forms the end of an arm or lever which turns on an axis at the rear end of the breech chamber, and is capable of being raised in a vertical direction, so as to uncover the mouth of the chamber for the admission of the cartridge. The chamber is again closed on the block and breechpiece being depressed, and the breechpiece is held fast in position by means of shoulders placed on each side of the breechblock. The breechblock is of a wedge-like form, the sides being parallel to the triangle formed in front by the mouth of the breech chamber, and in the rear by the curve of the two shoulders. The form of the breechblock may be varied, and it may be made with parallel and concentric curves, or may be triangular, with straight or curved sides. A movable piston is placed in the breech chamber, and, by means of a cocking piece, which passes through a slot in the bottom of the chamber, is capable of being withdrawn towards the butt end of the gun, thereby compressing a spiral spring, which is placed in the interior of the chamber, and bringing the sear spring into operation, thus cocking the gun. A needle is fixed to the piston, and is adapted to pass through a hole in the centre of the breechpiece and penetrate to the centre of the barrel.—Patent abandoned.

129 W. H. Brookes, Sheffield. *Door fastener.* (A communication). Dated January 15, 1869.

This fastener consists of a metal shank, about 1in. in length, ⅛in. in breadth, and 1-16in. in thickness, and split at one end, which is turned at right angles to the rest of the shank. The other end of the shank is also turned up and rounded, so as to fit into a recess formed in a button, to which it is attached by a pin. The fastener is used by putting the shank in between the door and the door jamb (with the split end of the shank towards the door jamb) so that when the door is shut the split end of the shank is forced into the door jamb, and the button being turned the door is made fast from the inside. The fastener, when applied to a window, is forced between the sash and frame in like manner.—Patent abandoned.

130 J. Spence, Manchester. *Sulphate of potash.* Dated January 15, 1869.

This invention is carried out by taking the muriate of potash and treating it with an excess of sulphuric acid, and it is preferred that this excess should be about 50 per cent. above its combining quantity. The boiling or heating is conducted into a vessel similar to that which is used in the manufacture of chlorine from hydrochloric acid and peroxide of manganese, the heating medium being a jet or jets of steam, and the operation is continued from three to five hours, or until the whole of the muriatic acid is driven off. The resulting solution, which now contains sulphate of potash and free sulphuric acid, is run into vessels, where shale or other aluminous matters are being or are to be boiled with sulphuric acid, and the free acid in the solution becomes available for combining with alumina, and the sulphate of potash enters into combination with the solution of sulphate of alumina to form alum, as is well known.—Patent completed.

131 T. Howcroft and A. M'Gregor, Bedford Leigh. *Reapers and mowers.* Dated January 15, 1869.

This relates, first, to reaping machines having one main driving wheel. The gearing actuating the knives is contained within, and shielded by a dome-shaped cover or case, in the centre of which the main axle is firmly keyed or fixed; this dome-shaped cover or case has an internal spur wheel cast on or bolted to the inner face of its outer rim, immediately under or inside the revolving circular plate that covers it. This revolving circular plate is free to turn on the main axle, and the main driving wheel is free to turn on the boss or nave of the revolving circular plate. This boss or nave is of sufficient length to carry an ordinary clutch gear, by which the main driving wheel and the revolving circular plate can at once be connected or disconnected; when disconnected, the driving wheel alone revolves, and when connected, the gearing receives motion through the revolving circular plate. This plate carries one or (by preference) two wheels, at such a distance from the internal spur wheel that they work into it, and at the same time, into a pinion on the boss or nave of the large bevelled wheel, which bevel wheel and pinion turn freely on the main axle, and are shielded within the dome-shaped cover or case; the bevel wheel gives motion to a bevel pinion on an inclined shaft, which, through the medium of a crank pin and connecting rod at its lower end, gives motion to the knife bar. The inclined shaft turns in a long bearing or pipe, bushed at its two ends, which bearing or pipe is cast to the dome-shaped cover or case, and forms part of the framework, the latter being curved outwards to allow the inclined shaft to pass under the

main axle; the shafts are attached to the machines by wrought-iron arms, which move freely on the main axle, and the patentees attach a lever to the shafts, by which the cutter bar can be raised or lowered at pleasure, whether the machine is at work or not.—Patent completed.

132 E. CRADDOCK, Camberwell. *Punching metals.* Dated January 15, 1869.

To a suitably shaped body made of metal are connected two metallic arms, one of them being fixed to the upper part of the body (or it may be cast or made in one piece with it), and the other (which is movable) is secured to a quick-threaded screw passing through the centre of the body of the apparatus to the lower extremity of which screw a punch is firmly secured. At the outer end of each arm is fitted a jaw or joint, made capable of revolving, and in each jaw or joint a stud or nut is placed, which is also made capable of revolving. A screw or circular piece of steel, one-half of which is threaded as a right hand screw and the other half as a left hand screw, is passed through the studs, one end being so formed as to allow a handle or key to be fitted thereon to operate the screw. On the screw being turned by the handle or key, the double action of the screw causes the movable arm to approach to or recede from the other arm, and causes the punch to be forced down by means of the quick threaded screw secured to the movable arm, and to it, thereby causing the desired punch or perforation to be made in the metal submitted to the operation.—Patent completed.

133 M. BOYCE, Abchurch-lane. *Whist scores.* Dated January 15, 1869.

This consists of a box, case, or frame holding or wherein is affixed or delineated one set of markers, symbols, or contrivances for scoring. This box, case, or frame being provided with a sliding cover, which when drawn out to a suitable extent exposes to view a marker, symbol or contrivance indicating a score of one, then when farther drawn out, exposes to view another marker, symbol, or contrivance, thereby indicating a score of two, and so on, until that particular set of markers, symbols, or contrivances is exhausted. In the sliding cover of this box, case, or frame there is a recess formed, in which is placed or fixed another set of markers, symbols, or contrivances, and this recess is provided with a sliding cover which operates in a manner similar to the cover first described.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated August 3, 1869.

2319 J. Pinchbeck, Whiskin-street, Clerkenwell, Middlesex. Improvements in gas meters.

2320 H. Turner, Hazel House, Plaistow, Essex. Improvements in high and low pressure expansive condensing steam engines for marine and other purposes.

2321 C. D. Abel, Southampton-buildings, Chancery-lane. Improved mechanism for converting reciprocating rectilinear motion into rotary motion, and for converting rotary motion into reciprocating rectilinear motion.

2322 E. Beanes, Cordwalles, near Maidenhead, Berks. An improved process for re-working wrought iron.

2323 A. Louden, Ceres, Fifeshire. Improvements in taps or cocks used for drawing off water and other liquids from casks or other vessels.

2324 T. Grace, Bristol. Improved apparatus for stoppering bottles.

2325 W. E. Gedge, Wellington-street, Strand. An improved curry comb.

2326 C. Tuer, R. Howarth, and J. Pimbley, Farnworth, Lancashire. Improvements in machines for polishing threads.

2327 J. T. Way, Russell-road, Kensington, Middlesex. Improvements in the manufacture of manures and in the purification of gas.

2328 J. T. Way, Russell-road, Kensington, Middlesex. Improvements in the manufacture of soap, and in cleansing wool and woollen goods.

2329 J. Bapty and A. Hall, Massachusetts, U.S.A. A new and useful improvement in mechanism for spinning wool or other fibrous matters.

2330 I. Davies, Harborne, Staffordshire. Improvements in rotary gas exhausters.

Dated August 4, 1869.

2331 T. Livesey and T. Abbott, Blackburn, Lancashire. An improved mode of boiling size, and in the apparatus employed therein.

2332 E. H. de Bodmer, Boulevart de Strasbourg, Paris. A new kind of carriage wheels with springy spokes and eccentric nave.

2333 F. C. Colney, Boulevard Bonne Nouvelle, Paris. Improved mechanism for the propulsion of vehicles.

2334 G. Broadhurst, Manchester. Improvements in waterproof capes, cloaks, and leggings.

2335 G. S. Hazlehurst, Runcorn, Chester. Improvements in mechanism or apparatus to be employed as a medium of communication between passengers, guard, and engine driver on railway trains.

2336 J. Booth, Shipley, Yorkshire, and R. W. Morrell, Bradford, Yorkshire. A new or improved textile fabric.

2337 W. T. Ramshill, Abinger-road, Deptford, Kent. Improvements in the construction of heels for boots and shoes.

2338 G. C. Ramsay, Aldermanbury, Middlesex. Improvements in circular boxes.

2339 J. Taylor, Herne Bay, Kent. An improved attachment or device for balancing toilet and other looking glasses.

Dated August 5, 1869.

2340 A. Tylor, Newgate-street, City. Improvements in apparatus for regulating, adjusting, and comparing the standards of measures.

2341 J. Elce and R. Bond, Manchester. Certain improvements in self-acting temples for looms.

2342 W. Brown, Smethwick, Staffordshire. Improvements in machinery for rolling rails and girders, and other sections of iron and steel and other metals.

2343 G. W. Murray and G. M. Garrard, Banff Foundry, Banff, North Britain. Improvements in means or apparatus employed in ploughing and tilling land.

2344 J. U. Fairbairn, Southampton, Hants. Improvements in the construction of velocipedes.

2345 E. Beanes, Cordwalles, near Maidenhead, Berks. Improvements in preserving articles of food.

2346 B. J. B. Mills, Southampton-buildings, Chancery-lane. Improvements in meters for measuring liquids and gases.

Dated August 6, 1869.

2347 E. Cocking, Bradford, Yorkshire. Improvements in the construction of easy chairs, and in the ornamental nails for the upholstery of the said chairs, which said improvements, wholly and separately, are also applicable to reclining seats, couches, wheel chairs, and other articles of furniture.

2348 E. Rihoux, Paliseul, Luxembourg, Belgium. A life-preserving dress.

2349 J. and A. Garde, Boulevard Bonne Nouvelle, Paris. An improved ventilating hat.

2350 B. Hunt, Serle-street, Lincoln's Inn. A new or improved numbering register or apparatus.

2351 W. B. Rust, Sheffield. An improved portfolio or case for the preservation of letters and documents in an alphabetical or other orderly manner.

2352 C. J. Chubb, Endsleigh-street, Tavistock-square, Middlesex. Improvements in drills and apparatus for boring holes in coal, hard ground, slate, and minerals.

2353 T. Leach, Tramere, Chester. An improved composition for coating the bottoms of iron ships and other navigable vessels, and marine works, to preserve the same and prevent the adhesion of animal and vegetable matter thereto.

2354 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in devices for holding the chimneys of gas burners and other lighting apparatus.

2355 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in expanding drills for boring rocks.

Dated August 7, 1869.

2356 W. Tongue, Brixton, Surrey. Improved means, apparatus, and machinery for generating elastic vapours and applying such vapours for producing motive power.

2357 E. W. Hawes, Balmoral Lodge, Clontarf, Dublin. Improvements in the construction of buoys and other floating sea-marks.

2358 W. Manwaring, Britannia Works, Banbury, Oxon. Improvements in harvesting machines.

2359 D. Ridge, Smethwick, Staffordshire. An eccentric lever polygonal boring brace, to be used in place or in lieu of the ordinary ratchet brace.

2360 G. Nickerson, Barningham, Suffolk. Improvements in apparatus for raising and stacking straw and other agricultural produce.

2361 W. Guest, Ardwick, Manchester. Improvements in clearers used in machinery for preparing and spinning cotton and other fibrous materials.

2362 H. Brandreth, Manchester. An improved arrangement and construction of cutter to be employed in the manufacture of saw handles and other articles of a similar description.

2363 I. Brown, Elm Croft Grange, Edinburgh. Improvements in irrigating and manuring land, and in the apparatus or means employed therefor.

2364 W. E. Newton, Chancery-lane. An improved process for purifying or disinfecting alcohol and alcoholic liquors.

2365 J. Mitchell and T. Settle, Bolton, Lancashire. Improvements in the manufacture of Marseilles quilts.

2366 A. B. Ibbotson, Sheffield. Improvements in joints for uniting and securing the ends of railway rails.

2367 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for sowing and covering seed and for cultivating land.

2368 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for combing fibrous materials.

2369 J. T. Greenfield, Pencester-street, Dover. Improvements in life buoys.

2370 G. Ritchie, Belmont Villa, Tyrwhitt-road, Lewisham-road, Kent. Improvements in the construction of tents and sunshades or weather protectors suitable for carriages and other vehicles.

2371 A. C. F. Franklin, Abingdon-street, Westminster. Improvements in bearings and lubricating apparatus for screw propeller and other revolving shafts.

Dated August 9, 1868.

2372 G. Rastall, Manchester. Improvements in velocipedes.

2373 J. Quinton, Moorgate-street, City. An improved tobacco pouch.

2374 S. Osborn, Sheffield. Improvements in knives and knife bars for reaping and mowing machines.

2375 J. Staniar and S. Dawson, Manchester, and E. Davies, Birmingham. An improved arrangement of mechanism or apparatus to be employed for the purpose of dressing or distributing the different qualities of ground or pulverized grain into compartments or chambers.

2376 J. Froggat, Lenton, Nottinghamshire. Improvements in pickers employed in the process of weaving.

2377 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of felted fabrics, and in the application of such fabrics to the manufacture of hats and other useful purposes.

2378 C. E. Brooman, Fleet-street, City, patent agent. Improvements in means or apparatus for carrying or storing eggs.

2379 A. Turner, Leicester. Improvements in utilizing waste strips of india-rubber, and in machinery for cutting sheet rubber into thread.

2380 H. Wimshurst, Attenburg-terrace, Wandsworth-road, Surrey. Improvements in marine propellers, and in vessels to receive the same.

2381 G. F. Ansell, Bernard-street, Russell-square, Middlesex. Improvements in the manufacture of iron and steel.

2382 W. R. Lake, Southampton-buildings, Chancery-lane. An improved apparatus for adding numbers.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following uumbers:—

1489	2201	2221	2238	2247	2257	2267	2275
2059	2203	2223	2239	2248	2258	2268	2277
2079	2205	2225	2240	2249	2259	2269	2278
2113	2207	2227	2241	2251	2261	2270	2280
2128	2209	2231	2243	2252	2263	2271	2282
2129	2211	2233	2244	2254	2264	2272	2284
2133	2215	2235	2245	2255	2265	2274	2286
2169	2217	2237	2246	2256			

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," August 10, 1869.

930 D. Jones
931 F. Parker
936 W Riddell and T. Bletcher
937 F. B. Taylor
951 A. Muir
952 M. M'Leod
956 T. E. Williams
959 T. G. Webb
965 T. A. Dillon
967 A. F. Baird
981 T. Lippiatt
982 J. Caldwell
983 C. Lange
985 G. Holcroft and W. N. Dack
987 E. O'Connell
989 C. D. Morton
990 T. Higgins
993 G. H. Wilson and G. E. Pullen
995 W. Bayne and O. E. M'Gregor
996 G. H. Smith
1006 M. Wolfsky
1012 U. Scott
1018 F. W. H. Medhurst
1037 J. M. Johnson
1051 J. and J. Menzies
1058 G. Ashcroft
1060 L. Mond
1061 W. E. Newton
1088 A. V. Newton
1102 D. B. Peebles
1121 E. Beanes
1135 A. V. Newton
1140 J. Leechman
1169 J. H Johnson
1215 W. R. Lake
1388 T. Welton
1396 W. Galloway
1485 F. Hedley
1540 G. Martin
1646 W. R. Lake
1746 A. C. Engert
1801 W. A. Lyttle
1820 W. E. Newton
1890 E. H. C. Monckton
1973 R. Heyworth
1989 A. Turner
2052 A. V. Newton
2148 R. P. Williams
2171 J. Imray and G. G. M. Hardingham
2173 W. Leftwich
2183 T. Thomas
2211 A. C. Kirk
2217 H. Knight
2242 G. T. Bousfield
2248 W. Dredge and A Stein
2263 E. Attenborough
2287 H. A. Bonneville
2288 H. A. Bonneville
2311 W. R. Lake

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 6, 1869.

380 T. Nichols and J. Parr
385 O. Sarony
395 J. and G. W. Dennell
396 J. Wilkinson and W. Scott
407 G. Gros
410 J. Stuart
412 W. Lever
414 C. T. E. Lascelles
416 J. F. Bentley
420 J. Clayton
427 P. J., F. W., and H. G. Smith, and A. Pappenberger
438 W. H. Hayhurst
492 J. Darlington
1253 W. B. Dick
1504 D. Hitchen
1581 W. Morris
1868 W. R. Lake
1869 W. R. Lake

Sealed August 10, 1869.

434 H. Edwards
437 F. J. Vandenvinne
440 T. V. Trew
441 G. H. Morgan
446 C. Gordon
448 J. Holmes
451 E. G. Brewer
476 J. Fletcher
479 J. W. Yates
499 J. A. Wade and J. Cherry
539 J. and W. Weems
599 J. T. H. Richardson
602 J. Reap and W. H. Michelmore
607 W. Thomas and W. Davis
767 J. Cooke
918 T. Sowden and J. Newton
922 H. Downie and I. B. Harris
934 J. W. Girdlestone
944 A. Clark
1011 J. Howden
1180 J. H. Johnson
1289 R. Sterne
1526 E. C. Warburton
1574 J. Platt
1691 H. Browning
1739 H. Downie and I. B. Harris
1456 J. G. M'Kirdy
1871 T. Bourne
1917 D. B. Park

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2059 C. F. Cotterill
2113 W. Tranter

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2198 J. Townsend
2227 J. Tatham
2311 S. A. Bell and T Higgins
2448 H. L. Emery

LIST OF SPECIFICATIONS PUBLISHED

For the week ending August 7, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3748	1 4	3847	0 10	3942	0 8	3963	0 4	3984	0 4	11	0 4
3789	2 0	3852	0 6	3948	0 4	3965	0 4	3991	0 4	12	0 4
3793	1 0	3857	1 0	3949	0 4	3966	0 4	1	0 4	14	0 4
3800	0 10	3858	1 2	3954	0 4	3967	0 4	3	0 4	22	0 4
3803	0 10	3874	0 6	3956	0 8	3970	0 4	4	0 4	26	0 4
3813	0 8	3875	2 4	395[illegible]	0 4	3973	0 4	5	0 4	42	0 4
3814	0 6	3878	0 8	3960	0 4	3975	0 4	8	0 4	54	0 10
3831	1 4	3894	0 8	396[illegible]	0 4	3978	0 4	9	0 6	128	0 8
3834	0 6	3904	0 8	396[illegible]	0 4						

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 20, 1869.

THE BRITISH ASSOCIATION, 1869.

THE history of the British Association for the Advancement of Science has been so frequently given in the pages of the MECHANICS' MAGAZINE, and is now so well known to all who take an interest in science, that it would be superfluous here to repeat it. The present is the thirty-ninth annual congress of the Association, and its career has been one continued practical comment upon its name. It has ever sought the advancement of science, not merely by annual gatherings and the reading and discussion of papers, but by substantially aiding the development of science by monetary grants. The first three years of its existence were not, indeed, marked by this feature, but subsequent years have been and still continue to be thus distinguished. Sir David Brewster, the venerated "father of the Association," as he is justly termed, proposed at the first to work without corporate funds or outlay, beyond that attending the immediate purposes of the annual gatherings. But it soon became clear that the Association, to be of practical benefit to science, must work upon other principles. This it did, and in the fourth year of its existence—1834—it made its first modest grant of £20 to science. The next year, however, £167 was applied to that purpose, and this amount went on gradually increasing until in 1839, at the Birmingham meeting, £1,595 was granted. The largest grant ever made was at the Norwich meeting last year, when £1,940 was the amount allotted. Altogether, since 1834, upwards of £32,000 has been granted by the Association for the carrying out of scientific objects outside the operations of its own annual meetings. Such have been the popularity and success of the meetings, and such the impetus given to all departments of inquiry—chemical, astronomical, geological, geographical, and statistical—that money has flowed freely into the coffers of the Society. Had the Association done nothing more than produce its wonderful astronomical catalogue, its elaborate meteorological and magnetic observations, and its contributions to various abstruse departments of mathematical and physical science, it would have been fully entitled to take rank as a great national institute. But it has done far more than this; it has, on several occasions, stimulated the Government and Parliament of the country to put forth efforts in behalf of great scientific and humane enterprises.

Various towns and cities have at various times had the honour of receiving the British Association, some of them more than once. It is now the turn of the good old city of Exeter to do honour to and to be honoured by the assembling of the *savants* of the present day. And the visit of the Association is the more opportune and appropriate inasmuch as there are two scientific institutions just ready for opening. These are the Albert Memorial Museum and the Victoria Hall of Science. These buildings will be inaugurated upon the present occasion, and will thus be for generations to come associated with the visit of the men of science in 1869 to the city which they grace. It is now more than three years and a half since the first step was taken in Exeter which led to the holding of the Science Congress of 1869 in that city. The originator of the movement was Mr. H. S. Ellis, of Fair Park, who, in January, 1866, started the proposal to invite the Association to meet in Exeter. In last November, when the invitation had been accepted and preparations were making to entertain the learned guests, Mr. Ellis was elected mayor of the city by common consent, as a fitting recognition of his exertions to bring so much honour to Exeter. The executive local committee consists of the following gentlemen:—Dr. Blackall, Messrs. S. S. Bastard, W. Buckingham, Lieut.-Colonel Brent, Messrs. W. Cann, John Daw, R. R. M. Daw, W. S. M. D'Urban, G. T. Donisthorpe, Rev. W. David, Messrs. C. J. Follett, A. H. A. Hamilton, Joseph Harding, J. Hayward, R. T. Head, R. W. Head, Kent Kingdon, R. M. Lingwood, W. Mortimer, C. H. Roper, E. A. Saunders, Dr. Scott, Messrs. C. L. M. Teesdale, J. Trehane, Charles Tucker, H. D. Thomas, C. A. W. Troyte, J. E. C. Walkey, C. Wescomb, and the hon. treasurers and hon. secretaries *ex officio*. These were subdivided into finance, buildings, conversazione, lodgings, and railways and excursions committees. The labours of these gentlemen to promote the interests and welfare of the visitors, and to give the Association a fitting reception, have been most untiring, and will assuredly render the meeting of the British Association in Exeter in 1869 a complete success.

THE GOLD COINAGE OF ENGLAND.

IT was intended that the fallacy of Mr. Lowe's proposition for reducing the weight of the sovereign without reducing its value should be demonstrated in our columns this week. Since our last issue, however, Mr. Hubbard, through the medium of the "Times," has so completely forestalled us that it is unnecessary to carry out our plan. We need not attempt to "slay the slain," and, no doubt, the Chancellor of the Exchequer himself now wishes that he had not entered the lists in the teeth of so many unknown but doughty knights. Mr. Hubbard's statements are positively fatal to Mr. Lowe's arguments, but the illustrative experiment introduced at the close of the Bank director's letter closes the ground over those arguments. They are now dead and buried, past hope of resurrection. Mr. Hubbard thus inflicts the deadly blow. "They hold," that is Mr. Lowe and his backers—the Master of the Mint and Col. Smith—"that a coinage charge enhances the value of a coin. English sovereigns are coined free, Australian sovereigns are coined at a charge of one per cent. for coinage. They value, therefore, 100,500 Australian sovereigns for 100,000 English. I propose to meet Australia half way and deliver to Mr. Smith or Col. Smith, at Madras or Bombay, 100,000 Australian sovereigns for 100,000 English sovereigns. We shall each hope to gain 500 sovereigns. The operation, if satisfactory, can be repeated, and the result shall be duly reported to the Chancellor of the Exchequer." If this be not a fair sample of the destruction of a sophism by the process known as that of the *reductio ad absurdum* we are much mistaken. The next time Mr. Lowe submits himself to a "cramming" operation let us hope that his "crammers" may better understand what they are about, and not place him and themselves in so humiliating a position as they now occupy.

The weight of the English sovereign must on no account be interfered with, whether its standard of fineness be touched—and this is to be deprecated—or not. The probability is that no more will be heard, officially, of Mr. Lowe's wild and impracticable scheme of debasement. A far more practical consideration in reference to the gold coinage of England than the lessening of the weight of individual pieces, is that of increasing their durability. Mr. Lowe has stated, on the authority of Mr. Jevons, that the average length of the life of an English sovereign is eighteen years. After that time wear and tear have so told upon its constitution that when "weighed in the balance" it is inevitably "found wanting," and is doomed to be remelted. It has been already shown in these columns that very great pains are taken at the Mint to produce sovereigns of nearly equal and true standard weight, and that in reality those issued to the Bank are virtually correct, when dealt with in sensible quantities. Another very important question is, Are they manufactured in such a way as to give them the maximum of resisting power to the abrading influences they will have to encounter? Is it not rather the truth that those parts of the coin which are to be brought into immediate contact with the hard surfaces of tables and counters are soft, and easily wearable, and that they must be reduced very quickly by force of attrition? It will be perceived that this latter question cannot be answered other than in the affirmative, and that the former must receive a negative reply.

Gold coins obtain their impressions by pressure, just as sealing wax is ornamented by the forcible application of a stamp. In order to make the gold discs impressionable they have to be softened by heating in an oven, or annealed, as the technical term is. When this has been accomplished they are placed between dies and struck. The striking depresses and hardens those parts of the embryo sovereigns which do not require hardening, and leaves prominent and soft (by annealing) those which will have to sustain the chafing and rubbing inseparable from the duties of circulation. This, then is an evil born with the coin, and which hastens it to its grave. The "protecting edges," as they are termed, afford no protection to the devices on the coin, but are speedily ground down with them. Thus the allowance made in weight for abrasion is soon disposed of, and the piece becomes "light." In order to obviate this inconvenience, the stamping process of the Mint should be made to administer two blows to each gold coin before it is suffered to leave the dies. One of these would give the impressions, and the other would harden the piece of money, and prepare it for its work. There is no doubt that the second squeeze would add at least a dozen years to the life of a sovereign.

Whether the Mint authorities will entertain this proposition or not is doubtful. Probably they may not appreciate its value, for it has been stated that during the last six months about half-a-million of sovereigns have been annealed at that place after stamping as well as before. If this be true, that half-a-million of coins will not last six months after being issued, that is to say, they will have become light in half a year instead of wearing the eighteen years spoken of by Mr. Jevons. It is scarcely credible that so serious a mistake can have been fallen into, but the parboiled and scratchy appearance of many sovereigns in circulation justifies the belief that it has. Had the Chancellor of the Exchequer taken counsel of practical men as to the best mode of increasing the longevity of our gold currency, and given instructions for renewing our disgraceful silver coinage, he had entitled himself to public gratitude; as it is, he has simply invoked public ridicule or excited the grief of the judicious few.

MANUFACTURE OF CAPS AND CARTRIDGES.

No. IX.

FROM the results of the experimental testing and firing of the completed cartridges, it appears that the *fusil á tabatière* is hardly so much appreciated as it ought to be. It possesses the advantages of being loaded with facility, being readily disembarrassed of the empty cartridge case, and is infinitely simpler in its construction than the more complicated and well-known Chassepot. Having described all the details connected with the manufacture of war cartridges, those belonging to the

other description, intended for the peaceful purposes of sport and the chase, will be now examined into. The general features of both kinds present many points of similarity, and some of absolute identity. Of the numerous varieties of sporting cartridges, those chiefly in use are the vertical and the central-fire examples. The latter description is yet manufactured, but on comparatively a small scale, although it has already partially superseded the original cartridge of Lefaucheux. The component parts of a cartridge fired by a vertical needle are the case, the copper endpiece or socket, the "renfort," the morceau, the chamber, the needle, and the priming. A whole workshop is appropriated to the manufacture of these sporting cartridges, for which there is an enormous demand. In order to effectually solve the problem of their economical and efficient production, M. Gevelot had several conditions to fulfil, which at first sight seemed attended with nearly insurmountable difficulties. One of the first steps to be effected was to render the cartridge air or gastight, so that not a particle of gas should escape at the back end of it when it was fired. Although the escape might not be sufficiently great to cause any injury to the firer, yet the result of the slightest leakage would be to diminish the projectile force due to the expansion of the gas, to reduce the range of the gun, and also to foul the parts in contact with the explosion. The property, therefore, of preventing all escape of gas is an absolutely essential one in the construction of a cartridge. In addition to possessing this indispensable qualification, the cartridge must also be easy of extraction after a shot, and must not undergo too great a dilatation, in consequence of the high temperature to which it is exposed by the ignition of the powder. It must likewise come away in a sound, entire condition, without being torn or mutilated by the discharge, or otherwise the bits that would be detached would interfere with the accuracy of the fire, and necessitate, besides, the frequent cleaning of the weapon. As a last desideratum, their price must be sufficiently moderate to render them suitable to all classes of sportsmen. All these conditions are fulfilled by the cartridges manufactured at present, and they are sold at 15s. 6d. the thousand. To arrive at some estimate of the extent to which the manufacture of sporting cartridges has attained, it may be mentioned that M. Gevelot despatches from his premises every year about 35,000,000, a quantity that will be exceeded next year. Of this number, 12,000,000 are exported—some to Germany, England, and Italy, and others to Spain and Southern America.

There are several varieties of sporting cartridges, but the essential characteristics are common to all. In the first place, a brass endpiece is let into a matrix having a diameter equal to the required bore. The second component piece consists of a solid paper cylinder covered with size, and rolled round a mandril of small diameter. It is in this cylinder that, at the time of the pressure, a punch forms the chamber, where, at a later period of the manufacture, are placed the priming and the two small semi-cylindrical projections, one of which serves as a conductor to the needle, and the other as a support to the priming. A hollow paper tube rolled round a mandril constitutes the third piece. It is subsequently dried and brought to the necessary diameter, and with the brass socket end and cylinder already mentioned completes the cartridge case, which is now ready for striking. The needle is of brass wire cut to the proper length, and its two extremities turned in a different manner. A conically shaped point is given to the end which explodes the priming, while that which is struck by the hammer has a spherical cap-like appearance. The priming consists of fulminate of mercury enclosed in a small brass pan. The cartridges of a better description differ in some respects from the others. The copper ends are deeper, and the paper is of a better quality. Besides, there is a "renfort" or small cylinder of paper or tinsel which virtually doubles the thickness of that portion of the cartridge case, where the pressure from the explosion of the charge is greatest. The priming also is of a better description. We shall now proceed to describe successively the various operations which are executed in the combination of these several parts. The "renfort" is a cylinder of paper or of tinsel, and is prepared by rolling a sheet of either material round a mandril. When it is composed of paper it is coated with paste, and when of tinsel, it is covered with an external cylinder also of paper to prevent it unrolling. In the interior of the "renfort" is enclosed another cylinder of cap paper and paste, termed the "bit." The "bit" is cut out of a roll of paper sheets piled round a core, and between which are placed thick layers of paste. After being dried either in the open air or in a warm current, the rolls and tubes are mechanically cut by small apparatus worked by women. With one hand they push the roll into the interior of a cast-iron cylinder, which has six apertures in it to allow of the passage of a corresponding number of the blades of a circular knife. This knife revolves with great rapidity, and by means of it each woman can cut about 20,000 "bits" per diem. Some of these knives have as many as twenty-five blades. The cartridge case, which is represented to full size in fig. 1, is a hollow

FIG. 1

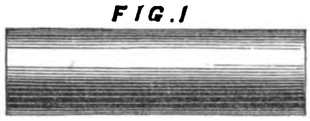


FIG. 2

cylinder cut out of paper tubes rolled round a mandril, and coated not with the ordinary paste, but with a peculiar description made from the skins of rabbits, which are brought to the establishment either in whole skins or in strips. This glue or paste is of an exceedingly adhesive character, and is applied to the paper hot. Upon the tables before the workwomen is placed a copper disc or plate, which serves to roll up the paper on to the proper form and spread the glue on it. So soon as the case is thoroughly dried, the next step is to render it polished and sufficiently smooth to glide easily in the gun. This is accomplished by pushing it over a mandril, and passing it by both extremities successively through a ring, thus bestowing upon it the satin-like appearance so well known in newly made cartridges. The cases are cut to the required dimensions by circular knives, in the same manner as the "bits," which are placed inside the "renforts." In the interior of the "bit," a copper chamber in the form of a cap is fixed by a blow of a lever. The "bit," together with the chamber, is shown in fig. 2. While these operations are in progress at the premises of Moulineux, the brass ends are in process of manufacture at the workshops at Rue Notre Dame des Victoires, where they are stamped and annealed.

THE CONSTRUCTION OF HEAVY ARTILLERY.

THE name of Mr. Lynall Thomas has for long past been associated with the development of the true principles of the science of artillery. Some ten years since, he started his theory of the nature of the action of gunpowder, which he calls the percussive theory. He has now, in a pamphlet* of seventeen pages, developed this theory in a most skilful manner, and has laid down the true basis upon which heavy artillery should be constructed. In order to prepare our minds for the reception of his ideas, Mr. Thomas begins by sketching the theory as laid down by Robins and Hutton, and which was even by them considered faulty. Of course it must be borne in mind that those two students in this field of science laboured principally with a view of ascertaining the effects of a discharge as far as the velocity of the shot and its curved path, &c., were concerned, and the errors of their theory were not brought forth in those startling colours which more recent experiments have imparted to them. They had no such great and costly guns to deal with as we have now; and the bursting of one of their 32-pounders was not so serious a matter to them as similar accidents which are continually depriving us of the substantial results of immense labour and expense are to us. It soon became evident, on the introduction of heavy rifled ordnance, that not only was something wanting to render the rules laid down in the old theory applicable, but that there was some radical and serious error. Large guns which had been constructed at a fabulous cost and were regarded as most perfect specimens of mechanical ingenuity, exhibited such symptoms of premature decline on being tested by charges less than they were intended to carry as to baffle the skill of the most experienced engineers. Some of these destructive engines bulged, and so became unfit for service; others, although preserving their external form, were found after being used for a short time, to have contracted in some mysterious manner a steadily corroding disease, whilst others, again, in a still more alarming fashion, burst into fragments and disappeared with the charge that rent them.

The profession was utterly unable to account for these untoward mishaps. The elder members of the profession, no doubt, congratulated themselves on having been educated in a school in which the construction of such massive pieces was never contemplated, whilst the younger members escaped from the dilemma by asserting that gunpowder was not subject to the control of the laws that regulate the operation of physical or chemical forces. In fact, these irregularities were regarded as nothing more nor less than freaks of nature. It is from this painful state of uncertainty that Mr. Thomas promises to relieve us, and we have every reason to hope, from the suggestions offered in his pamphlet, that his promise will be performed. The word "percussive" conveys to us as much information as names and definitions generally do. In the first place, it is laid down that the whole charge is not inflamed at one and the same instant. This important fact will not be disputed, as it has been already recognized by nearly every writer on the subject. Mr. Thomas then proceeds to assert that that portion of the charge which has been converted into gas impinges with a terrific velocity upon the shot, and begins to expel it before the whole charge is completely consumed, or its force fully developed. This fact, no doubt, induced Mr. Thomas to adopt the phrase "percussive theory," for, as he subsequently says, "the whole time that elapses between the ignition of the charge and the expulsion of the shot from the pieces is scarcely sensible." So far the action of the portion of the charge initially inflamed is of an impulsive or percussive nature, generating, as it does, velocity in the shot in an indefinitely short period of time. After this we arrive at the gist of the whole theory. "Whilst the shot is traversing the initial space the rest of the charge is undergoing complete conversion into gas, and when such conversion has taken place the gas rushes forth in the direction of the axis of the bore." This volume of gas by means of its kinetic energy condenses a portion of itself in that space that has been just vacated by the shot.

Mr. Thomas then proceeds to narrate how he was induced by these considerations to make a series of experiments for the purpose of ascertaining the relation

* The True Basis for the Construction of Heavy Artillery. By LYNALL THOMAS. London: F. TAYLOR and FRANCIS, Red Lion-court, Fleet-street. 1869.

between the initial velocity of the shot, its own weight, and that of the powder employed. Four laws are stated as the results of his observations. By the aid of these laws he deduces expressions for the initial velocity, the tensional strain, and the corroding effect of the pressure. It is then shown how the weights of the powder and shot may be varied according to circumstances without altering the strain on the gun.

It must be confessed that there is something very plausible in this theory; the principles which it embodies are being daily recognised by those who have had experience in gunnery. We hope that our authorities will soon take the important subject into consideration. We shall ourselves hail with delight the establishment of a theory which promises to ensure the safety and perfection of those mighty instruments for the preservation of peace, and to relieve us from the fear of having such gigantic offsprings of labour and ingenuity cut off by any more erratic freaks on the part of nature.

SOMETHING NEW IN PHOTOGRAPHY.

A FEW weeks ago, an announcement was made by Mr. Thomas Sutton, B.A., a scientific gentleman well known to photographers, that he had discovered a new and excessively rapid process of taking negatives. So rapid was it, he stated, that it was too sensitive for use with very quick-acting lenses without stops, and it altogether eclipsed the ordinary wet process. These and other similar announcements were made in his contributions to the "Illustrated Photographer," accompanied by some of the details of the process, and the withholding of some of the essential particulars. The full particulars were to be published in a pamphlet, which pamphlet is now out and lying before us,* we mean, lying on the table before us.

Upon examination of the pamphlet it appears that the process is still a secret one. A special kind of collodion prepared with a special description of pyroxyline is to be used, but the formula for making this collodion is withheld. Those who want it must, according to the pamphlet, go to Mr. Sutton's agents, and buy it at ten shillings per bottle. Had any other man pursued this course, his pamphlet would have been considered as an impudent trade puff by the majority of photographers. In the case of Mr. Sutton, it is a very great error in judgment, and only his long-standing reputation as a skilful scientific photographer, indefatigable in his researches, will save this false step of his from the condemnation a similar line of action would have brought down upon the head of an untried man.

But Mr. Sutton would not commit himself so deeply respecting a new process without it had some merits, so we give the details as far as they have been revealed. In fact, they are all plain enough, with the exception of the kind of collodion used. This collodion contains no soluble iodide, so probably is much the same as the bromised collodion used in Major Russell's tannin process. The coated plate is sensitized in a bath of pure neutral nitrate of silver, strength eighty grains to the ounce of distilled water. Mr. Sutton recommends that the nitrate of silver be also bought of his agent. The time the plate should be left in the nitrate bath is longer than with an iodized collodion; about five minutes would be the time in warm weather, and longer when the temperature is low. It is next immersed for five minutes in a first bath of distilled water, and then placed in a large pan of distilled water, where it may remain some hours, if necessary, until required for use. When that time comes the plate should be washed with a little pure rain or distilled water poured over it from a jug, after which the "organifier" should be applied. Mr. Sutton suggests the substitution of the word "organifier" for "preservative," and in many respects the change is an improvement.

The organifier is composed of:—

Distilled water	1 fluid oz.
Neutral gelatine	3 grains.
Sub-carbonate of soda	3 grains.

The gelatine is dissolved in warm water, then the alkali is added, and the whole filtered through three folds of calico. Nelson's patent gelatine should be used, for acid samples, like most of those of commerce, are worthless, and the sample when dissolved should be tested to see that it does not redden litmus paper. The developer consists of three solutions, which must be mixed and filtered immediately before wanted for use. The solutions are:—

No. 1.	Pyrogallic acid	3 grains.
	Distilled water	1 oz.
No. 2.	Bromide of potassium	20 grains.
	Distilled water	1 pint.
No. 3.	Liq. ammoniæ fortis	1 oz.
	Distilled water	1 pint.

The developer is made by adding twenty minims of No. 2 and twenty minims of No. 3 to one ounce of No. 1.

After the plate is taken out of the camera it should be well rinsed with pure rain water, and the developer applied. The development is slow. In about one minute the details begin to appear, and in from five to ten minutes they are well out, supposing the right time of exposure to have been given. When developed the picture should be well and carefully washed with water from a jug to remove all traces of alkalinity, after which it may be intensified by any of the known methods. Mr. Sutton uses an intensifying solution composed of two grains of pyrogallic acid and thirty minims of acetic acid to the ounce of water, to which is added, just before application to the plate, a few drops of a 30-grain pure nitrate of silver solution. The picture is then again washed, fixed with hyposulphite of soda, and then, after another very thorough washing, is finished and ready for varnishing.

Although no single portion of this process is new, as a whole it is certainly new, for we remember no wet process in which the plates have been alkaline all through the operations. Organifiers are weak developers, or substances having an affinity for oxygen. This tendency to absorb oxygen is increased the more they are rendered alkaline. Gelatine has rather a retarding action upon sensitive films, but, as shown by this process, the addition of an alkali until the verge of fogging is reached increases sensitiveness.

Supposing this process to be only half as sensitive as asserted by Mr. Sutton it is one of very great value, because of the difficulties such a process would remove in the way of obtaining instantaneous views of crowded thoroughfares, and other busy scenes of active life. It is too long and complicated to supplant the wet process in ordinary portraiture. All through the process it is necessary to guard against fogging from diffused white light in the dark room, or from diffused light in the camera or slides. Of course, the greater the sensitiveness the more care must always be taken in this respect.

We trust this process will receive a fair trial at the hands of skilful photographers, though such men do not haste to test every new plan, and Mr. Sutton's mistaken course of so strongly introducing the commercial element is not encouraging. The pamphlet has a neat appearance, and shows considerable taste on the part of its printers, Messrs. Gilbert and Rivington.

* Description of a New Instantaneous Wet Collodion Process. By Thomas Sutton, B.A. London: J. W. Green, 54, Paternoster-row. 1869.

THE TELEGRAPHS' BILL.

ONE of the latest Acts of the past Session was completing the "Telegraphs' Bill," bringing the Government scheme for the purchase of the telegraphs to a successful conclusion by the passing of a Bill authorising the money required for the purchase. The Bill obtained last year was for the purchase of the telegraphs without providing any money, leaving the matter between the Post Office and the various telegraph companies—a question of negociation and arbitration. Provisional agreements were then made, and during the course of the present year indefatigable exertions have been made to settle the amount to be paid to the several companies under their respective agreements. In some cases arbitrations had to be resorted to, and it is owing to the great time occupied by them that the Bill was brought before the House at so late a date as to warrant the fear that it would not become law this Session. It has, however, fortunately passed, slight alterations having been made in select committee, the principal portion of the time being taken up with hearing petitions. The important points in the present Act are the amounts to be paid for the acquisition of the "telegraphs," and the monopoly given to the Post Office.

The preamble recites the objects of the previous and present Acts, which clause 1 enacts may be cited together as the Telegraph Acts, 1868-1869. Clauses 4 and 5 give the monopoly to the Post Office. "The Postmaster-General, by himself or by his deputies, shall from and after the passing of this Act have the exclusive privilege of transmitting telegrams within the United Kingdom of Great Britain and Ireland, and shall also within that kingdom have the exclusive privilege of performing all the incidental services of receiving, collecting, or delivering telegrams." The following descriptions of telegrams are excepted:—Telegrams transmitted by private telegraph for which no charge is made, such as sent by a telegraph maintained and used solely for private use. Telegrams transmitted by a telegraph maintained for the private use of a corporation, company, or persons for which no money or valuable consideration is given. Telegrams transmitted with the written license or consent of the Post Office. Telegrams transmitted by a telegraph company existing on July 22, 1869, the undertaking of which has not been acquired by the Post Office. Transmission of telegrams authorised by the Act of 1868. And telegrams transmitted to or from any place out of the United Kingdom. A penal clause is introduced for contravention of the Act in transmitting telegrams. Powers are also taken for acquiring any undertaking not already agreed to, and a clause is introduced enabling companies to require the Postmaster-General to purchase their undertaking, provided that the Postmaster-General shall not be required to purchase the whole or any part of the undertaking of any company engaged in the transmission of telegrams to or from any place out of the United Kingdom.

In consequence of petitions and efforts made in the select committee the following clause was introduced:—"The Postmaster-General may, upon the reasonable request in writing of any company or person constituted for the transmission of messages to or from any place out of the United Kingdom, make all necessary arrangements for the transmission of such telegrams within the said United Kingdom and for the connection with that view of the cables or other apparatus of the Postmaster-General;" any question arising therefrom to be settled by arbitration, provided that the Postmaster-General may contract with any such company or person or with respect to the construction or use of wires and other telegraphic apparatus in connection with those of the Postmaster-General for the purpose of transmission of such telegrams."

The amount of money authorised to be raised is £7,000,000, and is distributed as follows:—For the purchase of the telegraph companies, £5,715,048; for railway companies, £700,000; and for the other pur-

poses of the Act, £300,000; making in all a sum of less than £7,000,000. The arbitration and agreements with all the railway companies are not yet concluded, so we cannot give the separate amounts, but the actual amount to be paid to the various telegraph companies will be as follows:—

Electric and International Telegraph Company	£2,938,826	9	0
British and Irish Magnetic Company	1,243,536	0	0
Reuter's Telegraph Company	726,009	0	0
United Kingdom Telegraph Company	562,264	9	11
Universal Private Telegraph Company	184,421	10	0
London and Provincial Telegraph Company	60,000	0	0
	£5,715,048	8	11

Such is the large sum to be paid for the undertakings of the various companies. The amount is undoubtedly enormously in excess of the capital expended, and the sum paid for the goodwill must be therefore taken as very considerable; the agreements were on the basis of a twenty years' purchase, at the rate of a certain specified month in last year. If the present Act had not been passed, the various agreements would have lapsed, and in bringing forward the Bill again, the Government would have paid very much more for a bargain that, all things considered, must be looked upon as a favourable transaction.

We are now upon the eve of this important change, the transfer of the telegraphs from private into Government hands, and we cannot but look upon it otherwise than we have always done, as tending to the great benefit of the public at large. A cheap telegraph service, one more extended, opening up fresh districts, extra facilities for telegraphing—all are before us. The one fear we have is that the extra and sudden increase of traffic will at first be too much for the present system, but that we shall fare worse than we do now is manifestly absurd. The entire system as it now is will be bodily transferred; there can therefore be no immediate difference, and there is every hope and probability of things being improved greatly for the better. The actual date of transfer will probably be on the 1st of the new year, preparations having evidently been made for that, as a vote was inserted in the estimates for the amount required for the telegraph service to March, 1870. The question and amount of work involved in the transfer must be very great, and we cannot well see how it can take place at an earlier date than that we have named.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

PROCESS FOR BLEACHING FEATHERS—METHOD OF DYEING LEATHER A LIGHT GREEN—NEW ALLOYS FOR SMALL BELLS—DECOMPOSITIONS EFFECTED BY LIGHT AND HEAT.

THE following is given by Dr. Artus as a perfectly new and very successful process for bleaching feathers, ostrich or goose. The feathers are first to be carefully cleansed from greasy matters, and are then immersed for three or four hours in a dilute solution of bichromate of potash to which a small quantity of nitric acid has been added. In this solution the feathers acquire a greenish colour from the deposition of oxide of chromium, in consequence of the reduction of chromic acid. The nascent oxygen developed in the reduction of course acts as the bleaching agent. To remove the green colour the feathers are afterwards placed in weak sulphurous acid, which dissolves the chrome oxide and leaves the feathers perfectly white. The darkest coloured ostrich feathers are said to be completely bleached by this process, and their value is of course greatly increased. The only precautions to be attended to are not to employ too strong a solution of bichromate of potash, and not to use too much nitric acid. As regards the treatment of goose feathers in this way, it has struck us that, besides being useful as a process for bleaching, it may be an admirable means of disinfecting feathers, and might be applied to the feathers of beds on which people with contagious diseases have lain.

From the same source we have a process for dyeing leather a light green colour. The skins stretched out in the usual way are to be brushed over with a mixture made by dissolving one hundred grammes of iodine aniline green in paste, and ten grammes of picric acid, in five grammes of sulphuric acid and twenty-five litres of water. The shade of colour can be deepened by giving several coverings to the leather. We do not know the aniline green mentioned above, but we suppose it is an article of commerce in Germany.

In the same country there are produced bells of remarkably clear bright tones, which attracted the attention of a chemist and induced him to see what the metal was composed of. He found the metal of a large house bell to be composed of 83·22 of copper and 16·76 of tin. A smaller house bell was composed of copper 83·09, tin 16·80. Another bell was made, copper 84·50 and tin 15·42. These three alloys are said to have a bright white colour like that of silver.

M. Morren, of Marseilles, has followed Dr. Tyndall in experimenting on the action of light on rarefied vapours and gases. Our English Professor, it will be remembered, occupied himself with the vapours of some organic compounds; the Marseilles Professor has experimented with some compound gases, and has found that they undergo a similar decomposition. Thus highly attenuated sulphurous acid exposed in Dr. Tyndall's tube to the electric light gave rise to a cloud of sulphur, which showed that the gas had been completely decomposed, or, as M. Deville would say, the elements were completely dissociated. The experiments of M. Morren show that the chemical rays alone are concerned in bringing about this dissociation, and he sees even in the effects of a heated platinum wire in causing the combination of oxygen and hydrogen, and in its power of decomposing water at the melting point, only the action of the luminous rays emitted.

It is generally believed that sun light is absolutely necessary to enable plants to decompose carbonic acid. M. Prilleux, however, has found that the artificial lights which contain chemical rays—such, for example, as the electric light, and that of burning magnesium—do afford sufficient stimulus to enable a plant to carry on the action, though at a much reduced rate. Thus a branch of potamogeton placed in water containing a little carbonic acid and exposed to sunlight gave off twenty bubbles of oxygen in a given time. Exposed to the electric light it gave off only eleven bubbles in the same time. The evolution of oxygen went on under gaslight, but was very much less.

THE BRITISH ASSOCIATION.

THE business of the thirty-ninth annual congress of the British Association commenced on Wednesday. The first business of the congress was a meeting of the general committee in the school of art in the Albert Memorial Hall, at one o'clock—Dr. Hooker, F.R.S., presiding.

The minutes having been read by the assistant secretary, Mr. Griffiths, and confirmed,

Professor Hirst read the report of the council for the year 1868-9, which was adopted.

The chief officers of the present congress are—

PRESIDENT ELECT—George G. Stokes, M.A., D.C.L., Sec. R.S., Lucasian Professor of Mathematics in the University of Cambridge.

VICE-PRESIDENTS ELECT—The Right Hon. the Earl of Devon, the Right Hon. Sir Stafford H. Northcote, Bart., C.B., M.P., Sir John Bowring, LL.D., F.R.S., William B. Carpenter, M.D., F.R.S., F.L.S., Robert Were Fox, F.R.S., W. H. Fox Talbot, M.A., LL.D., F.R.S., F.L.S.

GENERAL SECRETARIES—T. Archer Hirst, Esq., F.R.S., F.R.A.S., Professor of Mathematics in University College, London; Dr. Thomas Thomson, F.R.S.

ASSISTANT GENERAL SECRETARY—George Griffith, Esq., M.A.

GENERAL TREASURER—William Spottiswoode, Esq., M.A., F.R.S., F.R.G.S.

LOCAL SECRETARIES AT EXETER—Henry S. Ellis, Esq., F.R.A.S., John C. Bowring, Esq., the Rev. R. Kirwan.

LOCAL TREASURER—William Cotton, Esq.

Upon the officers of sections being proposed, Mr. Spence Bate requested that the name of Dr. Percival Wright should be added as a vice-president, which was acceded to at once by the council.

The inaugural meeting was held in the evening in the new drill hall, when Professor Stokes delivered an elaborate and lengthy address, which was repeatedly interrupted by well-merited applause. We regret that our space will only permit of an abstract of the learned Professor's

INAUGURAL ADDRESS.

The President commenced by giving an interesting account of the origin and purpose of the Association, which may be briefly stated to be the giving of a more systematic direction to scientific inquiry, and the organising of means for the prosecution of researches which require co-operation. Apart from the vast amount of time and thought which has been expended on researches through the medium of the society—which latter, at least, cannot be measured by any overt standard—something may be conceived as to what has been done by means of the pecuniary outlay caused by grants for defraying the expenses of such researches, and which up to the year 1867 amounted to £29,288 8s. 1d. When it is remembered that these grants were of small amount, and did not include personal expenses, and that many of the researches involved no money grants at all, some idea may be formed of the amount of scientific inquiry which has been evoked under the auspices of the Association.

Passing to a historical sketch of the most recent progress of science, the President took up the subject of astronomy; and, having traced its progress through Newton, Adams, and Le Verrier, he argued that it might have been supposed, after the brilliant achievements of these discoverers, that the field of astronomical research must have been well-nigh exhausted. But researches which have been carried on within the last few years, even the progress which has been made within the last twelve months, showed how shortsighted such an anticipation would have been, and proof had been given of the value of the union of one science with another, towards which the organisation of this Association had greatly contributed. In an elaborate but untechnical disquisition, admirably adapted to an audience which, whatever infusion of savans it might contain, could not be wholly scientific, Dr. Stokes explained how the sciences of astronomy and optics had acted upon and assisted each other, astronomy being indebted to optics for instruments essential to its development, while astronomy had repaid its debt to optics by an important result, namely, the first proof of the finite velocity of light, and the first numerical determination of that enormous velocity. By means of optics, and especially by means of the spectroscope, the motion and the masses of the heavenly bodies had been more fully revealed to astronomical observation. In some detail, the theory of "fixed stars" was next dwelt on, the result being laid down that the term was not wholly exact, inasmuch as it was proved that the stars, including the first and greatest of stars—the sun—or some of them at least, are moving in various directions in space, and that it is merely the transversal component of the whole motion, or rather of the motion relating to our sun, that is revealed to us by a change in a star's apparent place. In regard to determining whether any particular star is approaching or receding from the sun, astronomy alone was powerless to help researches; and here the science of optics came in in a remarkable manner. By an analogy, almost fanciful, but specially illustrative, between the sound of a bell and the vibratory movement of light, it was shown that, by means of optical science, evidence had been obtained that light consists of a tremor or vibratory movement, propagated in an elastic medium, filling the planetary and stellar spaces—a medium which thus fulfils for light an office similar to that of air for sound. Here opportunity was taken to illustrate the theory propounded by references to the researches in regard to the solar spectrum of Professor Kirchhoff, and the result of observations obtained by the use of a telescope furnished with a spectroscope of high dispersive power by Mr. Huggins, in the solar system, and which presented a grand conception of the unity of plan pervading the universe.

The President then turned to a recent application of spectral analysis, in the observation of the total eclipse of the sun, August 17, 1868; the use of which was carried out on that occasion by two expeditions from England, to the countries crossed by the line of central shadow, under the auspices of Captain Herschel and Major Tennent. The information received had proved to be most valuable, or, as Dr. Stokes phrased it, "most precious;" and was a special illustration of the reacting on

each other of astronomy and optics. This theme was still further worked out elaborately; and, in apologizing for dwelling upon it so long, the President adduced it as evidence of the value of the object of the Institution—that of a union or bringing together of the different branches of science. He congratulated the Association on having attained an object for which it has been labouring ever since 1849, namely, the establishment of adequate instruments for astronomical observations in the southern heavens, which had at last been achieved by the erection of a telescope at Melbourne, Australia, for which a grant of £5,000 had been made by the Colonial Legislature, and which is now under the superintendence of Mr. Le Sueur. A very interesting account was next given of the issue of an inquiry by a Royal Commission, appointed at the instance and by the pressure of the Association, into the application of gun-cotton to warlike purposes. It had been shown that there are some purposes for which gun-cotton can advantageously replace gunpowder, while its manufacture and storage can be effected with comparative safety. It had been spoken of highly, though only promisingly, for the use of small arms; though, even in the state of development to which it has attained, its application to great guns seems more doubtful. Next it was stated that, owing to the exertions of the Royal Society, soundings in great ocean depths had been undertaken by the Admiralty, and dredging had been carried down to more than 2,400 fathoms, and animal life had been found in that depth in considerable variety; while, in a depth of 650 fathoms, the existence was established of a varied and abundant fauna, at depths which had been supposed to be either azoic or occupied by animals of a very low type; besides which the character of the fauna and the mud brought up was such as to point to a chalk formation actually going on.

Diverging to an interesting personal topic, the President told them it was found impossible to make the Chancellor of the Exchequer understand that any contribution should be made out of the taxes paid by the people towards a memorial to a man like Faraday; and how happily that object would be carried out by the voluntary exertions of those who appreciated his individual and scientific merits. In regard to chemistry, it was stated that no great step had been made; but an account was given of the discovery of the existence of a red colouring matter obtainable from the wings of the turaco, or Plantain-eater, of the Cape of Good Hope, a bird celebrated for its beautiful plumage; and another of the improvement of alizarine, one of the components of madder, which occupies so important a position amongst dye-stuffs of calicoes. Again, it was stated that by the action of hydrochloric acid on morphia a new base was produced, whereby the narcotic properties of morphia were changed, so that it became a powerful emetic, unattended by injurious after-effects. In relation to mechanism, a graceful allusion was made to this being the centenary of the great invention, the steam-engine.

The last subject comprised in the address was the branches of science more or less concerned with the phenomena of life, in which the bearing of physical on biological science was dwelt upon. This was argued out with great minuteness and ingenuity, and concluded as follows:—But do the laws of chemical affinity, to which, as I have endeavoured to infer, living beings, whether vegetable or animal, are in absolute subjection, together with those of capillary attraction, of diffusion, and so forth, account for the formation of an organic structure, as distinguished from the elaboration of the chemical substances of which it is composed? No more, it seems to me, than the laws of motion account for the union of oxygen and hydrogen to form water, though the ponderable matter so uniting is subject to the laws of motion during the act of union just as well as before and after. In the various processes of crystallisation, of precipitation, and so forth, which we witness in dead matter, I cannot see the faintest shadow of an approach to the formation of an organic structure, still less to the wonderful series of changes which are concerned in the growth and perpetuation of even the lowliest plant. Admitting to the full as highly probable, though not completely demonstrated, the applicability to living beings of the laws which have been ascertained with reference to dead matter, I feel constrained at the same time to admit the existence of a mysterious something lying beyond—a something *sui generis*, which I regard not as balancing and suspending the ordinary physical laws, but as working with them and through them to the attainment of a designed end.

What this something which we call life may be is a profound mystery. We know not how many links in the chain of secondary causation may yet remain behind; we know not how few. It would be presumptuous indeed to assume in any case that we had already reached the last link, and to charge with irreverence a fellow worker who attempted to push his investigations yet one step further back. On the other hand, if a thick darkness enshrouds all beyond, we have no right to assume it to be impossible that we should have reached even the last link of the chain—a stage where further progress is unattainable—and we can only refer the highest law at which we stopped to the fiat of an Almighty Power. To assume the contrary as a matter of necessity is practically to remove the first cause of all to an infinite distance from us. The boundary, however, between what is clearly known and what is veiled in impenetrable darkness is not ordinarily thus sharply defined. Between the two there lies a misty region, in which loom the ill-discerned forms of links of the chain which are yet beyond us. But the general principle is not affected thereby. Let us fearlessly trace the dependence of link on link, as far as it may be given us to trace it, but let us take heed that in thus studying second causes we forget not the first cause, nor shut our eyes to the wonderful proofs of design which, in the study of organized beings especially, meet us at every turn.

Truth we know must be self-consistent, nor can one truth contradict another, even though the two may have been arrived at by totally different processes—in the one case, suppose, obtained by sound scientific investigation; in the other case, taken on trust from duly authenticated witnesses. Misinterpretations, of course, there may be on the one side or the other, causing apparent contradictions. Every mathematician knows that in his private work he will occasionally, by two different trains of reasoning, arrive at discordant conclusions. He is at once aware that there must be a slip somewhere, and sets himself to detect and correct it. When conclusions rest on probable evidence, the reconciling of apparent contradictions is not so simple and certain. It requires the exercise of a calm, unbiassed judgment, of looking at both sides of the question; and oftentimes we have long to suspend our decision, and seek for further evidence. None need fear the effect of scientific inquiry carried on in an honest, truth-loving, humble spirit, which makes us no less ready frankly to avow our ignorance of what we cannot explain than to accept conclusions based on sound evidence. The slow but sure path of induction is open to us. Let us frame hypotheses if we will; most useful are they when kept in their proper place, as stimulating inquiry. Let us seek to confront them with observation and experiment, thereby confirming or upsetting them as the result may prove; but let us beware of placing them prematurely in the rank of ascertained truths, and building further conclusions on them as if they were.

When, from the phenomena of life, we pass on to those of mind, we enter a region still more profoundly mysterious. We can readily imagine that we may here be dealing with phenomena altogether transcending those of mere life, in some such way as those of life transcend, as I have endeavoured to infer, those of chemistry and molecular attractions, or as the laws of chemical affinity in their turn transcend those of mere mechanics. Science can be expected to do but little to aid us here, since the instrument of research is itself the object of investigation. It can but enlighten us as to the depth of our ignorance, and lead us to look to a higher aid for that which most nearly concerns our well-being.

At the conclusion of the address, a vote of thanks was moved to the President by the Earl of Devon, seconded by Sir Stafford Northcote, and carried amidst great applause.

TREATING CORN FOR PANIFICATION.

An improved mode of preparing corn for the manufacture of bread without the process of grinding, whereby all nutritious portions of the grain are retained, and only the outer pellicle removed, has been patented in England by M. Alexandre Sezille, of 10, Rue de Lancry, Paris. Corn contains only from 4 to 5 per cent. of indigestible pellicle; when this has been removed, all the remaining parts constitute a nutritious aliment when mixed together; the practical application of this principle forms the basis of this invention. The existing system for transforming corn into bread by reducing it first into flour has only rendered about 80 per cent. of the grain available for this purpose, which 80 per cent. under favourable circumstances, give about 112lb of bread to 100lb. of grain. By the present improved process, from 145lb. to 150lb. of bread are obtained from 100lb. of grain, giving an increase of about 33 per cent. over the ordinary process. At the same time, the improved process, in doing away with the grinding, preserves a much greater quantity of gluten which, in the ordinary system, is lost by decomposition through heating during the grinding; also, the improved mode of fermenting the dough does not attack the gluten so much and renders it of a much whiter colour. The bread is therefore not only of greatly increased yield, but it is also more nourishing. The improved process consists of the following operations:—First operation.—The grain is thrown into a receptacle filled with water, and is stirred about therein for some minutes, when any defective grain will float on the top of the water and can readily be removed. The washing has also for its object to remove dust and other impurities. After the grain has been steeped in the water for about half-an-hour, the water (which will be found quite turbid even with the best grain) is run off. In place of steeping the grain, it may also be merely subjected to the action of jets of water. By this first operation the pellicle of the grain is distended.

Second operation.—The grain thus moistened is passed through a sheet metal cylinder or tube having a rasp-like inner surface, whereby the outer coarser pellicle of the grain is removed. The second pellicle beneath, which is the colouring matter, is removed by passing through a horizontal sheet metal cylinder with rasp-like inner surface, inside which are moving stiff brushes which act on the grain and render it as white as rice. The pellicles may, however, be removed by any apparatus suitable for the purpose.

Third operation.—This operation consists in steeping the grain after removal of the pellicle in a vessel filled with fermenting liquor, prepared, as we shall presently describe, at a temperature of from 68deg. to 77deg. Fah., and in the proportion of about 200lb. of liquor to about 100lb. of grain, in order that the latter may be well covered with the water. The grain is introduced after the liquor has been prepared about from eighteen to twenty-four hours, in order that this may have attained its full energy. The grain is subject to the action of the liquor for about seven or eight hours, during which time the fermentable matter in the liquor acts by degrees on the grain, penetrating into it gradually and extracting to a great extent the colouring matter situated beneath the skin of the grain; the liquor, which becomes of a reddish tinge, is then drawn off. The fermenting liquor is prepared by mixing with water, at a temperature of from 68deg. to 77deg. Fah., about 10 per cent. of fermented dough.

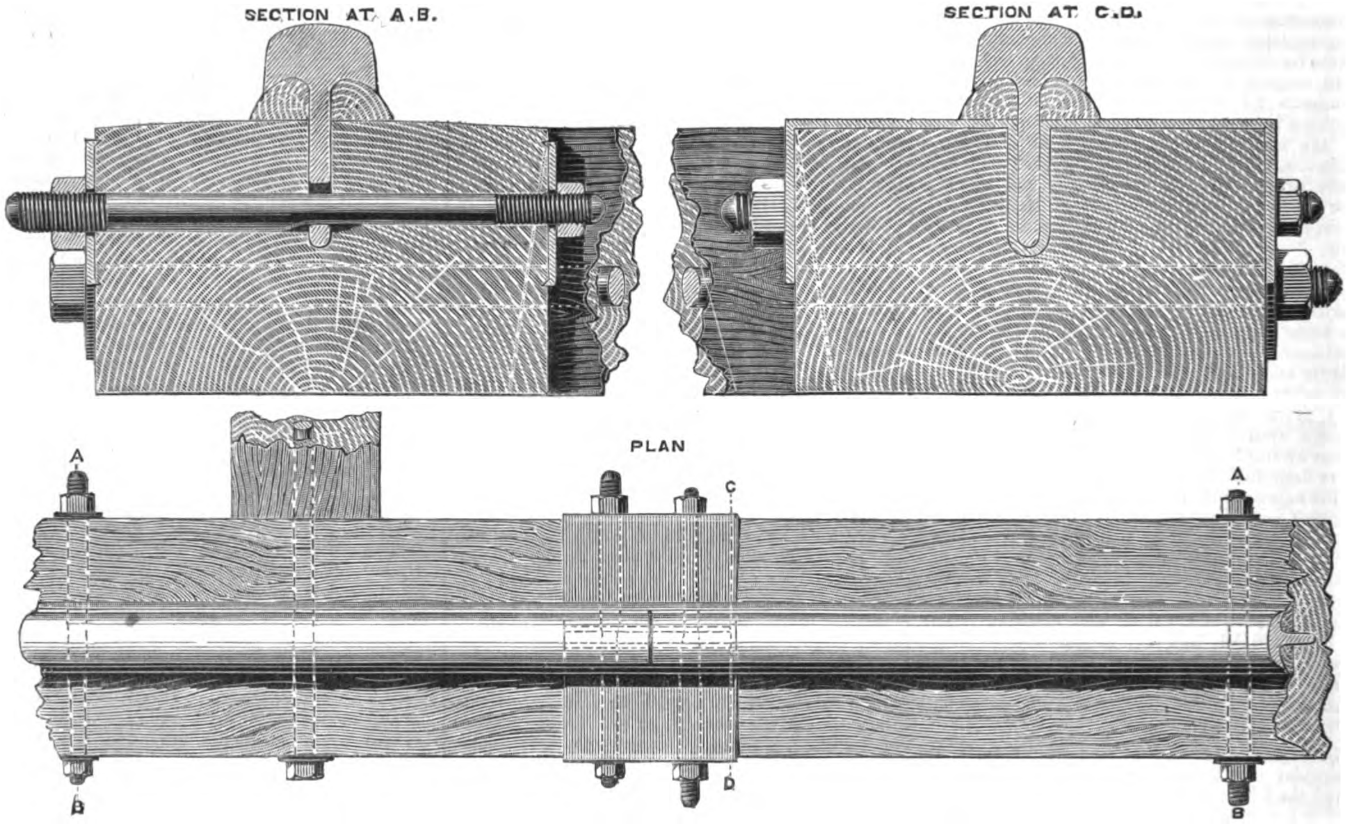
Fourth operation.—The grain is then drained, and is placed in a hopper, which, by means of a distributor, causes it to pass between one or more pairs of revolving cylinders which reduce it to paste as it passes through; this being completed, the requisite quantity of salt is dissolved in water and is then poured on the dough placed in a kneading trough. The dough is then kneaded so as to thoroughly mix all the particles thereof, and the operation of making bread is completed in the usual manner, that is, the dough is divided into loaves, turned, left for completion of the fermentation, and, at the desired moment, is placed into the oven, yielding a very white and nourishing bread.

The sediment remaining at the bottom of the steeping vessel in the third operation can, after drawing off the coloured water, be mixed with the paste passing from the crushing cylinders in the fourth operation. For making biscuits by this process the grain is not allowed to soak for so long a time as for bread, and, in order to produce a paste of greater consistency, it is passed twice through the cylinders; it is then treated in the ordinary manner. It is preferred to pass the dough through machines similar to those employed for moulding earthenware drain pipes in a continuous manner, and through dies imparting to the biscuit the desired width and thickness; the dough, in passing through the dies, will also attain a more homogeneous condition.

This improved system of preparing corn for bread has the further advantage of requiring considerably less motive power than the existing system, in addition to which the machinery, apparatus, and implements are of a much simpler character, and the different operations can be effectually carried on without the employment of specially skilled workmen.

LONGITUDINAL TIMBER PERMANENT WAY.

BY MR. G. F. GRIFFIN.



GRIFFIN'S LONGITUDINAL PERMANENT WAY.

THE permanent way of railways is a question which has engaged the attention of engineers and inventors ever since the first rail of the first railway was laid. Judging from what has already been done, and from the enormous number of patents which have been taken out upon the subject, we thought it hardly possible that any novelty could be produced in this direction. But Mr. G. F. Griffin—whose name has for some years past been connected with the permanent way question—has shown us something new in his longitudinal timber system, which we recently inspected at his offices, 19, Great George-street, Westminster. This system is illustrated in the accompanying engraving in section and plan. It will be seen to consist of a longitudinal sleeper, in which a groove is cut to receive the rail, which is of the single-head type, having a vertical web and weighing but 60lb. to the yard. The rail is packed under the head with oak packing strips, and is held in place by through bolts of varying diameters, as shown in the section taken through A B. This form ensures that the inclined shoulder of the bolt shall bear against the lower side of the hole in the rail-web, thus forcibly drawing down the rail upon the packings and sleeper. A wrought-iron strap plate is used at the joints, as shown in the section through C D, which binds the parts firmly together, the bolts being placed with the small and large ends alternating. The transoms are placed at the usual intervals and are fixed by through bolts, as seen in the plan. This system offers many advantages, especially over the transverse sleeper system generally adopted. It is about as simple a way as could be laid, and at the same time it attains to a maximum of safety. Its great economy over the transverse system lies in the absence of chairs, keys, trenails, and spikes, which are entirely superseded. Then there is a further saving in the first cost of rails, a much lighter rail being used by Mr. Griffin, and for which the system is particularly adapted. The maintenance of way—the *bete noir* of permanent way engineers—is stated to be reduced to one-half of what it is at present. Happy for the line that adopts his system if this be so, and we see no reason to question such a result, as bolts and nuts are very different things from wooden keys and trenails to deal with. The keys are perpetually playing fast and loose as the weather is either damp or dry, and the trenails are constantly getting sheared. The actual economy in maintenance of the new system, however, is a point which the experience of practical working alone can decide. This we believe it will shortly have, as we are informed that it will soon be laid on two of our leading railways. Unquestionably the longitudinal is the best system for rapid and safe travelling. Brunel was well aware of this when he laid the Great Western way, and the happy combination which Mr. Griffin has effected promises to supersede the chattering arrangements now so generally in vogue.

LECTURE EXPERIMENTS TO ILLUSTRATE THE LAWS OF MOTION.*

BY PROFESSOR ROBERT BALL, A.M.

I HAVE found the arrangements described in this paper effective in demonstrating to an audience a few elementary properties of gravitation and the laws of motion. It is certainly true that a clear appreciation of the truth of these laws, so essential for properly studying dynamics, requires some experimental illustration to beginners. However satisfactory may be the multitudes of indirect proofs of these laws with which the more advanced student is familiar, it will hardly be denied that it is a little difficult to demonstrate them directly. So far are they from being axiomatic that for centuries they were not believed at all.

The apparatus which is described in works on physics as available for the purpose of proving them consists merely of a very few instruments, among which Atwood's machine is that most commonly referred to. This meagreness contrasts strangely with the profusion of apparatus which has been devised for the illustration of the elements of other branches of science (electricity, for example); yet surely it would be as desirable to prove to a student the second law of motion by direct experiment, as it is to demonstrate experimentally the laws of electrical induction. I have communicated this paper, thinking that any contribution, however small, to the list of apparatus available for this purpose might prove useful to others, as it has been to myself.

A certain principle should always be borne in mind by the arranger of an experiment which is to be used for purposes of elementary instruction. A law A is required to be proved, and an experiment is performed which demonstrates the fact B; it is then shown by logical inference that the truth of the fact B necessitates the truth of the fact A. Thus A has been proved by two distinct steps—first, the experiment proving B; second, the chain of reasoning connecting A with B. For the instruction of a class of beginners it is essential that the experiment be so selected that the second step be reduced to a minimum, or, if possible, totally dispensed with. To take an illustration from the subject with which we are engaged. Suppose it be required to prove that a body will fall 16ft. in the first second. The distance may, of course, be determined most accurately by finding the time of vibration of a pendulum; but the subsequent chain of reasoning would be quite unintelligible. Atwood's machine might be made to give some approximation to the value; but it likewise does not indicate the direct result, but rather something from which the direct result is to be inferred by calculation. This appears to me one of the defects in Atwood's very beautiful machine; it possesses neither great accuracy nor great simplicity in the interpretation of its results, and one or the other, if not both, of these features should characterize every experiment. Besides, in its ordinary form, Atwood's machine is quite unadapted for use in the lecture theatre.

The arrangements now to be described have been designed with a view of proving the points required as directly as possible, and with the minimum amount of subsequent reasoning. It should be mentioned that whatever has been necessary for the purpose of supports and framework has been constructed out of the very beautiful system devised by Professor Willis, and described in his "System of Apparatus for the Use of Lecturers and Experimenters in Mechanical Philosophy." The convenience of this apparatus for every kind of mechanical appliance in a lecture room is wonderful. All bodies fall through the same height in the same time. This was Galileo's experiment from the top of the tower of Pisa; it can be repeated on a small scale in the lecture room in a striking manner. A scaffolding is built up with the stool, beds, and bolts of the system; and thus at the height of 24ft. from the floor a pulley is supported, through which passes a rope. A piece of wood, the shape of an equilateral triangle, 9in. each side, has two electro-magnets, each 3in. long, attached to its base, the wire being continuous round the two magnets. The triangle is attached by its vertex to the rope, and can therefore be easily raised to 24ft. or any less height, and lowered again at pleasure. The two wires communicating with the electro-magnets are sufficiently long to allow of the triangle and mag-

* Communicated by the author to the "Philosophical Magazine."

nets being hoisted up while the other ends of the wires are attached to a battery of a few cells, a contact-breaker being introduced into the circuit.

The mode of experimenting will be easily understood. Suppose it is desired to prove that a heavy iron ball and a light one will fall through the same height in the same time. The circuit being complete, the balls are attached one to each of the electro-magnets, care having been taken to interpose a piece of paper between each of the balls and the corresponding magnet, as this ensure their being disengaged simultaneously. The piece of wood and its freight are then hoisted up 24ft. (or less), and the two balls are in the same horizontal line, supported, of course, merely by the attraction of the magnets. At a signal, the current is broken and the balls fall together; they are disengaged simultaneously; and the line joining them is easily seen to be horizontal throughout their entire descent, though, of course, they are perfectly free from each other. The iron balls used were 1in. and 1½in. in diameter respectively.

An iron ball (1½in.) and a cork ball (2½in.) can be likewise tried. A flat headed nail driven into the cork affords sufficient holding-ground for the magnet. It is a most unexpected result to find that when they reach the ground, or rather the cushion placed to receive them, the cork ball is only a few inches behind its weighty companion. That even this difference is due to the resistance of the air is shown in the next experiment, by lowering down the triangle, again affixing the cork ball, and likewise the iron ball, with a small parachute of cardboard attached to it. Raising up the triangle and again breaking the current, the cork is seen this time to reach the ground before the iron.

The next experiment is to prove that a body falls 16ft. in the first second. The apparatus already described is employed for this purpose, but into the same circuit two other parts are introduced which will require a few words of explanation. The contrivance on which the arrangement principally depends is the contact-breaker, the action of which will be understood from the annexed diagram (fig. 1). To a block of wood

FIG. 1.

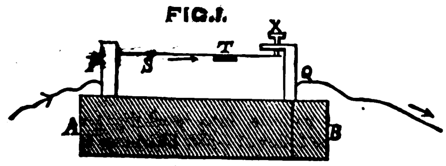


FIG. 2.

A B a brass pillar P is screwed. This pillar is 3in. high, and has a binding-screw attached to it to receive the current. Near the top of the pillar a very slender spring is riveted; this spring is of brass wire slightly flattened, and is 8in. long; at the point T, 5in. from P, it bears what may be called a saddle. This consists of a piece of ordinary tinplate cut into a rectangle of 1in. by ¼in. soldered lengthways on the upper surface of the spring and then bent down on each side, so that its section is similar to what is represented in fig. 2. The object of this will presently appear. The other end of the spring is free, but it bears against a screw X, which turns in a brass piece Q, likewise screwed to the block of wood A B. The spring being weak enough, the slightest touch will depress the end of it from X, to which, however, it immediately returns on the relaxation of the pressure. When the spring (along which the current travels) touches X the circuit is complete, and it is of course interrupted when the spring is depressed.

A seconds-pendulum is suspended from a suitable portion of the framework by a spring in the usual manner. No clock-escapement is used; indeed, if the bob be heavy, the pendulum once set in motion will vibrate for some minutes without requiring an additional impulse. Underneath the pendulum the contact-breaker is to be placed in such a manner that its spring is normal to the plane of vibration of the pendulum; and the height of the pendulum must be so adjusted that when the bob is in its lowest position, a point attached to it shall just touch the saddle in passing over it. The final adjustment, however, is inconvenient to make by moving the point of suspension of the heavy pendulum; so for the sake of making this with the necessary delicacy, the screw X has been introduced into the contact-breaker, by raising or lowering which the limiting position of the spring and therefore of the saddle is raised or lowered. By this means the amount by which the pendulum depresses the spring in its transit over it can be arranged with the greatest nicety. After the pendulum has received an impulse, and as the bottom of its swing comes into contact with the saddle, the current is broken owing to the depression of the spring from X. After the point has passed the saddle, the spring returns to its bearings, and the current flows again until the return of the pendulum to the lowest point, when the current is broken again; and if the contact-breaker have been nicely adjusted, exactly a second will have elapsed between these two breakings. Thus at the completion of each second the current is interrupted. The apparatus being nicely adjusted, the amount of *vis viva* lost by the pendulum in depressing the spring is so small that it will make, after having received an impulse, upwards of 200 breakings before it requires another push.

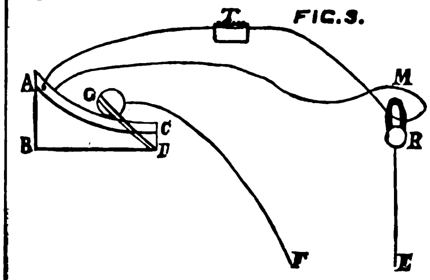
An electro-magnet acting on a bell is introduced into the circuit, so arranged that at each interruption of the current the bell is struck. The simple arrangement necessary for this need not be described. At every oscillation of the pendulum the bell rings, the sounds of which may therefore be regarded as the ticks of the pendulum rendered easily audible to the whole room. The reason why the spring or middle of the saddle of the contact-breaker should be placed exactly under the point of suspension of the pendulum can now be easily seen. It is in order that the intervals of two consecutive strokes of the bell shall be exactly equal. If the spring have not the correct position, then there will be two intervals, one as much greater as the other is less than a second, and these intervals will alternate. Errors which arise from the want of perfect adjustment of this position are fortunately rendered insensible by the fact that at its lowest point the pendulum has its maximum velocity. It will be noticed that with this contact-breaker the interval between the strokes is independent of the arc of vibration. I am not aware that this mode of breaking contact has been used before, and therefore I have given the details. It appears convenient, efficient, accurate, and not liable to derangement, and is free from the troubles (in my experience unavoidable) arising from using mercury or other fluids for the same purpose.

The mode of proving that a body falls 16ft. in a second is then easily seen. A large scale divided into feet is attached to the upright support of the pulley. One or both of the electro-magnets belonging to the triangle, the contact-breaker, and the bell are all included in a battery of a few cells. The pendulum being held to one side (for in its position of rest the point keeping down the saddle breaks the current), the current passes. An iron ball is attached to the electro-magnet, which is then hoisted to the height of 16ft. (as pointed out by the scale) above the surface of a cushion on which the ball is to fall, so as to deaden the sound. The eyes of the audience are to be directed to the cushion, while their ears listen for the bell. When the pendulum is released, the first break rings the bell and drops the ball together; the second break rings the bell again, and, as nearly as the eye and ear can judge of simultaneity, identically at the same moment as the ball reaches the cushion. If the ball be hoisted to the height of 18ft., it is seen to be too late; if lowered to 14ft. it is seen to be too soon. From this may be inferred the amount of accuracy of which the experiment is capable. It must be remembered that the arrangement is one for illustrating a certain quantitative result to an audience, and not for determining in the cabinet an important natural constant.

The next experiment may perhaps claim greater accuracy than that just described, as there is always more or less of difficulty (more, apparently, with some persons than others) in perceiving the identity of time of two phenomena presented to two different senses simultaneously. This arrangement depends only on the sense of sight; and the law which it demonstrates may be thus enunciated. "A body projected in a horizontal direction with any velocity whatever will take the same time to reach the ground as a body let fall vertically through the same height." This clearly is an important truth to impress on a beginner endeavouring to understand the second law of motion. It will teach him that, in at all events one very important case, the effect of the same force acting for the same time does not in the least depend upon the circumstance as to whether the body on which it acts is at rest or in motion; and perhaps this is the least self-evident of the truths that are wrapped up in Newton's concise enunciation of his law.

The arrangement consists of two parts, and the assistance of electricity as a rapid messenger is again called in. A B C D (fig. 3) is a piece of wood 1½in. thick; A C is an arc of a circle of 2ft. radius, the tangent to which at C is horizontal, A C being about a foot long. A ball being intended to run down this piece, it is grooved; and A C is one of the edges of the groove, the other being of course at a distance of 1½in. on the other side of the wood. The ball which rolls down the groove is a sphere of 2½in. in diameter, made of wood and neatly covered over with tinfoil. The two edges of the groove are each likewise covered with a piece of tinfoil, which pieces, however, must at no place communicate with one another. Each edge is furnished with a binding-screw, to which

FIG. 3.

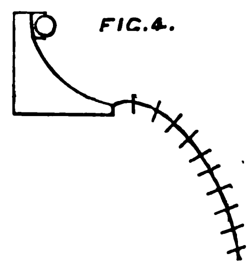


a wire is attached. Whenever the ball rests on the groove, the tinfoil enclosing it touching each edge completes the electric connection between the two binding screws, the ball acting as a bridge along which the current passes. At D, and the similar point on the other side, the two ends of a piece of india-rubber spring are fastened so that the ball can be grasped by the spring. When the ball is pulled up along the groove and then released, the force of the spring pulls it down and it darts off with a horizontal velocity. This piece of apparatus may be about 7ft. from the ground. At precisely the same vertical height as C, and at a distance of some feet, an electro-magnet M is to be supported. One wire from this goes to the battery, the other is fastened to one of the binding-screws on one edge of A C, the second edge being connected with the other pole of the battery.

As long as the tinned ball P is on the groove, the circuit being complete, the electro-magnet M will sustain a second ball R; but the moment P leaves the groove, R is released. Drawing back P and the spring which embraces it and then releasing it, P maintains the circuit until it arrives at C; in fact, a good contact is ensured by the double circumstance that both the spring and the centrifugal force of P conspire to keep it in close contact with the tinned edges. After leaving C the ball darts off in the trajectory indicated in the figure; but directly it is free R is likewise free, and the two can be seen with the greatest exactness to reach the ground together. By stretching the spring more or less, any amount (within reasonable limits) of horizontal velocity can be communicated to P; and it is a most striking result to observe in all cases the perfect simultaneity with which the two balls reach the ground. For demonstrating the particular point in question, this arrangement apparently leaves little to be desired.

"The path of a projectile is a parabola." The method of demonstrating this is indicated in M. Daguin's "Traité de Physique" (vol. i. p. 94). The arrangement for the lecture-room based upon it is simple enough. A quadrant (fig. 4) of 2ft.

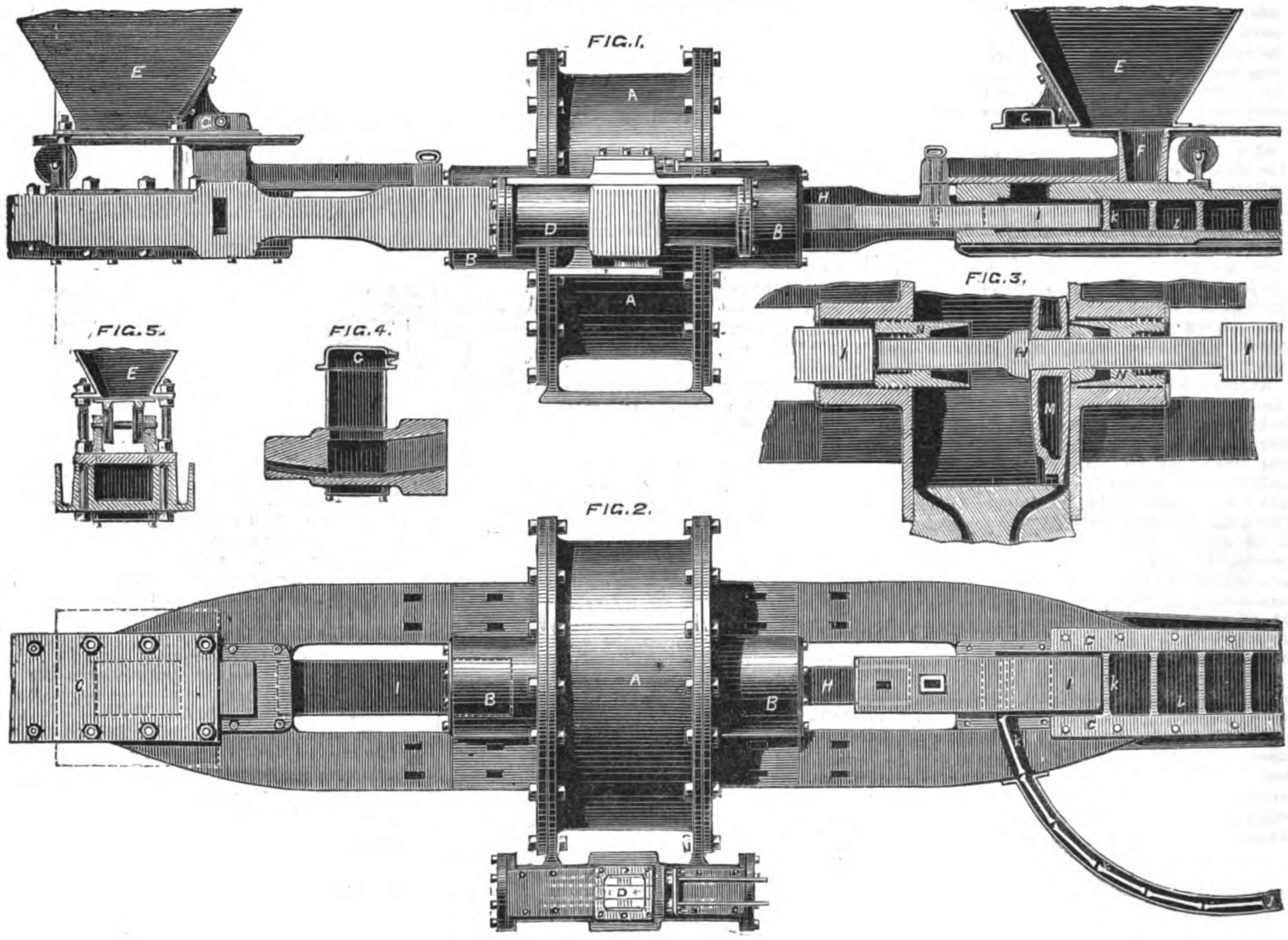
FIG. 4.



radius is made of wood 1½in. thick, and grooved as in the preceding experiment. This is to be very firmly supported parallel to the wall and about 2in. distant from it, and 6ft. or 7ft. from the ground. Down this a wooden ball 2½in. is to roll, and it is proposed to prove that the path it follows after leaving the groove is a parabola. That the ball after rolling down shall describe precisely the same path each time, it is necessary that the direction of projection be perfectly constant; this is ensured by fixing the quadrant very firmly; and then the direction of projection is the tangent at

MACHINERY FOR COMPRESSING COAL.

BY MR. H. G. FAIRBURN.



he base, which for convenience is horizontal, or nearly so. It is no less necessary that the velocity of projection be constant; this is provided for by allowing the ball always to start from the same position on the quadrant. To secure this, a small ledge is fastened at the top, and the ball is, before each descent, brought home against the ledge, and thence allowed to fall. By this means, the same trajectory can be reproduced as often as desired.

To show that this is a parabola, the following simple plan is employed. A number of little arches are made from slips of cardboard 1in. wide; these arches are about 4in. across and 6in. high, something like the shape of the letter U turned upside down. They are fastened to the wall by drawing-pins or otherwise all along the constant path traversed by the ball, as shown in the figure. The mode of placing them is easy. First, one is arranged so that after each descent the ball goes through its centre; then the next is similarly placed, and so on until ten or thereabouts have been affixed, through all of which, and without touching any, the ball will pass, after leaving the curve, finally falling into a basket placed to catch it. By joining the centres of the arches along the wall by a curve, the position of the focus and directrix of the parabola will be easily found, and the nature of the trajectory consequently demonstrated.

COMPRESSING COAL.

MR. H. G. FAIRBURN, of 45, Goswell-road, London, has recently patented some improvements in his machines for compressing coal. These improvements are of three kinds, and they apply, firstly, to the construction of the cylinder portion of the machinery, the objects being to economize the consumption of steam and to prevent breakage or injury to the dies or palletts. Secondly, to the arrangement for introducing the dies or palletts into working position. And, lastly, they include an arrangement whereby for pressing coal and other substances that require the palletts to be cool, they may, after having been in contact with the heated material, be cooled before being introduced into the machine, while for pressing peat and other substances that require the palletts to be hot, they can be introduced into working position in a highly heated state.

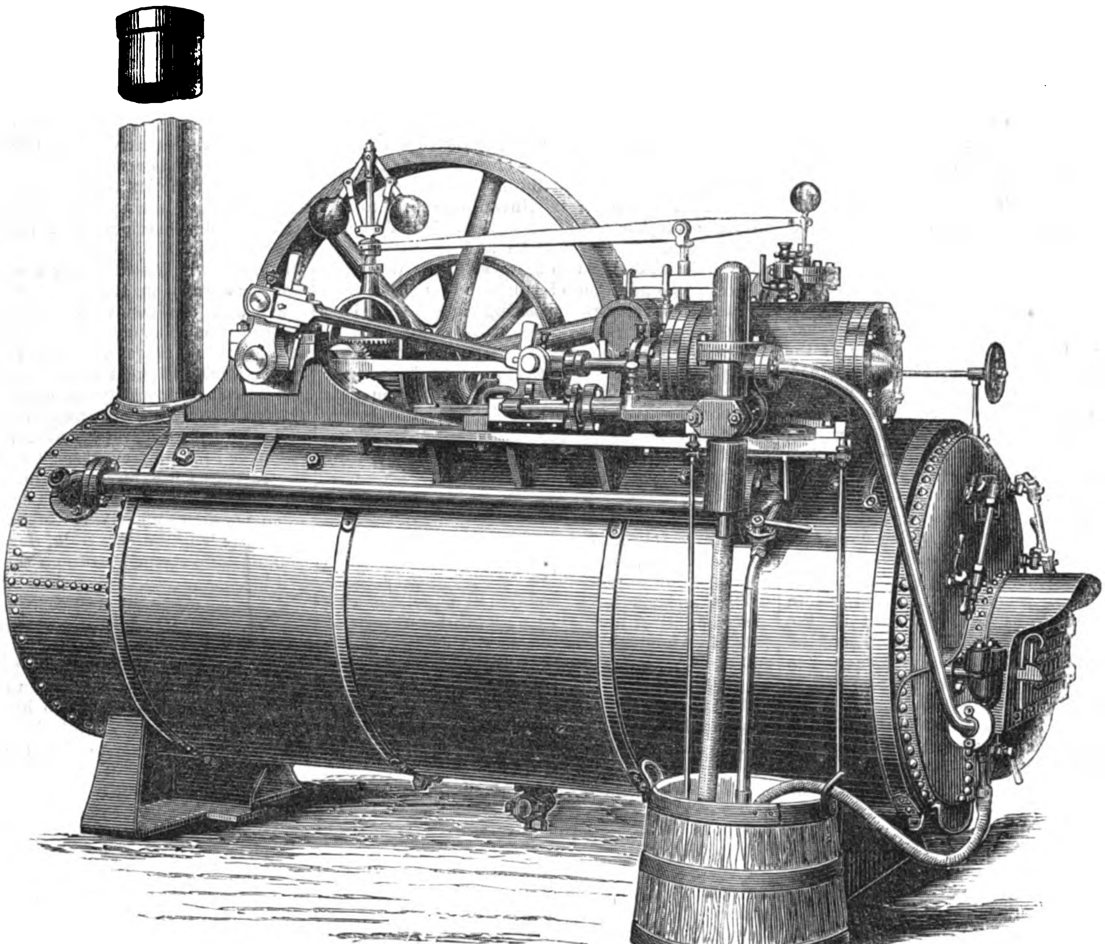
The first part of this invention is accomplished as follows:—Mr. Fairburn bores out the centre of the cylinder caps at both ends of the cylinder and forms in continuation a small cylinder at each end of the large cylinder, into each of which is inserted a movable adjusting plug. These plugs are capable of moving forward into the large cylinder, but cannot move backward or out farther than will bring their inner surfaces flush with the inner surfaces of the ends of the large cylinder. The piston being in the centre of its stroke, and the piston rod passing right through the large cylinder and out at each end, and through each of the adjusting plugs, stops are placed on the piston rod, one just at the outer edge of each of the adjusting plugs, so that the piston cannot move in either direction without drawing one of the plugs into the interior of the large cylinder. If now the piston be passed to one end of the large cylinder it will have drawn with it, by reason of the stop on the piston rod, one of the plugs as far into the cylinder as can be drawn, while the stop on the piston rod at the outside of the other plug will have left that plug by the same distance as the first plug is projecting within the large cylinder. The steam slide valve which has let the steam into the cylinder to bring the piston up to one end now opens a communication between the two ends of the cylinder, thus producing an equal pressure of steam on each side of the piston, but as on one side the steam acts on the movable plug drawn into the cylinder by the piston rod, the tendency of the plug to regain its position acts on the piston and forces it back until the stop on the piston rod on the outside of the other plug comes into contact with that plug when the piston remains stationary, at the same time closing the communication between the two ends of the cylinder; communication between one end of the cylinder and the exhaust is now opened in the usual manner, and the steam being let in on the other side of the piston it is driven home with the full pressure of the steam.

The second part of the invention, namely, the placing of the palletts into working position, is accomplished as follows:—Mr. Fairburn employs a flat circular ring in a horizontal or oblique position, of such a diameter that while one extremity of its circumference is in a position to introduce the palletts into the moulding chamber or pressing tube, the opposite portion of the circumference of the ring just passes beyond the end of the pressing tube to receive the palletts expelled therefrom after they have passed through the tube between the blocks of pressed material. Around this ring on its flat surface the palletts are laid, and are carried to their position by their own gravity, or a step-by-step motion being given to the ring the palletts are brought one after the other into the mouth of the moulding chamber, to be forced therein by the plunger or piston rod, as already described. Or, instead of the said ring, there may be an endless chain or belt worked in a similar manner, and each link carrying a horizontal platform to receive a die or pallett. In this manner the palletts may be heated or cooled in their transit by any ordinary process. For the better supplying the moulding chamber or pressing tube with materials the measurer is discharged when over the cavity of the moulding chamber by means of the admission of steam or air under pressure.

In our engraving fig. 1 represents the elevation of the machine, part in section, with portion of framing removed. Fig. 2 represents the plan of the machine, also part in section, with the upper portion of one side removed. Fig. 3 is a section of plan of cylinder and pistons. Fig. 4 a transverse vertical section of discharging and measuring apparatus, and fig. 5 a transverse vertical section of moulding tube through dotted lines. A is the steam cylinder, B B the cylinder caps, C C the moulding tube, D the valve box or steam slide, E E the hopper, F the measurer, G the discharger, H the piston rod, I the plunger, J the ring or channel for conveying the palletts, *k k k* are palletts, *l l l* are blocks or bricks, M is the piston, and N plugs or pistons. By the reciprocating motion of the piston rod and plungers the measurer is caused to pass under the bottom of the hopper to be charged, and is brought back with the plunger over the charging cavity of the moulding chamber,

SELF-CONTAINED ENGINE AND BOILER.

BY MR. JOHN CAMERON.



and the materials ejected out of the measurer into the moulding chamber by the admission of steam, air, or gas, &c., into the chamber above marked G, fig. 4.

Many thousand tons of fuel have already been pressed in Wales by Mr. Fairburn's machines at the lowest possible cost. The minor difficulties which existed in working the original machines are now overcome by the present improvements. A peat machine with all the recent improvements is completed and at work pressing the peat in balls 4½in. in diameter at the rate of from 30 to 40 a minute, or equal to 50 tons per day. There are also two machines in the course of construction for pressing coal, and when completed will be set to work in South Wales. They are capable of pressing 100 tons of coal each per day, giving a pressure of 40 tons on each block. The fuel being moulded and pressed while under a high degree of heat (which forms the subject of another patent), removes any tendency to flying or giving off particles when thrown into the hot furnace. In bituminous coal the non-heating volatile gases, water, sulphur, &c., are driven off, thus making the fuel almost smokeless. The blocks are cooled in their passage (while under pressure) through the machine, and are at once ready for transit and shipment. We may mention that this machinery is applicable for brick-making, and several machines for this purpose are nearly completed. They are to be worked in Wales and in the neighbourhood of London. Each machine is capable of making from 18,000 to 20,000 bricks per day, under a pressure of 40 tons, at a very small cost. Plastic bricks can be put in the kilns immediately on leaving the machine, and need not be kept to dry as in ordinary cases.

CAMERON'S PORTABLE ENGINE.

IN our report upon the Manchester Show we promised a more extended notice of the self-contained engine and boiler exhibited by Mr. Cameron, of the Egerton-street Ironworks, Hulme, Manchester. We now annex an elevation of one of these engines, which are alike excellent in design and sound workmanship. They can be mounted on wheels, if desirable, instead of feet, and the exhibitor showed two so mounted, but he does not appear to advise their use in this way, for which, indeed, they are too heavy. The engine is fitted on a strong bedplate, which thereby relieves the boiler from its alternate working strains, an arrangement which conduces greatly to the durability of both. All parts of the engine are external and easily got at. There is but one guide bar, with a very wide bearing surface, in place of the four generally used. All the brass steps have square bottoms, so as to be easily lined-up when worn; the crank shaft neck steps tighten horizontally on both sides, in the direction of the working strain, by means of an ingenious arrangement of wedges fitting on the whole surface of the brasses; the steps next the flywheel are two and a-half diameters long. The ordinary over neck wrought-iron crank is preferred, on account of its simplicity, to the inside bent crank, as, in case of accident, it could be repaired by any clever workman in any part of the world, with the tools generally found in a smith's shop; this is an important consideration for exporters, emigrants, and the general user. The governor is driven by bevel wheels, and communicates with an equilibrium regulating valve. The feed pump is fitted with air vessels, and with a valve at the bottom of the suction pipe; it is fitted with ordinary conical seat valves in preference to the ball valve. The piston pump and valve rods are made of steel, and so is the crank shaft and pin. The boilers are cylindrical throughout, and no angle iron is used in their construction. They have cylindrical fire-boxes, communicating by tubes with the smoke-box. They are lagged all over, and fitted with a very strong man-hole in the top of the barrel near the middle, in which is fixed an eye bolt, by means of which the whole engine and boiler can be swung by a crane. The boiler has a complete double set of fittings—two safety valves, two glass water gauges, and two fusible plugs in fire tube. The engines are all made to a system, under which the pistons all run 300ft. per minute, and the circumferences of the flywheels all run 1,880ft. per minute, which enables an engine to be replaced by any other size without alteration of diameter, driving pulley, or speed of shafting.

CURRYING AND DRESSING LEATHER.

HITHERTO, in currying and dressing leather, it has been usual to employ neatsfoot oil or cod or fish oil, together with tallow. According to an invention lately patented by Messrs. Vanner and Prest, of 32, Great St. Helens, London, the residuum oil obtained when distilling petroleum is employed for this purpose. When the residuum oil is of a specific gravity of about ·880, which is about the specific gravity of the oil as now usually manufactured, it is used with tallow in the proportion of 14lb. of oil to 16lb. of tallow. By thus using the residuum oil in place of fish and other oils hitherto employed in currying and dressing leather, it will be found that the oil so combines with the tallow as to carry it almost wholly into the skin, and so forms a good stuffing, and also that it gives greater elasticity and more permanent weight to the skin than any oil now in use; it also renders the leather more impervious to water and less liable to decay or gum. The inventors employ the residuum oil obtained when distilling petroleum by the aid of a partial vacuum in a still heated by an internal steam coil. A mixture, consisting of fourteen parts of the residuum oil to sixteen parts of tallow, with two to three parts of cod oil added, to make the mixture more fluid, that it may work easier, will be found very suitable for dressing leather, or in cold weather less tallow might be employed. When using a stuffing composed of vacuum oil and tallow and cod oil, as above described, care should be taken in regard to the amount of stuffing used, for if too much is applied it will strike through, and make the grain of the leather dark. A currier will readily judge the amount necessary to apply if he bears in mind that the residuum oil so combines with the tallow as to carry it almost wholly into the skin.

ELECTRO-DEPOSITION OF COPPER AND BRASS.

An invention has recently been patented by Mr. W. H. Walenn, of 76, Brecknock-road, Holloway, for enabling the electro-deposition of copper and brass upon iron and other substances to be made with less battery power, with greater economy, and more solidly and perfectly than has hitherto been done. A solution for electro-depositing brass is made as follows:—Crystallized sulphate of zinc (1 part by weight) and crystallized nitrate of copper (2 parts) are dissolved in the smallest quantity of water that is possible. Sufficient strong ammonia water is added to precipitate and then fully redissolve the oxides. Then the purple tint of this solution is completely removed by a standard solution of cyanide of potassium. The resulting solution should be left to stand for a day or two, and may then be worked with from one to three battery cells, using heat if a brass anode be employed. Mr. Walenn, however, prefers to work this solution by either of the porous cell arrangements to be presently described, the hydrated oxides of copper and zinc being from time to time supplied, and, if necessary, ammoniuret of copper being added. Before adding the hydrated oxides, it is advantageous to add as much of the cyanides of the metals as will dissolve in the menstruum. Ammonia water and a standard solution of cyanide of potassium should be added occasionally to this depositing liquid in order to keep the salts of copper and zinc well in solution. The hydrated oxides of copper and zinc are mixed, and thoroughly incorporated in the proportion of 2 parts by weight of the hydrated oxide of copper to 1 part of the hydrated oxide of zinc before they are added to the solution. During working, little or no hydrogen should be evolved from the article.

A second solution for electro-depositing brass, chiefly useful where heat is used, but also able to be employed cold with a porous cell arrangement, is made as follows:—A solvent solution is first made consisting of,—

Cyanide of potassium (standard solution) -	6 parts by measure.
Nitrate of ammonium (standard solution) -	1 part.
Sulphate of ammonium (standard solution) -	2 parts.

The standard solution of each salt consists of the salt in the solid form dissolved in five times its weight of water. The standard solution of cyanide of potassium referred to in the description of the first electro-brassing solution is so made. Eight-ninths of the whole of the ingredients are mixed in order to receive to saturation the cyanides of copper and zinc previously mixed in the proportions of 3090 parts by weight of cupric cyanide to 1795 parts of zinc cyanide; the remaining one-ninth of the solvent solution is added as free solution to the eight-ninths. This mixture is then treated to the hydrated oxides of copper and zinc, as in the first solution, and the ammoniuret of copper is added if it is found that this solution evolves hydrogen gas during deposition. Previous to trial by the battery, the solution should be allowed to stand for one or two days. A few ounces (by measure) to the gallon of ammoniuret of copper will suffice to prevent the evolution of hydrogen gas. This method of mixing the solution is preferred to all others.

A modification of this second electro-brassing solution is made by mixing the whole of the solvent solution and then dividing it into three parts:—

Free solvent solution . . .	1 part.
Solution to dissolve cupric cyanide	$5\frac{1}{4}$ parts.
Solution to dissolve zinc cyanide .	$2\frac{3}{4}$ parts.

When the respective metallic cyanides have been dissolved to saturation in the portions of solvent solution appropriated to them, the free solution is added thereto, and the whole is thoroughly mixed. Ammoniuret of copper is then added, and the finished solution is allowed to stand for a day or two. Instead of using the cyanides of copper and zinc respectively, to charge the solvent solution with copper and zinc, oxides, carbonates, or other salts, compounds of the metals may be employed.

Another modification of this second electro-brassing solution, and one very nearly equal in quality to that first described, consists in charging the solvent solution with metal from a brass anode by electric power, using four Grove's cells of adequate size, and arranged for intensity for the purpose. After charging the solution with about two ounces of metal per gallon, the mixed cyanides are added, if it will dissolve any; then as much of the mixed oxides as it will dissolve; and, finally, to adjust the solution for the non-evolution of hydrogen, a small quantity of ammoniuret of copper. This adjustment may or may not be necessary. A serviceable modification of this solvent solution consists in employing equal parts of cyanide of potassium and sulphate of ammonium, and adding thereto one ounce (by weight) of crystals of nitrate of ammonium per gallon. The nitrate of ammonium is necessary, as it favours electric conduction, and tends to keep the solution in working order.

If a solution to electro-deposit copper be required, instead of charging the solvent solution with about one part of zinc to two parts of copper, it is charged with one part of zinc to ten or twenty parts of copper. This part of the invention refers to any alkaline solution, but more particularly to that containing cyanide of potassium and tartrate of ammonium, and to the two brass solutions described above. The addition of sulphate of zinc to acid solutions for electro-depositing copper has long been known to improve the quality of the deposit; the presence of zinc toughens the cupreous deposit. In a porous cell arrangement for electro-brassing or electro-coppering the surface of the solution next the zinc or other dissolving plate is at a greater elevation than that of the external or depositing solution. This plan tends to keep the depositing solution in working order.

The next part of Mr. Walenn's invention refers to rendering alkaline brass and copper electro-depositing solutions free from the evolution of hydrogen gas, during electro-deposition, thus enabling the whole of the electric power to be utilized and non-porous metal to be deposited. This is accomplished by adding to electro-brassing solutions, the hydrated oxides of copper and zinc in sufficient quantity for the purpose. Another method is to add simply ammoniuret of copper. In a third method, the hydrated oxides of copper and zinc are dissolved in ammonia water, and the resulting solution added to the depositing solution. In treating electro-coppering solutions, the hydrated oxide of zinc is not required. Although hydrated oxides are preferred, other oxides may be used.

The next improvement consists in applying to the brass and copper solutions mentioned above, the method of working them by the supply of the cyanides and hydrated oxides of the metal or metals, in conjunction with the use of a porous cell; to generate the electric power or to receive the same from an adequate battery, the cyanides and hydrated oxides either being stirred into the solution from time to time as required, or supplied from a tall porous cell containing an ammoniacal solution of the cyanides and hydrated oxides that acts by the pressure of the column of liquid in the said porous cell to force the ammoniacal liquid into the depositing solution outside the porous cell. When no separate battery is used, an amalgamated zinc plate in the porous cell furnishes the requisite electric current. The solution in the porous cell may be:—

1. The solvent solution of the second brass solution.
2. A mixture containing cyanide of potassium and sulphate of ammonium in solution, equal parts by weight preferred.
3. A solution of an alkaline chloride.
4. A solution of an alkaline sulphate.

When a separate battery is employed, a brass or copper plate in the porous cell as an anode, and immersed in the solvent solution of a brass or copper solution, enables a portion of the solution to be charged with brass or copper, whilst the other portion is parting with its brass to the cathode, and, by the alternate use of these solutions as depositing solutions, continuous working may be obtained.

The last improvement patented by Mr. Walenn consists in an acid solution for the electro-deposition of copper, which has not hitherto been used for that purpose. A few drops of bisulphide of carbon per gallon of solution (a larger proportion may be used) are mixed with a solution containing one pound of sulphate of copper to the gallon, and an ounce or two of sulphate of zinc to the gallon; it is essential that this solution should be acid. The effect of this solution is to deposit pure copper uniformly over the article to be coated of a silky and bright appearance. The solution is not liable to get out of order.

INTERCOMMUNICATION ON RAILWAY TRAINS.

The question of a means of communication between guards, engine drivers, and passengers on railways, has received the attention of Mr. James Leetch, of 11, Dowgate-hill, City, who has worked out and patented the following invention. It consists of a flexible galvanized iron wire rope or chain, attached by a new kind of pulley underneath the centre of the carriages, trucks, &c., each end being fitted with improved coupling hooks, for the purpose of connecting the communication between each carriage throughout the length of the train. Hitherto the great difficulty has been to effect communication through the entire length of the trains, allowing for the play of the buffers, yet easily worked, and at the same time capable of taking up the slack when the train is going down an incline. This essential object is accomplished by the introduction of a new but simple arrangement of elastic springs, permanently fitted to each end of every carriage, &c., having eyelet-holes through which the line of communication can freely work, and which continually keeps the entire line taut, or always on tension, whether the carriages are drawn asunder to the full extent of their coupling chains, or closed up together to the extent of the buffer springs. This novel method of taking up the slack has great advantages; each carriage has its own connecting line complete in itself, the springs contracting or expanding according to the action of every separate carriage, whether on gradients or rounding curves. To make up a train, the carriages are brought together in the usual way, the spring hooks are then coupled in a second, when a perfect connection is established throughout the whole length of the train, for the purpose of sounding the steam whistle on the engine and the bell in guard's van.

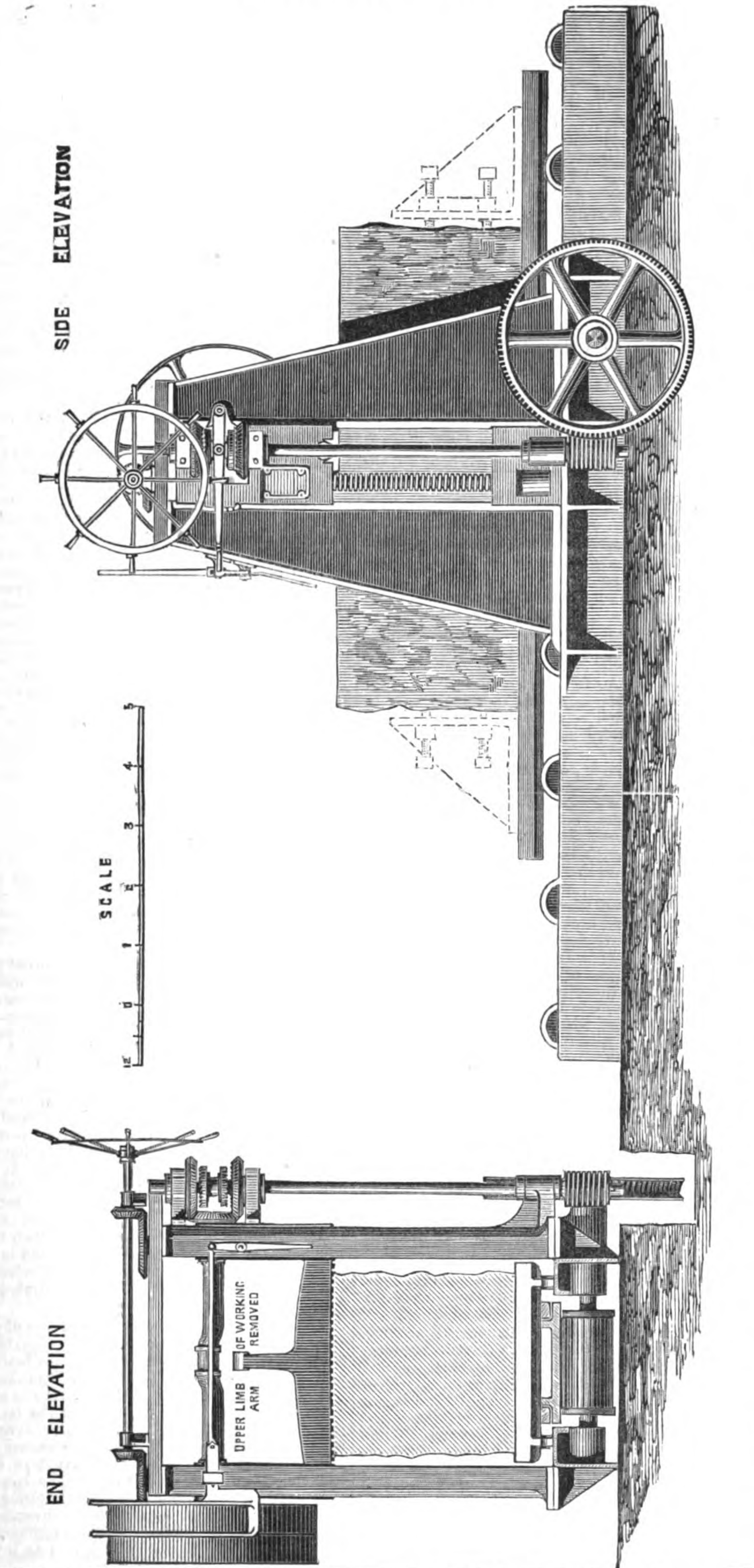
Attached to the through connecting line underneath the carriage is a strong wire, running over pulleys into each compartment encased with a handle like a bell-pull; should a passenger require to give an alarm, he has only to pull the handle down which is placed above his head, when the driver's whistle and guard's bell will be simultaneously heard at each end of the train, whatever length it may be. The guard and driver can communicate before starting, to prove that connection is complete, and can also telegraph with each other at any time while on the road. Each compartment is also provided with a self-acting indicator. The act of pulling down the handle of the centre signal sends out an arm on either or both sides of the carriage, where it remains locked till the guard returns it to its former place, which he can do in a moment, when it is again ready for use, but beyond the control of passengers. This self-acting tell-tale enables the guard to find the carriage in which the person is who either wants his assistance or who may have improperly used the danger signal. The advantages of this system are obvious. It is easily applied to the rolling stock on any line of railway, and uniformity can be obtained on all trains. There is no complicated machinery, it requires but little attention, and is not likely to become deranged. Curves cannot intercept its action, and if a carriage breaks loose from the train, the whistle and bell must necessarily be sounded by the separation.

HOLMES' STONE-DRESSING MACHINE.

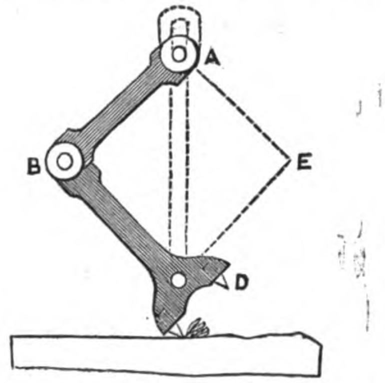
We last week noticed the successful application of machinery by Mr. Holmes to the dressing of stone, and the recent application of steam power for that purpose. We now publish engravings of the apparatus, to which the following description applies. Our readers will remember our illustrations of Mr. Holmes' hand machine a few months since. In that apparatus the cutters are arranged vertically; in the machine worked by steam power, however, they act horizontally; but the mechanism by which the cut is applied is essentially the same in each case. In another particular the two machines differ in action. In the hand machine the feed and the cut alternate with each other—the table rests while the cut is being given, and moves forward when the cutters rise from the surface that they are acting on; in the larger and more powerful machine the table travels continuously. The power is applied by a driving-belt direct from the engine to a rocking crank driving-shaft to which the cutters are attached. At the opposite end of this driving shaft is an arrangement of bevelled gearing, by which the cutters are put into or taken out of gear, and by which also the power is transmitted to a vertical spindle, which, by a worm-wheel, operates upon the travelling table. In working a block of Portland or other stone down to a rough level surface, two series of cutters are employed, and so adjusted that when the motion of the table is reversed the one set cuts away the ridges that

STEAM POWER STONE-DRESSING MACHINE.

BY MR. J. E. HOLMES.



have been left between the grooves cut by the other set. The spaces left between the faces of the chisels are wider than the cutting faces. For granite, black marble, and the harder kinds of stone, grooving points, rather than chisels, are used for the rough cutting-down to a uniform level. The finished tooling is by a broad chisel working across the entire face of the stone under treatment. The working arm and cutters are shown in the annexed diagram to an enlarged scale, from which their action may be gathered. The rocking shaft at A gives the scooping action to the range of cutters. When the stone ha passed for its whole length under the cutters th motion of the table is reversed, the pin at B is taken out, and the arms are joined again at E, and the cutters, or dressing tool, as the case may be, at D are brought into action. It is intended, we believe, to substitute screws for the roller wheels under the travelling table, with a view to more



firm and steady motion We have previously placed on record the results of working in this machine, which are highly satisfactory, both with regard to the work done in a given time as against hand labour, and also with respect to appearance and finish.

THE WHITWORTH SCHOLARSHIPS.

THE Lords' Committee of the Privy Council on Education have, in concert with Mr. Whitworth, made the following rules for awarding the Whitworth Scholarships this year, and for holding the examinations in handicrafts and in the practical use of tools.

It was decided that the Scholarships were to be awarded according to the results of the examination of the Science and Art Department in the following subjects, as defined in the Science Directory:—1. Elementary Mathematics; 2. Higher Mathematics; 3. Theoretical Mechanics; 4. Applied Mechanics; 5. Practical Plane and Solid Geometry; 6. Machine Construction and Drawing; 7. Acoustics, Light and Heat; 8. Magnetism and Electricity; 9. Inorganic Chemistry; 10. Metallurgy; and according to the skill shown by the competitors in a special examination in the following handicrafts—1. Smith's work; 2. Turning; 3. Filing and Fitting; 4. Pattern Making and Moulding, or in the use of the following classes of tools—the axe, the saw and plane, the hammer and chisel, the file, or the forge.

Mr. Whitworth desired that the number of marks obtainable in the theoretical subjects and those obtainable by the most skilled workman should be about equal; and it was decided that no candidate should be eligible to obtain a scholarship who had not shown a satisfactory knowledge of Elementary Mathematics, Elementary Mechanics, and Practical Plane and Solid Geometry, passed in Freehand Drawing, and proved his power to use one at least of the before-mentioned classes of tools. The relative position of candidates as regards the theoretical subjects will be determined by affixing the same scale of marks to the several grades of success as is laid down for the competition for Royal Exhibitions, viz.,—for a 3rd class in elementary stage, 1 mark; for a 2nd class in elementary stage, 3 marks; for a 1st class in elementary stage, 5 marks; for a 2nd class in advanced stage, 5 marks; if previously successful in elementary stage, 7 marks; for a 1st class in advanced stage, 7 marks; if previously successful in elementary stage, 9 marks; and 5, 4, 3, 2, and 1 marks in addition to the first five candidates in the advanced stage if they obtain more than 90 per cent. of marks. For honours, 2nd class, 14 marks; for honours, 1st class, 17; "good" in freehand drawing will count as 1 mark and "excellent" as 3 marks. The "satisfactory knowledge"* required for passing in the subjects mentioned in Section 3 will be taken to mean the obtaining of a first class in the elementary stage of elementary mathematics, a second class in the elementary stage of theoretical or applied mechanics, a second class in the elementary stage of practical plane and solid geometry, and a "good" in freehand drawing.

The results of the examination in all the theoretical subjects will be published about the middle of June. It will then be possible to define within comparatively narrow limits the candidates amongst whom the competition will really lie. These will be directed to hold themselves in readiness to undergo the practical examination, which will be

* The papers of candidates who have taken the honours papers and failed in obtaining a class will this year be specially considered, and if it shall appear that the candidates show such knowledge as would undoubtedly have placed them in the first class in the elementary stage, they will be passed—that is to say, they will be considered to have satisfied the condition of showing a "satisfactory knowledge," but no marks will be given for these papers in the competition.

conducted at a certain number of centres by qualified persons. The practical examination is of two kinds. There is the examination of the handicraftsman or skilled artizan, and there is the qualifying examination in the use of certain tools. The examiners will decide on the number of marks to be awarded, and the position of the skilled artizans by the rate of wages, &c., which they have been receiving (as vouched by the certificates of their employers), by work specially executed for the occasion, or by an inspection of work upon which they may have been employed. The examination in the use of tools will be the performance of one or more of the following pieces of work.

THE AXE.

a. To square up a block of wood 1ft. long and 6in. diameter.

b. To made a spoke for a cart wheel.

c. To be able to shaft an axe.

d. To cut out wheel spokes ready for fitting into nave.

THE SAW AND PLANE.

a. To saw from a plank two pieces of timber 3ft. long and 3in. square and plane them up true.

b. To make a box 18in. long × 9in. wide × 9in. deep, planed up true and the joints dovetailed together.

c. To saw out and plane up two parallel strips 2ft. × 2in. × in.

THE HAMMER AND CHISEL.

a. To chip a piece of cast iron 6in. square over on one of its surfaces ready for filing.

b. To cut out of sheet iron (any gauge) a figure or letter of any size from 1in. to 6in.

THE FILE.

a. To file two sides of a cast-iron 1-inch cube as flat as possible with a Stubbs' 12-inch second cut file, the stroke of the file not being less than 9in.

b. A wrought-iron hexagonal nut ½in. or 1in. to be filed up true.

c. To file up two parallel strips, iron or steel.

d. To file up pocket square as true as possible.

THE FORGE.

a. To weld or join together two pieces of iron ½in. square.

b. To make a pair of smith's tongs.

c. To make the head of a hammer.

d. To make a pick.

e. To make 2ft. ½in. chain with hook and ring.

f. To make a horse-shoe complete.

g. To cut off and draw out chipping chisel or drill and afterwards harden.

h. To make a pair of small callipers.

i. To make a pocket square.

A competitor is not restricted to one only of the handicrafts nor to the use of one class of tools; but he may show his skill in two or more. His position and the number of marks to be awarded to him will be determined by his general skilfulness as a workman. A skilled mechanic will thus be enabled to obtain credit and improve his position by showing his power of using those classes of tools not properly belonging to his own handicraft, and the ordinary student may in like manner, instead of simply qualifying in the use of a certain class of tools, show his skill in one of the handicrafts mentioned. To those who merely qualify in the use of tools, a certain proportion of the marks obtainable for practical workmanship will be given according to their relative skill. These marks will count towards the general result. The travelling expenses of poor students—2nd class railway fare with a personal allowance of 10s. per diem—will be allowed to enable them to attend at the places where the practical examinations are to be held.

MARKING INK PENCIL.

THE Crystal Palace has lent its name to a great variety of art products, both useful and ornamental. The latest application of this favourite prefix has been made to a new marking ink pencil, which formed the subject of a recent patent. Pencils of this class have hitherto required cutting, but the daughter of the late John Bond—of marking ink fame—has introduced one on the ever-pointed principle. A thin stick of solid ink is enclosed in a wooden casing, and is propelled forward as it becomes shortened by use. This secures a permanent point and obviates waste from cutting. It is convenient in use, and as unfailing in its results as Bond's liquid ink. We may here refer to the Crystal Palace marking ink pedestal, which is the most complete and compact marking apparatus we have seen. It contains a bottle of ink, a supply of special pens and a holder, and the top is arranged as a stretcher on which the material is fixed for marking. We should add that the manufactory for these useful articles is No. 75, Southgate-road, London.

ON the 3rd inst., the first stone of a monument to the celebrated German geographer Mercator, was laid with great solemnity at Duisburg.

THREE YEARS OF SHIPBUILDING.

A PARLIAMENTARY return, showing what vessels of above 50 tons have been built in the United Kingdom in the last three years, states that at the port of London, in 1866, 32 vessels, of 17,734 tons, were built; in 1867, 15, of 3,644 tons; in 1866, 11, of 6,607 tons. At Liverpool 38 vessels, of 23,667 tons, were built in 1866; 22, of 12,475 tons, in 1867; 44, of 50,247 tons, in 1868. At Glasgow, 121 vessels, of 68,134 tons in 1866; 95, of 52,865 tons, in 1867; 97, of 90,390 tons in 1868. At Sunderland 149 vessels, of 59,254 tons, in 1866; 128, of 47,625 tons in 1867; 131, of 64,374 tons, in 1868. At Greenock, 18 vessels, of 14,276 tons, in 1866; 22, of 8,532 tons, in 1867; 32, of 16,819 tons, in 1868. At Newcastle, 44 vessels of 27,961 tons, in 1866; 28, of 15,464 tons, in 1867; 27, of 19,031 tons, in 1868. At Port Glasgow, 24 vessels of 10,689 tons, in 1866; 22, of 11,709 tons, in 1867; 23, of 14,022 tons, in 1868. At Hull, 59 vessels, of 13,288 tons, in 1866; 22, of 7,266 tons, in 1867; 20, of 8,186 tons, in 1868. At Aberdeen, 16 vessels, of 11,471 tons, in 1866; 18, of 9,199 tons, in 1867; 15, of 7,924 tons, in 1868. At Shields, 88 vessels, of 13,548 tons, in 1866; 6, of 2,094 tons in 1867; 7, of 2,626 tons, in 1868. At South Shields, 19 vessels, of 5,087 tons, in 1866; 8, of 1,452 tons, in 1867; 5, of 2,099 tons, in 1868. At the Clyde Ports, at Liverpool, and at Sunderland the tonnage built in 1868 was greater than in 1866 and 1867; at the other ports it was less than in 1866.

PATENTS AND PATENT LAWS.*

By W. BRIDGES ADAMS.

THE word "monopoly" is one of exceeding ill-odour with the great mass of the community, and to affix such a name to patents is considered a very clever move on the part of their opponents. It catches the public ear, and the public is very apt to take things for granted that appear to conform to its interests. What is a monopoly? A privilege conferred upon special individuals, for their own advantage, to the disadvantage of the community. At first sight, numerous private rights appear to be monopolies—land, mines, forests, rivers, the raw material of the world, which are the property of the whole human race, as tenants in common; and for individuals to possess and own them as private property is simply a concession granted, because they will produce a generally greater fruit by the process of individual enclosure than by a general scramble. The conversion of the raw material into useful forms, by the operation of the human brain and human hands, creates another kind of property, giving the raw material far greater value by mental and physical labour, labour which would not be given unless the owners could reap some of the fruits of it by an enclosure of the results of their own brains or hands as their own property. Origination of new and useful ideas and forms, producing something better and more useful than has been produced before, is the most valuable kind of labour, and therefore the world, in proportion as it becomes civilized, gives exclusive property, for a longer or shorter time, to the producers of the ideas, and goes still further in giving hereditary rights to long-continued industry.

Language is common property; but the author of a book, putting language into new forms in combination with ideas, is endowed with what is called "copyright" for a term of years, a monopoly, in short, for the reason that, without that monopoly, the books would not be produced, or only a very few books would be produced by a few wealthy and powerful persons; and the very title of the book is also a monopoly. Another person produces a picture which has a high value, and the right to reproduce that picture by engravings, or photographs, or other means, is reserved to him. Another produces new combinations of musical sound, and the multiplication of copies of this music is as much his own property as the original. Another produces a piece of sculpture. with the same results. Another produces a new design for furniture, or patterns for dress, or other manufacture, and that is as much his own, with the exclusive right to sell it entire or in copies, as though it were the corn and cattle of the farmer, or the fruit of the orchard owner, or the vegetables of the market-gardener.

This monopoly goes still further. The style and title of a firm is private property; and, as if to guard against the contingency of the same Christian and surname in combination being used for competition by a namesake, trade-marks were invented to ensure the monopoly, and every possible means are resorted to, to prevent a trader's individuality from being trenched on by his neighbours. Yet more, a proprietor of a newspaper, with no individuality, and who purchases all his wares ready made from other persons, has the exclusive right to a particular word or combination of words out of a dictionary, which, if he be the first to assume, no one can appropriate till he chooses to abandon his right.

Throughout all these things it is the right of property which the law jealously guards, mental or other. But for this law, a large mass of mankind would disguise themselves in their neighbours' likeness, to reap the profits accruing from their neighbours' reputation. What are called patents are mental originations, multiplied in matter, and the law professes to confer on the originator the sole right to use and sell them to the public for the course of fourteen years. Some of these originations are very popular, and an enormous trade grows up, from which large profits accrue, and it is very commonly an article not of real importance to the welfare of the community that makes the largest profits; but whatever it may be, trade rivalry is excited, and any means are resorted to for evading the patent without payment to the inventor. Everything previously known in the trade is at the disposal of the rivals, but the Naboth's vineyard they covet is the new thing which the public prefer, either for its superiority or its cheapness, and which has been the production of the inventor's brain. So they set to work to defame him, to deny his originality, to call him a monopolist, to decry his invention, to try to evade it by inferior methods, and, finally, to take advantage of inefficient laws to plunge him into costly trials that may ruin him and put the invention out of use, if they cannot appropriate it to themselves without paying anything for the cost of its production.

A few years back, an attempt was made to decry and abolish patents at the meeting of the British Association, and now once more an attempt is making to obtain a huge monopoly, under pretext of abolishing another—not a monopoly as of old in the case of the Corn Laws, for the benefit of landlords or landowners, but for the supposed benefit of trade lords and capitalists generally. Large manufacturers, material converters, and similar people, desire to get the use of brains without paying for them, or to keep things as they are. It is not a case of patentees against the community, as their opponents endeavour to make out, but a case for the community itself, as interested in progress, against wealthy traders who would keep down all progress, if by so doing they could keep up their own profits. It is the case of the community, in behalf of the active brains that work for them with mental capital, and without material capital, against the dull and inert brains with material capital in masses, which at present, stimulated into competition by the restless brains around them, lead an uneasy life, and would fain become the slaveholders of the active brains, and prescribe limits to their labours under their own control, and for their own imaginary benefit. It is an attempt to create an hereditary trade aristocracy by taking away the fulcrum through which clear brains rise into the possession of material capital, and their owners elbow the inert rich from their seats. And not uncommonly, it is those who have grown rich upon patents who are the most strenuous opponents of other men's patents.

The common ground of opposition is that patents impede progress. If they did, that would be sufficient reason for their abolition. But assertion is not demonstration. It is asserted that the patent is a monopoly which no one but the owner can use. Quite true; but so is land a monopoly which no one but the owner can use, the difference being that the patent is a monopoly for fourteen years, and the land for ever. The patent is a fourteen years' monopoly of individual brainwork, the land monopoly is that of the material works of the Creator. If the land were the property of the State, the rentals would belong to the general community as a tax-fund, and the community gives it to individuals on the supposition that they will manage it better for the general benefit of the community than the State could, the rental being the payment for their trouble. The patent is a limited property, the land is an unlimited property, both conferred by the community, and capable of resumption if demonstrated to be mischievous to the community.

The brain-worker can only, in the case of patents operate by the agency of matter, the property of the landlord, who exacts a large share of the brain-work in return for the use of the matter. But the brain-working patentee has no monopoly. He is exposed to the competition of all others using the landlord's matter or the materials of the Creator, save in the patentee's particular mode. And no sooner has he achieved a success than other inventors are immediately at work to eclipse him, to the benefit and advantage of the public; and it is notorious that, even in the case of a successful invention not superseded by another improvement, commonly half the fourteen years' term expires before an invention is brought even into limited use.

The large manufacturer has his choice of patents by competition amongst brains, saying nothing of the stored-up records of lapsed patents at the Patent Office, which he rarely has recourse to, save to compete with, and defeat, something new, which a rival manufacturer has produced under a patent, and turned to profit. It is well known that few manufacturers will embark in new things without the protection of a patent, for the reason that money must

* Journal of the Society of Arts.

be expended experimentally, and that rivals lie in ambush to reap the profits in competition, without outlay, and consequently can undersell the originator, and for this reason the records of lapsed patents in the Patent Office are not resorted to, but remain dead letters.

It has been sought to make a distinction between copyright and patent right. There is none; they are alike, in their integrity, original emanations of the human mind, and we may be quite sure that the abolition of patents would soon be followed by the abolition of copyright in books or works of art. Copyright in designs is copyright in a representation. Patent right is copyright in form, and utility, and methods of production; whether brain imagination be multiplied in printed books, or in music, or in engraving, or artistry, or design, or theatrical exhibitions or shows, or stamped on matter under what are called patents, it is the same process of expressing mind in matter as an origination; and as the originators are comparatively few in number, it is desirable to cultivate them, and give them enclosures of mental domains wherein to have free scope for the exercise of their various arts, for precisely the same reasons that the enclosures and private ownership of land—a common property—is granted to the producers of food, and for other purposes.

It is simply the system of bad laws to which all the evils of patents are traceable. There was a time when, amongst the manufacturers of printed fabrics, all new designs were kept secret as far as possible till the moment of issue, and all were busy bribing, or trying to bribe, their neighbours' designers. The Act for copyright in designs abolished this system of piracy, and with it the secrecy. Were patents abolished, one of the results would be a return to secrecy in all small things, a closing of manufactories against inspection, and a general dearth of information to mechanical periodicals, while improvements, involving a large outlay of capital, would cease to be made, unless perchance in Government establishments. If the spread of knowledge be a national advantage, the inducement to secrecy by the abolition of the patent—OPEN—would be a serious evil.

Amongst the reasons alleged for the abolition of patents, one is, that the patentees gain no advantage —being ruined by opposition and law suits in case of the invention being successful. This is the greatest farce of all, as if land property would be safer than brain property, were it protected by as bad and inefficient laws as patents are subjected to, and as if there were any difficulty in making as efficient laws for patents as for books and designs, were only influential men interested in bringing them to pass, and lawyers not interested against them. Another allegation is, that the great mass of modern patents are useless. If they are useless they need not be coveted. If impedimental, they certainly must supply something useful. But it is again alleged that they are frivolous. But is not trade itself widely frivolous? Yet what merchant is there who despises anything frivolous, provided only large profit be mixed up with it? What is more frivolous than the majority of theatrical farces, yet what is there more carefully guarded against piracy? But, say the objectors, patents are granted for things not new, and merely serve as an excuse for lawsuits. That simply means that the law and practice have not yet been fitly established. Some say that patents are becoming so numerous that they cannot keep count of them, and so unwittingly infringe them. This is not logical. The patentee might as well object. "The great manufacturers make so many new things without giving me notice, that I cannot keep count as to my originality." This complaint on the part of manufacturers only proves that they manage their business badly. It is surely part of the business of a great manufacturer to know of everything produced in his special art, and, therefore, he should keep a book of patents as regularly as his price-list, with a managing clerk to it. He can, at small cost, have all the specifications in his trade supplied to him as fast as they come out, and he can index them and mark out all the real novelties and utilities, and put them to use by agreement with the owner. It is said that every British subject is bound to know all the laws, or take the consequence of breaking them, and certainly a British manufacturer is bound to know all the patents in his trade as part of his business.

All existing knowledge and manufacturing experience up to the present time is the joint property of the whole nation, less certain things protected by patents expiring in fourteen years. But these patents are the "Naboth's vineyard," coveted by the lords of trade. But they may fairly say that amongst the numerous patents there are many fictitious ones, involving lawsuits, and thus deterring them from the use of what is really common stock. That is to say, the patent laws are bad laws, so bad, that were all laws equally bad, the nation would be in a condition of anarchy. To abolish the patents instead of to reform the law would be a precedent upon which we might abolish all laws.

Let us begin at the beginning. Patents are virtually granted for something new and useful, thereby to teach the public, and the reward for such teaching is a fourteen years' exclusive right. What, then, is novelty? "There is nothing new under the sun," absolutely. The patent is really granted for something new to the existing generation, as an inducement for a skilled man to bring it into use. The title should, therefore, be put on a similar footing to that of land. A piece of unowned land unclaimed for thirty years becomes the property of whoever may occupy it, and for ever. Therefore, supposing patents to be in the interest of progress, absence of public use for thirty years should constitute a claim to anything useful as a novelty for fourteen years, or such time as might be deemed equitable.

Everybody of legal age should be competent to apply for and obtain a patent, but as any preliminary examination and refusal might involve an accusation of nepotism or a contingency of error, not afterwards to be amended, it is desirable that protection should be granted, if desired by the applicant, after pointing out to him the defects; and that the specification, after completion, should be put on open, not secret, trial, by a competent judge, in the presence of the patentee, and the original fees should cover this cost. It is not desirable that a model should be put in at first, as involving the employment of workmen and the risk of discovery before protection is granted; and models being expensive, it is not fair to encumber the patentee with costs. The affirmation of the patent by the court should facilitate all further litigation as to title and right, the court itself taking the initiative, or acting at the instance of a complainant. Pecuniary damages should be dealt with by a magistrate, as in the case of copyrights, or by the ordinary courts of law. Fictitious patents abolished by the court would cease to be a nuisance in the hands of sharking pretenders. There are very few patents requiring deep thought to apprehend them when produced, or any length of time when legal quibbling is abolished. An inventor should not be bound to licence other persons, for the reason that they might be rivals, only taking a licence in order to damage his invention in public reputation. If an unreasonable man, he would damage himself by limiting the use. If a manufacturer, he might be interested in selling at the lowest price without royalty profit, and thus, as a small capitalist, he might compete with great capitalists by securing the trade in a better article.

If the invention were a small item in a large machine, and the inventor required an unreasonable royalty, that would simply be a stimulus to other inventors to make other improvements, and this would be clearly in the interest of the public. In cases where the subject of a patent has been in private use previous to the specification, unknown to the patentee, it would become a question for the court to decide as to whether the public had been kept out of the knowledge furnished by the patentee, and, if so, the patent should be confirmed, subject to the use of the first user, but without giving to him the right to licence earned by the patentee by his publication. No excuse of ignorance of a patent should be admitted as a plea or mitigation of infringement, because, with the full means of obtaining the records of the Patent Office, the ignorance must arise either from wilfulness or negligence.

Patents are the Magna Charta of the material progress of a nation, by the agency of the rich brains of men, poor in practical capital, who can mould matter to man's uses after new and useful fashions, just as copyright is the Magna Charta of the nation's progress by the agency of men of rich brains who can mould language to men's uses after new and useful fashions. When laws shall be made to take away this charter and throw brains into common stock, one of the sources of England's eminence, her true equality, will have departed from us, and the trade lords will find that their vitality has departed with it. They will compete with each other with increasing competition and lowering profits, till their trade becomes as wild land, which no one cares to cultivate. They will then find that the fourteen years' mental enclosure, which induces men of thought to bring forth new things, is also one of the processes essential to profit, and that by abolishing it they "kill the goose which lays the golden eggs." Trade-marks are the legitimate arms and quarterings of a trade aristocracy, guarantees of honesty in execution, and which become valueless as a manufacture becomes debased. They are monopolies in one sense, as they enable the owners to keep to themselves a large trade so long as they keep up their character, and the law now jealously deals with their infringers. The patent is also a trade-mark exclusive for fourteen years, enabling the owner to establish a reputation for originality and improvement, and to keep his reputation when thrown into competition with rivals. And with patents confined to the owners of manufactories, that would simply be establishing a caste of veritable monopolists.

The question has been dealt with thus far simply in the interest of the public, regarding the inventor merely as a part of the public. But the true inventors are more than this—they are a select body of students, who foresee those things that the manufacturing men of routine pass by blindfolded, and thus stir them up to action; and the public is deeply interested in caring for these men, and guarding their interests as their own. From the trade point of view, the mere manufacturer only looks to the profit percentage attainable by the conversion of raw material into wrought, and would work up the whole raw material of the land, and afterwards throw it into the sea, if realizing the percentage thereby. It is this class of men that deteriorates our national manufactures in money competition, that makes rails as brittle as cast iron, and delights in shoddy, that has no perception of, or care for progress, but only for money. It is not thus that the greatness of England has grown; nor is it of the highest importance that inventors should reap enormous fortunes, albeit trifling in proportion to the gain to the general community; but it is desirable that they should be in the unanxious position requisite for the most advantageous pursuit of their studies and experiments, as a result of their own labours. The nation in which all classes of its people can rise in succession, according to their faculties and cultivation, from the lowest position to the highest, must ever be more powerful than a nation of castes, and a nation without laws efficiently protecting mental as well as physical property must degenerate into a land of castes—or robbers.

There is yet another allegation on the part of opponents of patents. Having to pay a royalty in England, other nations paying no royalty can undersell them. It is scarcely so, for other nations are as desirous of having patents as English people are. Of the two republics, America and Switzerland, the former abounds with patents, the latter has none. The reason is, that in the former case they are a function of the Federal government, in the latter of every separate canton, rendering patents a practical impossibility. But citizens of Switzerland expatriate themselves, and get patents here and elsewhere, and it is probable that the patent branch of legislation will be transferred to the Federal government, and Switzerland will cease to be an exception to other civilized states. With a climate and condition like that of England, where workmen live longer and do more days' work in every year than in most other countries, it is impossible that she should be undersold in her indigenous manufactures, so long as her materials shall endure. Capital embarked in the growth and training of a workman is profitable in proportion to the length of his working life, and the faithful and honest work produced.

The assumption that every patentee only forestalls a number of other persons, who would have discovered or planned the same thing, may or may not be true, but this does not concern the public. What the public want is individuals who will work, and teach in the best mode they can, something new and useful; and daily experience tells us that such individuals cannot be obtained save on the condition of thereby obtaining a specific sphere of action involving their own benefit as well as that of the public. Let any one try if, by simply publishing a new and useful thing, he can get it taken up unless he can offer an exclusive right with it. Neither is there any probability in the assumption that all the principles of action have been discovered, and that the details are in every one's hands. The tree of universal knowledge is yet far from having been plucked, and it is to be desired, that the men of science, as well as the men of practice, should be not only recognized but rewarded, as the benefactors of the community—not rewarded, as M. Chevalier proposed, by the State, but by the community. We do not want political inventors, with a government reward as a compensation for something other than an invention, and with their own friends to apportion it. We want for them the only true appreciator, the public.

There is no difficulty in remedying all the evils complained of in the present practice of patents. Forms of specifications can be prepared, embodying everything that is required to be stated, leaving no loopholes, and preventing verbiage, giving an exclusive privilege to make something useful, and leaving it open to competition to make something still better. The life of the inventor patentee is no lazy life. He has the public for a master, and a very exacting master too, content with nothing but the best or the cheapest, and ever ready to abandon its idol of to-day for its idol of to-morrow, succeeding each other in constant following. What do the long list of patents in the same arts mean, save that the human brain works only from step to step, eclipsing yesterday by to-day, and thus preparing the way for the morrow, a 'vantage ground being gradually attained, till the process culminates in an apparent perfection, at last found to be no perfection, when a fresh start is made to a new elevation. By the sweat of the brain within his brow the inventor diminishes human labour and the sweat of many brows, for his only profit is out of the service he renders to mankind, who will not pay for anything they do not appreciate as useful or pleasant. No State reward is needed as a stimulus to this kind of labour. The inventor only asks to be let alone to reap the crops he has himself sown, secure against depredation.

It was Prince Albert by whom the amended Patent Law, then being worked at by the Society of Arts, was finally urged, and it was Lord Granville who brought in the Bill and passed it through Parliament, in the course of a very few days, because it was believed that only thus could a number of latent inventors amongst mechanical men be brought to

light for the benefit of the Great Exhibition. It was this bill which, by reducing first cost, multiplied the number of patents, and put poor men more on a level with capitalists. And it would appear that non-inventive capitalists would rather be without these patentees, and would prefer to buy up their inventions for their own purposes, and so limit the public choice in the market. Patents give a large market for constant improvements, which would not exist without them. All the large manufacturing towns and cities of England may be said to be built upon patents, and were patents abolished, the result would be similar to that of the abolition of the Edict of Nantes; the imaginative brains would depart from England, and settle down in the countries wise enough to understand their true interests. Viewed from the monopoly point, the wisest course the manufacturers could take would be, not to abolish patents, but to enhance their cost. If patents cost £5,000 each, with efficient laws to maintain them, every poor man would be shut cut, and patents would become the practical monopoly that the manufacturers insist on calling them. But the motive would thus be too gross.

The subject cannot be too widely discussed, nor the facts elicited too clearly, for we cannot, as a nation, afford to risk our prosperity in order that a small number may grow richer at the general cost. We want a general diffusion of wealth, and not a greater aggregation in masses. Large manufacturers tend to the growth of quantity rather than quality. Small manufacturers tend to the growth of quality, and that diffusion of wealth so largely trenched on of late by the gigantic establishments which permit only two classes, the very rich and the very poor. The higher classes, living on incomes the result of land or hoarded wealth, are deeply interested in the question, for it is a question of property right; and in the diffusion of property rather than in its concentration lies its safety. The convenience or profit of manufacturers is but a small consideration, as well as the convénience or profits of inventors. The national prosperity is the real question at issue. Shrewd Frenchmen tell us that we began patents some fifty years before them, and, therefore, they have never been able to overtake us. Were we now to abolish patents for fifty years, our human energy would be expended in producing original workers for all other nations, and excluding our own.

TREATING WOOD FOR MANUFACTURING PAPER.

An invention has been patented by Dr. Matthieson, chemical lecturer of St. Bartholomew's Hospital, which relates to the preparation and treatment of fibrous materials suitable for the production of paper. The wood when in a state of division, such as shavings, sawdust, or disintegrated wood, is submitted to what is known as a retting process, that is, the wood in a state of division is steeped either in running or stagnant water, and is allowed to undergo a retting or fermenting process, by which certain constituents of the wood will be decomposed and removed, and the subsequent treatment of the residual ligneous fibre for the production of pulp or paper will be thereby rendered more economical, and the process of boiling and bleaching be more easily effected. The time necessary for effecting the process of retting will depend upon the temperature of the water and the nature and state of division of the wood operated upon; the higher the temperature the shorter is the time required.

Dr. Matthieson also submits the wood when in a disintegrated or divided state to the repeated and successive action of water at a temperature below 212deg. Fah., in order that those constituents which are soluble in water may be removed either before or subsequently to the retting process. By this additional process the ligneous fibre is rendered better capable of being more economically treated by any of the processes usually employed for the boiling and bleaching of the ligneous fibres and materials which are employed in the production of pulp or paper. The ligneous material, after having undergone either or both of the processes before described, is submitted to the action of an alkaline ley and to the processes of boiling and bleaching.

In the third place, the inventor submits timber or wood in bulk, either at the ordinary or at an elevated temperature, to the action of water or of an alkaline solution in a manner similar to that which is known as the Boucherie process, and at such a pressure as that the water or the alkaline solution shall purge the cells and other portions of the vegetable structure from the sap and other fluid constituents contained therein. The timber or wood thus purified may then be employed for the production of paper in the manner as hereinbefore described or otherwise. These processes may be applied to either dry or seasoned wood or to green or fresh wood, preference being given to the latter.

Correspondence.

BOTTLE-SHAPED CARTRIDGES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I am told that cartridges of a bottle form are now being made for the Martini-Henry rifle and that they were used in that arm at the lat Wimbledon meeting. I should be glad if you o any of your readers can inform me if this statemen is correct, and also if this form of cartridge ha been previously proposed or used.—I am, Sir, yours, &c., J. B.

London, August 18.

[We are not aware that the bottle-shaped cartridge is being made for the Martini-Henry rifle, nor do we think it was fired at Wimbledon. At any rate, we did not meet with it at any of the firing points. This form of cartridge is no novelty; for several years past it has been made in copper for the Spencer repeating rifle. It was also adopted by Colonel Boxer in some of his cartridges before the rifle competition, and cartridges on this principle are now largely manufactured by Messrs. Eley Brothers, some we have by us being stamped "Eley-Boxer patent."—Ed. M.M.]

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

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Naval, Military, and Gunnery Items.

It has been decided that there will be no examination in December next for admission to the Royal Military College, Sandhurst.

A War-office return shows that in the year 1868 2,524 men were enrolled in Great Britain under the Militia Reserve Act; and in 1869 6,589 men had been enrolled at the end of July.

Advices have been received that the "Aerial" and "Lahloo," tea ships, left Foo-chow on July 2, and the "Leander" and "Thermopylæ" on the following day. The latter two vessels are the favourites in China for the annual "tea race."

By an Act of Parliament just printed power is given to remove military prisoners to Millbank to be treated as other prisoners. Regulations may be made for the treatment of military offenders at Millbank Prison.

The Admiralty flag will be hoisted on the forthcoming cruise on board Her Majesty's ironclad ship "Agincourt." The First Lord of the Admiralty will be accompanied by Vice-Admiral Sir Sydney Dacres, K.C.B., Captain Beauchamp Seymour, C.B., and Captain Willes, C.B.

Orders have been received at Chatham dockyard from the Admiralty, directing the construction of a target of great weight and thickness of armour plating, to be used in the experiments intended to be carried out at Shoeburyness to test the effects of vertical firing.

The Supervising Inspector of Navigation for the Eighth District, which comprises the great lakes on the northern boundary of the United States, has just made public his report of disasters during the year 1868. The statistics are as follows:—Passengers carried, 900,000; lives lost from fire, 73; from collision, 51; from wreck, 26; from explosion, 1; making a total of 151. The accidents were 19 in number, as follows:—Collision, 8; fire, 6; striking on sandbars or rocks, 3; foundering, 2. Of the fires, five were of vessels burnt at night while lying at the dock.

In connection with the King's Lynn dock, recently inaugurated by his Royal Highness the Prince of Wales, it may be remarked that the contractor (Mr. Lawrence) has pledged himself to complete the railway which will bring the dock into communication with the Great Eastern and Midland system by January 1, 1870. A warehouse on the south side of the dock is making good progress, and a commencement has been made with the construction of a series of four warehouses on the north side. It is expected that the Midland Railway will deliver 50,000 tons of coal annually for exportation from the dock.

We note in the "Birmingham Post" that Mr. A. Somerville, of the firm of Braendlin, Somerville, and Co., has been created by the King of Italy a chevalier of the order of St. Maurice and St. Lazarus. Mr. Somerville's firm are the patentees of the Albini-Braendlin rifle adopted by the Italian and Belgian governments, and Mr. Somerville, who is now in Italy, has lately effected an improvement in revolvers, adapted for use of cavalry regiments. Some Italian officers, we are told, pointed out to him that the revolver is comparatively useless to cavalry, because mounted soldiers cannot easily take aim. To meet this objection Mr. Somerville caused the ball to be cut into four, six, or more pieces of equal size, and these being fitted together were re-introduced into the cartridge in the same manner as a single bullet. This experiment, we learn, proved very successful, the charge when fired scattering like grape shot and the revolver being thus altered into a mitrailleur.

Miscellanea.

The Berlin Committee has received subscriptions to the amount of 5,166 thalers for the purpose of erecting a monument to Alexander von Humboldt.

The number of public Acts passed in the recent session was 117, against 130 in the preceding year. In the session just ended the local statutes numbered 182, and in the last year 159.

With regret we record the death, at the age of 71 years, of Mr. Edward Barrow, for nearly 40 years a member of the literary staff of the "Morning Herald," and for several years of that of the "Standard."

The number of visitors to the Patent Office Museum, South Kensington, for the week ending August 14, was 4,591. Total number since the opening of the Museum, free daily (May 12, 1858), 1,621,616.

A New Zealand paper says that several specimens of Taranaki steel have been taken to England, smelted from the Taranaki steel sand, which is said to contain 75 per cent. pure steel. Samples of both crude and manufactured have been sent.

In the years 1863, 1864, 1865, and up to June 30, 1866, 85 tigers, 365 cheetas and panthers, 72 bears, and 61 hyenas, were destroyed by Shikarees in the district of Vizagapatam, and in that period the reward for the skin of a tiger was raised from 35 rupees to 100 rupees.

We understand that the emigration of Cornish miners continues, more than 50 having left the country during the past week. The cause is, not want of employment, but the low rate of wages. Unfortunately, the miners who are emigrating are mostly of the best class.

A recent telegram from Ajaccio states that the domanial forest of Mormano has been on fire since the 8th. Measures had been taken by the troops quartered at the penitentiary establishment of Casabianca, close by, to extinguish the flames, but the attempt failed and the conflagration was still spreading.

The Great Western Railway Company have given notice of the suspension of their traffic between Hereford and Ross from to-morrow night till the 23rd inst., in order that the line may be converted from the broad to the narrow gauge. The line between Ross and Grange Court will be closed from August 23 to August 31 for the same purpose.

A letter from Rio Janeiro says that, owing to the bad reputation of nitro-glycerine, a small quantity in the military arsenal there was ordered to be thrown into the bay. Six ten-pound cans were put into a boat and taken out 250 yards. The first one thrown out exploded on striking the water, and the concussion set off the others. The boat was blown to pieces, and all the crew, seven persons, killed.

The number of visitors to the South Kensington Museum during the week ending August 14, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 14,871; Meyrick and other galleries, 3,132; on Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,805; Meyrick and other galleries, 209; total, 20,017. Average of corresponding week in former years, 12,087. Total from opening of Museum, 8,695,818.

According to a report in the "Industrial Alsacien," a shocking accident occurred a few days ago in a quarry on the territory of Bollingen, about a league from Berne. A piece of rock upwards of 80 yards high suddenly gave way and fell upon some men who were working at the time, overwhelming them under a mass of rubbish. Fifteen were found to be missing. Eight bodies were immediately dug out in a dreadful state of mutilation, and no hope was entertained of finding the others alive.

At a general meeting of the Royal Horticultural Society, held on Tuesday, Mr. W. Wilson Saunders, F.R.S., in the chair—Mrs. J. Humphrey and Henry Whitworth were elected fellows. Among the objects of interest shown was a magnificent specimen of lilium auratum (on which were over 150 blooms) from the gardens of the Dowager Lady Ashburton. The Council specially awarded the Lindley Medal to this fine plant. Mr. Bull exhibited a gigantic aroid, the property of Dr. Seemann. Messrs. Kelway and Sons' collection of gladioli and Mr. Chater's collection of hollyhocks were deservedly admired.

The British Consul at Chee-foo reports that the wild silkworm is bred in large quantities by the country people of Shan-tung, and a great deal of wild silk is produced annually in the neighbourhood of Chee-foo, in the central part of the province, and in the vicinity of Tsi-nan-foo. The silk cloth made from this wild silk is brought to Che-foo for sale. It is used by the Chinese for summer clothing, is very strong, and wears extremely well. It is thought probable that the wild silkworm may be acclimatized in Europe, and attention has been drawn to it both in Italy and France. Che-foo can furnish the eggs of both the wild and the domestic silkworms.

The mining industry in Queensland is in a very satisfactory condition, and is rapidly acquiring increased importance, in consequence of the frequent discoveries of mineral wealth that are being made. This progress has made itself more especially felt within the last year. By the statement of imports and exports to the colony during 1868, it appears that the largest increase in the exports has been in the value of gold. In 1867, the amount was £189,248; last year it was £593,516, which shows an increase of £404,268 on last year's operations in this direction. The value of the exports of copper and copper ore has increased during the same time from £66,038 in 1867, to £72,136 in 1868.

It used to be the boast of England, says the "New York Times," that on its empire the sun never sets. Well, we have an empire on which the sun only sets occasionally. Mr. Seward, at San Francisco, expressed the greatest interest in viewing for the first time the broad Pacific; at Sitka, for which he has set out, he will find a novelty which not a dozen persons in the old States have ever seen. In that latitude the sun does not set at all in summer. It remains about 25deg. above the horizon at the hour we call midnight. The only mode of knowing there that it is midnight is to watch the sun when it begins to ascend. Fowls go to roost at 7 p.m., and repose until the sun is well up. In winter it is, of course, the reverse, as in the higher latitudes the sun is not seen for six weeks.

One of the last Acts of Parliament, rendered necessary by the recent fearful accident, was passed to prohibit, for a limited period, the importation and to restrict and regulate the carriage of nitro-glycerine. Save as mentioned, no person, after the passing of this Act, is to bring into any port or harbour of the United Kingdom, or ship or unship on, from, or near the coasts of any part of the United Kingdom, any nitro-glycerine. By acting in contravention to the provisions the party is to be guilty of a misdemeanour, and liable to be imprisoned, with or without hard labour, for one year, and all nitro-glycerine brought into any port is to be forfeited. New regulations are to be made as to the manufacture, sale, and carriage of nitro-glycerine, and notice of nitro-glycerine is to be given, and search permitted for the article.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—144, 179, 191, 209
Buildings and Building Materials—154, 163, 170, 197, 198, 206, 214
Chemistry and Photography—148, 186
Cultivation of the Soil, including agricultural implements and machines—177, 190, 193, 199, 217
Electrical Apparatus.—216
Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—138, 147, 150, 153, 155, 157, 158, 169, 184, 200, 204, 205, 207, 218.
Food and Beverages, including the apparatus for preparing food for men and animals—142
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c.—135, 146, 151, 152, 156, 185, 187, 194
General Machinery—145, 159, 165, 183, 195, 203, 210, 215
Lighting, Heating, and Ventilating—162, 186, 208
Metals, including apparatus for their manufacture—139, 149
Miscellaneous—134, 140, 141, 164, 167, 171, 173, 178, 180, 181, 188, 192, 201, 202, 211, 212, 216
Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—136, 137, 160, 172, 175, 182, 189, 213, 3888
Ships and Boats, including their fittings—143, 160, 168, 174
Steam Engines—196
Warfare—166, 176

3888 W. Pidding, Walcot-square. *Locomotion.* Dated October 21, 1868.
This consists in placing and affixing in naves equidistant bow-shaped double spokes with their hollows facing each other connected together at their extreme ends. Projecting from the ends of such spokes, alternately of different lengths and at right angles with them, are to be placed and fixed bolts or studs for the purpose of their being made to pass through sideways, and to partially rotate between the centres of rails placed in parallel lines, and almost in close contact at their ends. The disconnected rails are to be secured at their ends in pairs by elastic bands or fastenings, to allow of their movement when progressing and turning on to the feet or chairs described in the patentee's specification of the patent, No. 14,036, dated March 24, 1852. The naves in connection with the portable rails hereinbefore described are to be placed on axles affixed to the vehicle immediately over their ordinary wheels, and in such manner as to encircle them in such manner that the rotating surfaces of such wheels shall always be in contact with one of the parallel lines of the disconnected rails.—Patent abandoned.

134 A. H. A. Durant, Shepherd's Bush. *Manufacture of oil.* Dated January 15, 1869.
In the first place, the inventor winnows or removes the husk of the seeds or berries by the percussive force of blades or fans thereon, such blades or fans having a rotary action communicated by steam or other power for the purpose. The seeds or berries fall through sieves or feeders, so that the blades or fans strike them in their descent with sufficient force to break the husk or shell, and the albumen is afterwards removed from the husked seeds by boiling them in water, or immersing them in hot or cold water, and agitating them therein for a sufficient time; but it is preferred to use boiling or hot water, and in some cases 10 per cent. of nitric, sulphuric or other suitable acid is added to the water, for the last mentioned purpose. The seeds or berries thus husked and cleansed are then crushed and the oil expressed therefrom in the ordinary way.—Patent abandoned.

135 T. A. Warrington, Kentish Town. *Spoons.* Dated January 16, 1869.
The inventor makes the bowl of the spoon with an extension on one side formed as a continuation of the bowl, for guiding or directing the soup or other food into the mouth, and he constructs it with a curved bridge, guard, or plate formed with a ledge, and which guard or plate bridges or spans the bowl of the spoon in the direction of its length, thereby deflecting the hair of the upper lip from the bowl of the spoon, but nevertheless having suitable openings at each side so as to allow of the ready admission and emission of the soup, or other liquid food, to and from the bowl or body of the spoon. The bridge, guard, or plate may, if preferred, be hinged at one end, to facilitate the cleaning of the spoon.—Patent abandoned.

136 J. T. Bentley, Kendal. *Permanent way.* Dated January 16, 1869.
This consists in the use or employment, in combination with the fish plates and bolts at present ordinarily employed, of a device taking into suitable openings or recesses made in the webs of the rails in such manner as to ensure the formation of a perfectly even and continuously rigid road or way which shall not be liable to deflect at those points where the ends of the respective lengths of rails meet one another.—Patent abandoned.

137 S. Russell, Brixton. *Velocipedes.* Dated January 16, 1869.
The inventor constructs a carriage with a driving wheel placed at one end, whilst the other end is supported by a pair of steering wheels. The frame of the carriage is made of a triangular form, both vertically and horizontally, which enables the driving wheel to be held very steadily.—Patent completed.

138 R. Craig, Dalkeith. *Paper.* Dated January 16, 1869.
This consists in the application to paper-making machines of a roll or roller coated with vulcanite and with vulcanized india-rubber, and which roll or roller is substituted for the ordinary iron, brass, or other metal under press roll of the paper machine, and may be used as an under or upper second press roller.—Patent completed.

139 J. Jeavons, Sheffield. *Iron and steel.* Dated January 16, 1869.
In order to decarburize the iron while in a molten state in the puddling furnace, a vessel of suitable size attached to the end of a bar or rubble is filled with nitrate of soda and oxide of iron, or other suitable substance containing and capable of evolving oxygen. The vessel is then moved about under the surface of the molten metal, the result being that oxygen is evolved from the material contained in such vessel, and the same combined with the carbon in the molten metal, and according to the extent of the operation produces such quality as may be desired.—Patent abandoned.

140 J. G. Johnson, Warwick. *Signal apparatus.* Dated January 16, 1869.
When the improved signalling apparatus is intended to be used upon a railway or tramway, it is conveniently applied by attaching to a convenient frame or support fixed by the side of the railway or tramway, a signal arm, and also an index pointer and dial in such a manner that the tyres of the wheel of the passing engine or carriage, or some part of the engine or carriage, may act upon a bar, which acts upon a cam so as to give motion through a connecting rod and lever to a rod attached to the frame or support. To one end of the rod is attached a rack, and and at the other end is a piston working in a suitable cylinder like that of a force pump. The rod on being raised or lowered acts upon and turns a pinion which carries with the signal arm, and also the index pointer, which moves on the face of the dial like that of a clock. The passing engine or carriage acts by means of the levers and rod above mentioned upon the pinion wheel and so upon the signal arm and index pointer, which are thereby set at a given position, for example, so that the index pointer points to zero on the dial plate. The rod and with it the piston being raised produces a vacuum in the cylinder, which is connected with a suitable small reservoir or vessel containing water or other fluid. The fluid rushes in through the suction pipe and fills the cylinder. The piston and signal rod, and any necessary weight that may be attached to them, begin then to press upon the water or other fluid contained in the cylinder with a constant and uniform pressure. The water or other fluid is then allowed to flow out of the cylinder through a small aperture at a given speed, which may be regulated by any suitable valve. As the fluid issues, the piston descends and moves the signal arm and the index pointer on the clock dial at any given rate.—Patent completed.

141 J. H. Johnson, Lincoln's Inn. *Casks, &c.* (A communication). Dated January 16, 1869.
The object is to remedy certain defects which exist in the manufacture of casks by hand, to which machines hitherto proposed to be used in that manufacture, are liable. They relate to a series of machines intended to shape with the greatest rapidity and the requisite accuracy the different parts of which casks, tubs, and other like receptacles of any required dimensions are formed. At each operation the stave is worked according to the form it is required to have when the cask is put together, which principle admits of producing casks and tubs equal in quality to those made by hand. It should be observed that all the wood is first cut to the required length, width, and thickness, in the ordinary manner.—Patent completed.

142 H. A. Silver, Bishopsgate-street. *Cooking apparatus.* Dated January 16, 1869.
This consists in the combination of a vessel having a jacket or inner lining of tin, copper, tinned iron, or other suitable material, in the inner space or compartment of which is a dry heat with an outer case or heat retainer, constructed in the manner described in the specification of a patent granted to H. A. Bonneville, dated August 23, 1867 (No. 2417).—Patent completed.

143 John Bourne, Leith. *Propelling vessels.* Dated January 16, 1869.
Instead of propelling a vessel wholly by a screw or screws or by paddles, in the usual manner, the inventor propels her partly by a screw or screws or by paddles, and partly by a jet or jets of water, steam, air, or other gases, or by a mixture of all or any of them, the said jet or jets issuing sternward, and the screw or screws or paddles acting in conjunction or combination with the jet or jets in the propulsion of the ship.—Patent completed.

144 J. Loader and W. H. Childe, Finsbury. *Steam boilers.* Dated January 16, 1869.
The inventors employ a shell or boiler strong enough to withstand the strain, and they place therein a steam chamber of corresponding form, so that a water space is left all round the chamber between it and the shell. This chamber is made steamtight, except at the top, where an opening is made to receive a tube which is fitted steamtight to the chamber; the tube is open at the top or is perforated near the top. As soon as steam is generated it passes through the opening or perforations of the tube into the steam chamber. The steam chamber may be situated either above or below the water line, and may be fixed or allowed to float.—Patent completed.

145 W. and S. Bottomley, Rochdale. *Couplings for rollers, &c.* Dated January 16, 1869.
This consists in turning a round end on one roller, which end has a thread or screw formed on it; this round end fits into a round hole, and the thread or screw is screwed into this round hole in the other roller, thus coupling them together.—Patent abandoned.

146 W. Thomas, Cheapside. *Boots and shoes.* Dated January 16, 1869.
This consists in making boots and shoes as follows:—To the flesh side of the inner sole, prepared by thinning it round the edge, an inner welt of leather or other suitable material is sewn. The sole is then secured with its grain side to a last, and after turning up the edge of the inner welt, the upper is drawn on to the last, the stiffener inserted, and the upper and the outer welt are sewn to the turned-up edge of the inner welt; the welts and upper are then beaten flat to the last, the waist is stiffened by the insertion of the filling or shank piece, and the outer sole is sewn to the outer welt. The boot is afterwards finished in the usual manner.—Patent completed.

147 J. B. Whitehall, Nottingham. *Machinery for looped fabrics.* Dated January 16, 1869.
This consists in applying to each head a toothed wheel which turns with the head and gears into a wheel secured on the lower end of an axle which is held in a bearing secured to one arm of a standard to the right of the head. The upper end of the axle carries a circular plate which is furnished on its lower side with a presser plate which is shaped slightly eccentric for the purpose of adjustment. This presser revolves once round during two revolutions of the circular head. Above the toothed wheel, on the pipe of the head, and also revolving with it, is another wheel which drives a wheel half its size. This wheel is held on the lower end of a short shaft by a set screw; the shaft turns in bearings screwed to a standard at the left side of the head, the upper end of the shaft carries a wheel the same size as the wheel which drives a wheel twice its size, which wheel is supported by a collar under it secured to the pipe of a circular grooved cam held by screws to an arm secured to the top of the standard at the left of the head.—Patent completed.

148 F. Braby, Camberwell. *Sulphate of ammonia.* Dated January 16, 1869.
This consists, principally, in the employment of copperas

or green vitriol in the manufacture of sulphate of ammonia for commercial purposes instead of using sulphuric acid for that purpose, as has hitherto been generally practised. For this purpose, according to one process, the copperas is reduced to a solution by water, to facilitate which it may be ground or pulverized, and it is then added to gas liquor, or the copperas may be reduced to a solution by means of the gas liquor itself.—Patent completed.

149 L. B. PHILLIPS, Queen-square. *Metal fac-similes* Dated January 16, 1869.

The inventor first takes a fac-simile of the object to be copied by the usual methods employed to obtain an electrotype in copper or other metal or alloy. This fac-simile will be found to be an exact reverse of the original, but should a fac-simile of the reverse of the original be required the usual electro or other reversing processes must be employed previous to casting, so that the mould bears the original either in relief or intaglio as the case may be; and it is this electrotype which is to be used as a mould or matrix into or upon which the metal or alloy is to be poured or flushed by heat, the usual fluxes being employed for that purpose.—Patent abandoned.

150 W. R. LAKE, Southampton-buildings. *Figured shawls.* Dated January 16, 1869.

The warp is made up of one thread of each of the colours of the ground of the figuring; as, for example, one red and one blue, one green and one black. The warp may be of diverse nature, such as wool, two-fold yarn or wool, and raw or net silk. The arrangement and mounting of the loom may be performed in two ways according as it is desired to produce a figured serge fabric or a figured taffeta. In the mounting for the serge the beeting or tie-up is of combined cords. The first hook raises the mails or loops which are thus engaged therein. Weave together upon fifteen leaves, sinking and rising one thread of each colour, say one red, one white, one blue, one green, one black. The tie-up for the figured taffeta is of simple cords and regular, and there is a single mail or loop to each hook. Weave together for five threads one of each colour, as for instance, one red, one white, one blue, one green, and one black. Then regular or together upon ten leaves sinking and rising.—Patent completed.

151 M. HENRY, Fleet-street. *Mouldings.* Dated January 16, 1869.

A mould, countermould, or cast of the article to be moulded is first taken from the pattern, and sand or other ordinary moulding substance is pressed into the mould to form a core. The thickness which the intended casting is to have is determined or regulated by taking off a sufficient quantity of material to correspond with such thickness from the outer surface of the core. Another mould, countermould, or cast is taken from this core and filled with sand, or like moulding agent, so that a second core is obtained and so on, and thus any desired number of similar cores may be obtained. The cores are used to form the holes or hollows of the article, but they are combined with the employment of a plaster or such like mould or shell to form the outer part thereof. For this purpose the first mould or countermould together with a core, both produced as above described, is used, and thus a complete mould is obtained in which the spaces between the core and countermould correspond with the intended thickness of metal of the casting.—Patent completed.

152 W. PIDDING, Walcot-square, Surrey. *Mosaics.* Dated January 18, 1869.

The textile or other fabric to be used is saturated with starchy, glutinous, or other stiffening matter. It is then placed on a suitable frame, table, or other appliance, and pierced or perforated, the perforations being close together and equidistant. The perforating apparatus used consists of numerous sharp pointed wire fixed permanently and nearly close together in flat boards or other suitable material; these wires are to be taper in form and thicker at their base, so that when they are inserted into the fabric the fabrics may be distended as much as possible. The piercing or puncturing apparatus is to remain in the fabric until the same is dry and then to be extracted. To facilitate such operation it is preferred that the wires of the perforating apparatus shall be greased.—Patent abandoned.

153 W. H. PLATT, Ashton. *Looms.* Dated January 18, 1869.

This consists in the hole to receive the head of the pin or tongue a distance equal to the depth of the same, the bottom of the shuttle underneath the head by this means being left solid. Into this solid part a recess is made parallel to the bottom of the shuttle, into which a metal plate is inserted that forms a slight yielding metallic surface or bed against which the head of the pin bears, thereby strengthening the shuttle and at the same time making the frictional surface against which the pin head bears more durable, or the recess may be carried through and a supporting pin placed underneath. In order to place the cop upon the shuttle tongue or pin with the greatest ease the inventor slightly inclines or curves the end of the spring, now well-known and extensively employed for retaining the cop upon this curved portion, a fixed pin is caused to press when the pin or tongue is opened, which depresses the spring so as to make it lie flat with the pin, allowing thereby the ready placing on of the cop, but when closing the cop in the shuttle, the curved end of the spring being free from the pressure of the fixed pin allows the pin to bulge or swell out and press against the interior surface of the cop, by which means the cop is firmly retained until finally run out during moving.—Patent abandoned.

154 N. VOICE, Handcross. *Closets and urinals.* Dated January 18, 1869.

This consists of a mechanical arrangement for operating the pan valve of waterclosets, and for regulating the supply of water thereto by the simple opening and closing of the closet door. The arrangement consists of sliding rods or bars connected to the door and by an arm to the valve lever, so that when the door is opened the rods and arm cause the valve lever to rise or move, whereby the pan valve is lowered and the valve for admitting water to the basin is opened, and again, when the door is closed, the valve lever is lowered or returned and the reverse action takes place. The valve lever may be weighted so as to return the parts to their normal position, and close the door when pressure is removed from the door, but as the weight for this purpose would have to be heavy, the inventor prefers to fit a strong spring to the door so as to keep the same closed when not pushed or pulled open.—Patent completed.

155 C. CALOW, Burnley. *Looms.* Dated January 18, 1869.

This relates, first, to an improved "letting off" motion, and consists in supporting the lower shedding roller or centres, or points, one at each end of the roller, so as to allow the said roller free vibration "to and fro." These are used in connection with the ordinary eccentric for working the same. Second, or instead of the eccentric, the inventor attaches at one or both ends of the shedding roller or vibrator a curved or cranked link, to the lower end of which is secured the ordinary weighting or beam chain; the curved or cranked link admits any desired degree of vibration by allowing more motion or "play" to the vibrator in the direction of the stay.—Patent abandoned.

156 J. D. THOMAS, Liverpool. *Artificial bust.* Dated January 18, 1869.

The inventor forms the whole of the parts of air proof or nearly air proof materials, the back, or that portion worn next to the person, being made of a rigid or stiffish material, such as cardboard, vulcanite, or other hardened india-rubber, and the front or raised portion of a flexible material, such as india-rubber, or other so-called air proof cloth. The inflating is effected, preferably, in an atmosphere of about 60deg. Fah., or air or other gas at that temperature is admitted before the parts are permanently closed.—Patent abandoned.

157 P. OLDFIELD, Bradford. *Wool combing.* Dated January 18, 1869.

The spiral skew or twist of the flutes may be made in one or more revolutions or circuits around the rollers as betwixt one end and the other thereof, or they may be in less than one circuit or only form part of a circuit. Also, instead of the flutes continuing to run spirally in one direction, they may run partly in one direction and partly in the other, in a curvilinear manner, as in curve lines upon a cylindrical surface.—Patent completed.

158 R. H. CLARKE, Evesham. *Silk cloths.* Dated January 18, 1869.

This consists in applying an equal strain or tension to the ends of these cloths as well as to the sides thereof, whereby the proper square or shape of the perforations is preserved, the desired quality and quantity of meal and flour obtained, and the process of dressing more speedily accomplished.—Patent abandoned.

159 G. R. POSTLETHWAITE, Birmingham. *Screw nuts, bolts, &c.* Dated January 18, 1869.

On the bed of the machine a series of dies or tools is stationed, immediately over which other movable dies or tools work. Each fixed die or tool forms with the movable one over it a pair of dies or tools. By the use of the series of pairs of dies or tools described, a piece of iron is cut off the end of a heated bar, and the cut off piece is shaped and partly punched, further shaped, and finished, the complete punching of the nut being effected by hand immediately after the part punching by the machinery. The dies or tools on the bed of the machine are dropped into holes in vertical slides, the bottom of each slide resting on the short end of a lever. The longer end of the lever constitutes a treadle on which the workman puts his foot to raise the slide sufficiently to bring the nut within the operation of the movable upper die or tool. The height to which each of the slides can rise is regulated by a stop screw. Besides the lever described, a second lever is connected with each vertical slide at about its middle, the short end of the second lever passing through a slot to the bottom of the holes in the axis of the slide. By depressing the lever, a rod, commonly called a "upper," in the hole is raised, and made to project from the die or tool. The slides described turn upon joints near their lower ends, to permit of their inclining forward for the removal of bolts and other long articles.—Patent completed.

160 J. W. PRICE, Abergavenny. *Horses' nails.* Dated January 18, 1869.

This consists in providing a machine employed in this manufacture with a special furnace, through which the nail rod is passed continuously before arriving at the anvil or anvils; also in an automatic feed motion for propelling the nail rod, and in the employment in such machines of two distinct anvils and hammers, one of which anvils is stationary and the other movable. One of these anvils has formed on its face a die, representing in section a nail on its side, and the other a die representing a nail on its flat, or these dies may be formed on the faces of the hammer of the respective anvils, or partly in the hammer and partly in the anvil in each case.—Patent completed.

161 W. R. LAKE, Southampton-buildings. *Propelling machinery.* Dated January 18, 1869.

This consists, first, as relates to water propulsion, in the peculiar combination of the dynamic lever with a pair of piston propellers, whereby the inventor is enabled to apply the power so as to overcome the resistance of a vessel's immersed cross section without overcoming the resistance of the water at the propellers, and by so doing reduce the slip to a fraction. Second, as applied to land locomotion in the adaptation and use made of a series of two or more toothed wheels, so arranged as to give multiplied velocity and continuous pressure of any requisite amount, and acting upon a pair of large driving wheels attached to any vehicle, and put in motion by means of weights, or by being connected with any steam engine for the purpose of economical locomotion.—Patent abandoned.

162 G. BROWN, Edinburgh. *Gas meters, &c.* Dated January 18, 1869.

The meter consists of a compartment made in cast iron and of the filling tube, which serves the purpose of conducting water into the meter. There is a cylinder at the back of the front box, and an endless screw fixed to the cylinder spindle. A toothed wheel is fixed to the upright spindle, and a tube or channel made in cast iron, and known as the upright spindle tube, serves the purpose of letting the upright spindle tube project upwards into the index box. The lower end of the tube dips into the water in the meter to prevent gas from escaping, while its upper end projects into the index box to prevent the overflow of water. A tube or channel is made in cast iron, and known as the water line tube, through which all surplus water flows out of the cylinder compartment into the waste water box.—Patent completed.

163 J. H. JOHNSON, Lincoln's Inn. *Burning bricks.* (A communication.) Dated January 18, 1869.

The essential feature of this invention consists in so constructing a brick kiln that the products of combustion from fires contained in furnaces at one end of the kiln are caused to forcibly permeate the mass of bricks by the action of jets of steam or other equivalent exhausting device, situate at the opposite end of the kiln and *vice versa*, the products of combustion being caused to pass through the mass from one end to the other of the kiln, first in one direction and then in the opposite direction, thereby heating the bricks uniformly throughout. Jets of steam are also directed into the combustion chambers and over the fuel of those fireplaces which are in action for the time being, as well as into their corresponding ashpits.—Patent completed.

164 A. M. CLARK, Chancery-lane. *Refining sugar.* (A communication.) Dated January 18, 1869.

The mode of treatment forming the subject of this invention is based on the decomposition of the molasses by an energetic acid contained in alcohol, but in such a diluted condition that the sugar may remain in solution, while, instead of precipitating it by means of acetone, ether, or other agent, the sugar is obtained direct by crystallization. The following is the mode of operation:—The inventor takes 1cwt. of spent molasses, marking when cold 45deg. Beaume, and about 20 gallons of alcohol at 85deg., with the addition of about 5 per cent. of sulphuric acid. The alcohol used may be more highly concentrated, but in this case the suitable apparatus containing a stirrer for a few moments when it becomes perfectly homogeneous, and is then filtered in order to separate the mineral salts formed. In this condition the alcoholic liquor containing on the one hand the sugar in solution, and on the other the acids displaced by the energetic acid employed retains the sugar, which remains dissolved in the alcohol, marking 85deg., the latter being diluted by the whole of the water contained in the molasses.—Patent completed.

165 H. and J. PARNALL, Bristol. *Weighing machines* Dated January 18, 1869.

The inventors cut or cast sockets or cavities in the bearings, and apply the agate or other hard stone by inserting it within such cavities and fixing it therein by an adhesive material or compound; and on each side of the agate, transversely to the line of the pivot or movable bearing, they apply a steel plate set between the agate and the sides of the socket; the surfaces or edges of these two plates are made concave and at a lower level in the centre than the curvilinear surface of the agate, leaving the shoulders of the pivot to merely bear against the sides of the plates.—Patent completed.

166 W. T. ELEY, Gray's Inn-road. *Cartridge cases* Dated January 18, 1869.

When it is desired to employ a cartridge which will hold a charge of powder considerable in proportion to the bore of the weapon, the powder chamber of the cartridge case is formed of larger diameter than that part of the cartridge which embraces the bullet or projectile. Where metal cartridge cases, or cartridge cases formed from a coil of metal, alone or combined with paper, are employed, formed as above described with a larger chamber to contain the powder, the neck or smaller diameter of the cartridge case is formed by means of a die or dies, so arranged as to form flutes or folds in the case and so allow of the reduction of its diameter.—Patent completed.

167 S. G. ARCHIBALD, Edinburgh. *Cleaning boots.* Dated January 19, 1869.

This consists of a frame having bearings in which a spindle or axle is mounted, provided with treadle motion or crank handle or other arrangements, in order that the movement may be given thereto as may be required. On this spindle or axle the inventor fits brushes for cleaning boots, shoes, and other articles requiring brushing. He also provides for cleaning knives, forks, spoons, and other articles by fitting on to the axle or spindle suitably formed rolls or pieces covered with chamois or buff leather or other suitable material; and for sharpening he sometimes provides each axle or spindle with a sharpening roller or stone. In order to provide for portability and compactness he sometimes uses pieces of chamois leather or other material attached to spindles, which are turned by direct action of the hand, as occasion may require.—Patent completed.

168 M. BURKE, Liverpool. *Ships' skylights.* Dated January 19, 1869.

This consists in so constructing the top sashes or frames of ships' skylights that they are capable of a double action—that is to say, each sash or frame is free to be raised or opened in the ordinary way for ventilation, and, in addition, is free to be moved outwards and downwards, so as to leave the space usually covered by it perfectly open, and thereby admit freer ventilation when required, as is the case in warm climates. For this purpose the inventor employs two levers for each sash, one at each lateral end thereof. These levers are connected at their upper ends to the ridge or longitudinal top rail of the skylight by a joint or hinge, and at their lower ends to the bottom of the sash by another joint. When a sash is raised in the usual way motion takes place on the joints at or near the ridge or top rail, but when the space is to be left free motion takes place on the lower joints, the sash being as aforesaid moved outwards and downwards, and in this latter case it rests close to the side of the skylight.—Patent abandoned.

169 G. LOURY, Salford. *Hackling machines.* Dated January 19, 1869.

This consists in applying certain apparatus to the brush roller situated below the sheet of hackles, which brush roller takes off the tow the hackles have combed out of the flax. At intervals on the circumference or periphery of the brush roller is placed a rod or stripper, so arranged that when the said roller is made to revolve the rod or stripper strikes outward from the centre of the roller and doffs the tow from the bristles of the brush; the stripper then recedes towards the centre of roller until the brush is past the hackles, when the before-described operation is repeated.—Patent completed.

170 W. and J. PAIN, Stepney. *Flooring cramp.* Dated January 19, 1869.

This improved floor-dog is composed of a metal plate, having a boss pierced with a slightly inclined screw tapped hole, through which passes a screw, the head of which is perforated to receive the end of a lever, and the opposite end socketed in a foot plate. The metal plate traversed by the screw also carries two gripping levers bolted loosely on its under side, the plate being pierced with several holes so that the pivoting of the grippers may be shifted at pleasure.—Patent completed.

171 H. W. HAMMOND, Princes-street. *Mechanism for driving piles.* Dated January 19, 1869.

This consists in applying the force of gunpowder or

other explosive materials to act between a cap or cylinder upon the pile to be driven, and a ram or hammer, arranged in suitable guides so as to force the pile downwards and the ram upwards, the ram being arrested and held at its greatest elevation by means of a rack and pawl until the next blow is required, when it is allowed to fall, and by its fall to drive the pile and explode the charge in the cylinder, which still further forces down the pile, and at the same time lifts the ram for the next blow.—Patent completed.

172 J. Armstrong, Masborough. *Crossings and switch apparatus.* Dated January 19, 1869.

This relates, first, to improvements in crossings for the permanent way of railways. For this purpose the inventor first makes a casting to the shape, or nearly so, of the crossing required, and he afterwards rolls, hammers, or otherwise works it to the desired shape, as is well understood, but instead of afterwards splitting the ends into two, as has before been attempted, he forms the casting with divisions to the extent required from the end thereof, so as to obviate the necessity of cutting them up after they have been sufficiently worked.—Patent completed.

173 C. Baunscheidt, Endenich, Prussia. *Instrument for rheumatics.* Dated January 19, 1869.

This instrument for the cure or alleviation of rheumatics consists of a metal or other block or disc, from the face of which project a number of needles of equal length. This metal block or puncturer is enclosed in a suitable casing provided with a hollow stem or neck, through which passes a spiral spring, attached to the back of the needle block, said spring terminating in a handle which projects from the end of the stem. The block is retained within the casing by a raised rim formed on the interior, and the open end is provided with a cover for the protection of the needles when not in use.—Patent completed.

174 N. D. Spartali, Liverpool. *Apparatus for propelling vessels.* Dated January 19, 1869.

The inventor proposes to obtain a stream or streams of water, and to set the same in motion by means of apparatus which consists of a vertical cylinder fitted with a piston, the rod of which carries a crosshead. This crosshead works in fixed guides, and pendent from its ends are rods which connect with the beams of a steam engine of the ordinary construction. The cylinder is fitted at bottom or at its sides below the external water line with valves which serve to admit water thereto. The water will enter by its own gravity through pipes leading either from below or through the sides of the vessel. At its rear side this cylinder connects with a taper tube, which extends beyond the stern of the vessel and some distance below the water level. This tube, which the inventor terms the propelling tube, he prefers, after expanding somewhat like a trumpet tube, should suddenly contract slightly at its mouth, in order to ensure that the stream of water issuing from the tube shall escape with a proper degree of rush or impetuosity.—Patent completed.

175 W. R. Lake, Southampton-buildings. *Railway carriage wheels.* (A communication.) Dated January 19, 1869.

The invention has particular reference to introducing cushions of rubber between the hub or the body of the wheel and the tire thereof, so that the hub or the body of the wheel is not only supported relatively to the tire against elastic cushions, so that both in radial directions and torsionally the direct strain comes upon the cushions, but is so bolted relatively to the tire that while the parts are securely fastened together wear cannot come upon the bolts.—Patent completed.

176 C. E. Brooman, Fleet-street. *Breech-loaders.* (A communication.) Dated January 19, 1869.

This consists in constructing the ring employed in closing the breech of guns of large calibre as hereafter described. The invention is an improvement upon that patented by L. W. Broadwell, on April 29, 1865. In the specification of that patent, the ring was described as recessed in the bore, and an annular chamber was formed in the face of the ring. The inventor now constructs the ring with a curved exterior forming part of a sphere, the bore of the gun being formed to correspond. The annular chamber is dispensed with, and thus no space remains for powder residuum or other dirt to lodge in. A cut or recess is formed on the inner face of the ring in order that, should it become fixed in the barrel, a tool can be employed to move it.—Patent completed.

177 G. A. Crow, Newcastle-upon-Tyne. *Radial drilling machines.* Dated January 20, 1869.

This consists of a combination of movable tables, whereby the work to be drilled after being fixed can be turned round or placed either horizontally, vertically, or at any angle, thereby reducing the time and labour of adjusting such work. The improvements first consist in a hinged or jointed table, which is made to move to and from the horizontal or vertical line either by a screw or other mechanical appliance. Second, in the application of a table to this hinged or jointed table with a bearing in or attached to it, and constructed so as make an entire or any part of a revolution as may be required, and is moved to and from the vertical or horizontal line together with the first named table.—Patent completed.

178 J. Siddeley and F. N. Mackay, Liverpool. *Ice making.* Dated January 20, 1869.

This consists, first, in the employment in connection with apparatus in which ether or other volatile liquid is evaporated in vacuo, of currents of cold air as means for producing certain new and beneficial results in cooling, refrigerating, and ice making. The inventors apply the currents of cold air, first, to carry off heat from troughs or vessels containing pure water to be frozen into ice, by passing the current of air through the enclosed space or apartment containing the said troughs or vessels, or by passing it through a passage or channel formed around the outer sides of the trough; second, to carry off heat from water or other liquid passing through or in contact with a tubular or other refrigerator, and thereby lowering such water or other liquid sufficiently in temperature to render it suitable for cooling in another refrigerator worts or other liquids which do not require a very low temperature; third, to carry off heat from worts or other liquids by surface contact, that is to say, passing the current of cold air through a refrigerator formed with tubes or passages, the worts or other liquid being either inside or outside the tubes, but separated from the air by the thickness of metal; fourth, to carry off heat from worts or other liquids by impelling or drawing the current of cold air in immediate contact with the worts or other liquids to be cooled through a closed vessel; and, fifth, to carry off heat from other condensers and effect condensation of the ether. This is accomplished by passing such current of cold air either inside or outside of the pipes or other parts of, or over the metallic surfaces, in the ether condensers.—Patent completed.

179 F. A. Paget, Adelphi. *Steam boilers.* Dated January 20, 1869.

Above and below the main horizontal boiler, and by preference parallel, and in the same vertical plane, are set up two other boilers, preferably of a diameter less than that of the main intermediate boiler. This central boiler is that in which the steam is principally formed, and whence it makes its way up into the boiler above where it is collected and superheated. The feed water is forced into the lower boiler, whence it passes into the central or main boiler. The water thus partly fills the main boiler and entirely the bottom boiler. —Patent completed.

180 W. Gillet and C. Bland, Croydon. *Bell and clock chimes.* Dated January 20, 1869.

Where separate mechanism is employed for raising or otherwise moving or preparing hammers or other appliances for action, the inventors arrange rotating or other cams or moving contrivances (which they prefer to be rods or bars arranged around a central axis) at the end of the levers upon which they act. This cam or moving contrivance they so arrange as to act directly upon the lever which is connected with and actuates the hammer or other appliance, in place of upon a lever kept in constant movement. They arrange a tumbler or movable piece at the end of the lever for the cam or moving contrivance to act upon, in order to move the lever and place the hammer or other appliance in readiness. After the lever has been so acted upon, the tumbler moves away from the cam or other moving contrivance, so as to allow the lever to move, and the striker or other appliance to act when released by the key barrel or other contrivance. After the hammer or other contrivance has acted upon the bell or other instrument, the tumbler by coming in contact with a suitable surface or projection is moved into such a position that the rotating cam or other moving contrivance at the end of the lever will come in contact with the tumbler, and again move the lever, and set the hammer or other appliance in readiness.—Patent abandoned.

181 J. Edwards, Hackney. *Passengers and guards railway communications.* Dated January 20, 1869.

This consists in the application of a tube, rope, or wire, with elastic connections, to the carriages of a train, suspending a weight at the ends. This tube, rope, or wire is jointed where required, and in order to signal the guard it is only needful to break the joint and set the weights at liberty, and allow them to fall, causing a bell to ring. Also in placing a piece of paper with known characters on it over the part to be moved to give the signal, which paper must be torn before the signal can be given.—Patent abandoned.

182 E. Burton, Upper Clapton. *Sand distributing machine.* Dated January 20, 1869.

The inventor places a hopper of suitable size in a frame mounted on wheels to render it portable, the hopper serving to contain the sand or other material. A fluted roller is mounted in bearings transversely in the framing at the bottom of the hopper, so as to close the same. This roller, on being rotated by means of suitable gearing driven by one of the wheels of the machine, distributes the sand or other matters with which the hopper is filled evenly over the surface of the ground. He also provides a gate composed of a number of independent flaps hinged to the hopper, and kept up against the fluted roller by springs or other means, so as to allow of stones or other substances mixed with the sand passing through, and at same time prevent the too rapid delivery of the sand.—Patent completed.

183 E. Barcroft, Rawtenstall. *Cocks, taps, and valves.* Dated January 20, 1869.

Instead of the valve or plug, as now used, the inventor employs a cup inverted on a seating of leather. This cup has a shank or pin, which is received in a hole in the screw spindle of the top, the pressure raising the cup and admitting the flow of liquid. On the plug being screwed down the cup is bedded on its seating.—Patent abandoned.

184 P. C. Evans, Gloucester. *Apparatus for feeding wool.* Dated January 20, 1869.

This invention comprises automatic apparatus, whereby the wool is weighed in separate quantities and deposited at intervals upon the ordinary endless feed cloth, which carries it into the machine. The wool may be supplied to the weighing apparatus by any of the various kinds of feeding mechanism in use or proposed for feeding wool from a heap or bulk, but the delivering action of such mechanism must be stopped as each charge of the weighing apparatus is completed, to be re-started at intervals by a slowly-moving catch or stud actuated from the carding or other machine to which the apparatus is applied.—Patent completed.

185 M. J. Matthews, Glasgow. *Improved harmoniums.* Dated January 20, 1869.

A knee lever is applied in the ordinary position of such levers to be acted on by the knee and by suitable connections to open the swell valve or valves, but, instead of arranging this lever to be acted on in one direction only, it is contrived to act and open the valve or valves when it is pressed by the knee, either to the right or to the left. To obtain this action it is mounted on a vertical hinge and is formed with projections on both sides. There is a broad lever behind it, and to whichever side the knee lever is moved the projection on that side pushes back the bottom of the broad lever. A cord or wire is connected to the top of the broad lever and draws forward a wedge, which enters under and lifts a bar connected to the valve or valves, and so opens them.—Patent abandoned.

186 H. A. Bonneville, Sackville-street. *Making gas, &c.* (A communication.) Dated January 20, 1869.

This relates to a process for manufacturing illuminating gas in which hydrocarbon fluids, such as rosin, rosin oil, crude petroleum, waste vapours from oil wells, &c., are passed through a retort filled with metallic ore, heated to a red heat in such a manner that a portion of the surplus carbon contained in said hydrocarbon fluids will combine with the metal of the ore, while another portion thereof combines with the oxygen of the ore and passes off in the form of carbonic acid, the remainder of the hydrocarbon being converted into hydrogen or illuminating gas, and thereby a double object is accomplished, viz., the production of a permanent illuminating gas, and also the conversion of the ore into sponge of a superior quality, at a comparatively small cost.—Patent completed.

187 H. A. Bonneville, Piccadilly. *Pianofortes.* (A communication.) Dated January 20, 1869.

This consists in the arrangement of a metallic action frame or a metallic frame supporting the action of an upright or other pianoforte, which frame is secured directly to the wrest plank and composed of hangers or standards perforated with holes to receive metallic traverses in such a manner that the derangement of the action due to the expansion or contraction of the wooden rail generally used for supporting the action is avoided, and a firm unchangeable support for the several parts constituting the mechanism of the action is obtained. The invention consists, further, in the arrangement of flanged metallic rods or flanged metallic tubes filled with wood and forming traverses connecting the metallic hangers or standards of the action frame in such a manner that a firm and unchangeable connection for the hangers or standards, and also a convenient and safe support for the various parts constituting the mechanism of the action, is obtained.—Patent completed.

188 F. Lipscombe, Strand. *Purifying and storing water.* Dated January 20, 1869.

The inventor constructs a chamber in the lower part of the filter, through which, by means of an aperture, the unfiltered water flows finding an exit through another aperture to any convenient part or parts of the house or building when necessary. The top side of the chamber is perforated with holes through which the unfiltered water in the chamber flows upwards through the filtering media, which is composed of animal or vegetable charcoal, plates of porous stone, or any of the usual filtering media separately or in combination, whence the purified water is drawn off either directly through one or more pipes leading to the outside of the cistern, or the purified water after leaving the filter is allowed to flow into a pure water reservoir placed or formed in the cistern, whence it is drawn off as required.—Patent completed.

189 C. de Bergue and C. Faure, Strand. *Locomotives and railway carriages.* Dated January 20, 1869.

This consists in constructing bogey supported locomotives with cylinders fixed or carried on the boiler or trunk or frame which rests on a bogey, and with the cylinders driving the bogey wheels. Also in constructing locomotives bogey supported or otherwise with compound compensation couplings between the wheels or working parts, which by connecting rods between them are required to be driven one from the other. These couplings permit or give out the desired extent or fixed amount of motion to the wheel or part driven, although the length between the driving and the driven parts will somewhat vary, also the working the valve or valves of one cylinder of a locomotive from off the motion of the piston rod of the other cylinder, and *vice versa.*—Patent abandoned.

190 D. Spooner, Kilburn. *Mills for cleaning grain, &c.* Dated January 20, 1869.

This consists in employing in place of the ordinary single drum or roller a series of circular plates or discs arranged vertically at convenient distances apart upon an horizontal shaft and caused to revolve in connection with the same upon suitable bearings within the outer case or jacket of the mill through the medium of steam or other motive power, by the construction and arrangement of which the aforesaid additional rubbing and frictional surfaces are obtained and the grain thus operated upon in greater quantity and in less time.—Patent abandoned.

191 J. W. Wilson, Barnsley. *Steam boilers.* Dated January 21, 1869.

In an ordinary flue boiler the part over the fire the inventor makes the form of what is commonly known as the Butterley shape. The upper part of shell retains the same cylindrical form the entire length of boiler. A section of the under part of the shell at the firing end is raised up into the boiler to the same level as the top of the inner flue to which it is connected, thus forming an arch over the fire, and thereby affording considerable heating surface to the water over the arch and that in the space between the sides of the arch and outer shell.—Patent abandoned.

192 J. C. L. Camel, Lyons. *Truss.* Dated January 21, 1869.

The inventor employs a compressing bandage of caoutchouc or other material in a textile form or otherwise, and so shaped as to press upon the part to which it is to be applied. He attaches this compressing bandage to a small cylinder of wood or other material, between which and the bandage the part rests and is held in the required position. He attaches this apparatus to the person by means of such a system of bandages, straps, tapes, or ribbons, with or without buckles or elastic fastenings, as shall most conveniently fit the form of the patient.—Patent abandoned.

193 D. Rivenc, Geneva. *Apparatus for mending millstones.* Dated January 21, 1869.

The body of the apparatus is of cast iron, and is fixed (by means of screws attached to the driving shaft) on the surface of the stone to be cut. From the centre of the frame a cylindrical column rises, bearing at its lower end interiorly a socket, on which a second shaft passing through the first named turns. This latter shaft bears on its upper end two pulleys; the top one receives motion from a driving shaft, and the other transmits the necessary movement for cutting the stone. The upper part of the column has a movable support in cast iron, turning by means of a hollow cylinder or socket round the column which serves as an axis, with a ring fixed at will by means of a screw. The other end of the support bears the axis of a lever, having at one end two conducting pulleys receiving motion from the pulley by aid of a cord, and transmitting it directly to the "porte diamond" or cutting tool; the other end of the lever bears a movable counter balance acting as desired on the lever for regulating the tension of the cord.—Patent completed.

194 A. M. Clark, Chancery-lane. *Scarf clasps.* Dated January 21, 1869.

This consists of the clasp properly so called and a covering of silk or velvet material, which is caused to adhere thereto by gumming, sewing, riveting, or in other suitable manner. The clasp may be made separately, and coverings of different materials supplied with the same. Two modes may be adopted of fixing the covering to the

clasp foundation. For example, the foundation may be provided with small projections, which are turned down on the covering around its edges, or enter small openings made in said covering, or the latter may be provided with small projecting catches, which are caused to enter spaces made in the clasp.—Patent completed.

195 C. J. CHUBB, Tavistock-square, W.C. *Drills for boring coals.* Dated January 21, 1869.

The inventor employs a drill, the cutting end of which is formed with teeth to cut first into the coal an annular hole, leaving a cylindrical core standing in the centre. This core is afterwards broken up by other cutters or projections on the central portion of the end of the bar which forms the stem of the drill, which is twisted or formed into a screw to remove from the hole the pieces of coal.—Patent completed.

196 T. C. LEWIS, Brixton. *Steam engines.* Dated January 21, 1869.

This consists in the generation of as much steam as is necessary to give motion to the piston of the steam cylinder throughout one stroke, the operation being performed successively for the production of each stroke or each alternate stroke. The mode of producing the steam is by admitting a given quantity of water on to a highly heated surface of metal, by which means the water is immediately converted into steam and its pressure exerted on the piston.—Patent abandoned.

197 C. G. GUMPEL, Leicester-square. *Keyhole escutcheons.* Dated January 21, 1869.

A keyhole plate and escutcheon constructed according to this invention is as heretofore a plate of metal or other suitable material, provided with screw or pin holes or other means for securing it to the door, drawer, or other thing to which it is to be applied, but the keyhole in such plates has a small portion cut away or provision for allowing the escutcheon to be shifted out of the way clear of the keyhole, thus allowing play for a pin or connecting piece connected to the escutcheon, and also to a slide working at the back or inner surface of the keyhole plate, which surface has guides for such slide to work in.—Patent abandoned.

198 F. WALTON, Staines. *Artificial marble.* Dated January 21, 1869.

The inventor makes a framework or carriage running on wheels, which are covered with india-rubber or other soft material. These wheels run upon the extreme edge of the sheet of glass or other material on which the artificial marble is moulded. On this frame he fixes a metal gauge, which can be lowered to the face of the glass at pleasure by means of screws or levers. He also fixes on the frame a metal or glass roller, which can be lowered by the same means, and attached to this roller he fixes an anchor of steel to keep the same clean. He also places on this framework a hopper to contain a quantity of dry cement. This hopper is provided with a slot in the bottom of it, and above this slot he fixes a roller, and against this roller he adjusts by means of screws a gauge to regulate the quantity of cement to be supplied. The roller is made to revolve by being geared into the wheels which travel on the face of the glass, and from which the roller derives its motion. —Patent completed.

199 W. R. LAKE, Southampton-buildings. *Skim shearer.* Dated January 21, 1869.

This relates to a shearing apparatus wherein a lancet is employed, which may have a reciprocating rectilinear motion, a continuous circular motion, or a reciprocating circular motion. Each modification of this shearing apparatus has three distinct parts, namely, the comb, the lancet, and the counter knife. These three parts may vary in form, and the lancet may receive its motion by different means of transmission.—Patent completed.

200 R. BAXENDEN, Chorley. *Looms.* Dated January 22, 1869.

The pick made use of is what is usually called a metallic under pick, formed and worked in the following manner:—At the bottom end of the picking stick receiver is formed a ball joint, which gives a universal motion to the pick, the pick and plate at one end being toothed and slotted for setting or regulating the motion sooner or later as the loom may require; the other end of the plate is open for readiness in application.—Patent abandoned.

201 A. B. CUNNINGHAM, Military Academy, Woolwich. *Apparatus for veterinary purposes.* Dated January 22, 1869.

This apparatus is constructed with a flap or door fitted with a pad, and hinged or otherwise suitably attached at one side to the side of a frame fixed in the floor or paving, or to the floor or paving itself, so as to move up and down in a similar manner to that of a trap door. This frame is made of a size to receive the flap or door, and is let into a recess in the floor or paving so as to allow the flap to sit flush with the other part of the floor or paving. The flap or door is raised to a vertical position to admit of the horse (or other animal to be cast) being attached thereto by means of blocks and tackle, or other suitable means adjusted thereto, and communicating with pulleys fixed above on suitable supports.—Patent abandoned.

202 B. CRAIG, Branthwaite. *Signals for passengers guards, &c.* Dated January 22, 1869.

The inventor employs a simple cord or cords extending along the top of the carriages, and in communication at each end with a bell or other signal in the guard's van and on the engine. The cords between each carriage are united by spring clips. By the guard or driver pulling the cord, either can communicate with the other. The cord which runs along the roof of the carriage passes through an aperture made in a roller, which latter is supported in bearings, and at certain times free to revolve therein, motion being communicated thereto by a spring with ratchet wheel and pawl similar in construction to a spring blind roller.—Patent completed.

203 M. TILDESLEY, Willenhall. *Annealing cans.* Dated January 22, 1869.

This consists in making annealing cans used for the above-named purpose of cast iron of the description capable of being converted into malleable iron, and then annealing the cans, by which process of annealing the cans they are rendered much more durable, and are prevented from cracking or flying when subsequently submitted to the action of the fire for annealing purposes.—Patent completed.

204 J. WILKINS, Nottingham. *Looped and knitted fabrics.* Dated January 22, 1869.

Looped fabrics having a fleeced surface on one side or at the back thereof have been previously made with yarns or threads of various descriptions, but the yarns or threads employed were either plain or of one colour, or of threads of different colours. The present improvements consist in the employment of printed or parti-coloured yarns or threads in the production of the face on one side or surface of such fleeced, looped, or knitted fabrics, whereby novel and improved fabrics of the above description are produced, of superior appearance, and at less cost than heretofore in order to produce an equal appearance.—Patent completed.

205 J. SPEIGHT, Bradford. *Spinning and twisting machinery.* Dated January 22, 1869.

This consists in the application of a horizontal rotary shaft under each row or series in a line of the spindles, tubes, or bobbins. A series of discs or friction pulleys are mounted on the said shaft, and arranged so that by having a flange or collar formed on each spindle tube or bobbin, they will rest or be supported upon the said discs or pulleys, and by the frictional contact therewith receive rotary motion therefrom.—Patent abandoned.

206 A. MAW, Broseley. *Earthenware moulds.* Dated January 22, 1869.

From the original model either in clay or plaster the inventor takes a "box mould," by preference, in plaster of Paris. He proceeds as follows:—He places against the original model pieces of clay or other material, so as to divide it into segments after casting the first segment. He makes in the sides of the segment so cast notches or hemispherical indentations. In contact with this segment he casts the second segment, so that the pieces are kept in their proper relative position by means of corresponding projections and indentations, the process being repeated till the "box mould" is completed by a sufficient number of segments being cast round the original pattern or "block." After drying this mould (if of plaster) he applies a suitable material or solution to its whole surface to stop its absorption, for which purpose he either soaks it in a machine of wax and oil in a heated state, which he prefers, or in a solution of gelatine or other suitable material. Or, instead of using the original model, as above described, he employs a corresponding model of glue or gelatine in an elastic state, from which he casts a box mould in plaster or cement as above described in one piece, instead of in segments.—Patent completed.

207 F. R. ENSOR, Nottingham. *Ensor net machine.* Dated January 22, 1869.

The front warp thread always crosses from bobbin thread to bobbin thread behind the bobbin threads, and the back warp threads always cross from bobbin thread to bobbin thread in front of the bobbin threads. As the front warp thread from one bobbin thread crosses to the next bobbin thread its place is taken by the front warp thread. From this next bobbin thread which crosses to the first bobbin thread and similarly with the back warp threads on crossing from bobbin thread to bobbin thread, so that all the crossings in one longitudinal line of meshes are made by front warp threads, in the next longitudinal line of meshes they are made by back warp threads, then again in the next longitudinal line by front warp threads, and so on alternately.—Patent completed.

208 T. COOK and J. WATSON, Old Kent-road. *Gas measuring apparatus.* Dated January 22, 1869.

The inventors provide a closed chamber into which the steam, water, or other motive power is introduced by a suitable pipe. The top side of this chamber is provided with three or more passages for the exit of the steam or water, which passages or ports are placed in a circle and lead from the chamber in an inclined direction at any suitable angle, and open out beneath a wheel placed horizontally, and resting on top of the closed chamber. This wheel is mounted on a vertical axis, and its under surface is provided with a number of cells or recesses of suitable form and size formed near the circumference of the wheel. These cells when the wheel is rotated will pass successively over the inclined ports above mentioned, so that when steam or water under pressure is projected from the closed chamber through the inclined ports it will fill the cells contained in the wheel, and at the same time rotate the same by impinging on the sides of the cells.—Patent completed.

209 J. and J. HORSFIELD, Dewsbury. *Steam boilers.* Dated January 22, 1869.

Instead of making the two flues open from end to end, so that the products of combustion pass from the furnace directly into and through each of the flues, and thence into the other flues leading to the chimney, the inventors close the back end of the boiler and connect the rear ends of the flues inside the boiler by a cross flue or bend, so as to form a continuous cylindrical flue. They form behind the fire bridges of the two separate furnaces of the boiler a combustion chamber, into which each of the said furnaces opens. The continuous cylindrical flue hereinbefore referred to opens into and passes from the combustion chamber to the rear end of the boiler and thence back to the front part of the boiler immediately behind the combustion chamber. Here the flue joins a short vertical flue, the lower end of which opens into a longitudinal flue formed between the brickwork setting and the under part of the boiler. The rear end of this flue opens into a flue formed between the brickwork setting and the side of the boiler, which flue is connected by a cross flue under the front end of the boiler with a return flue on the opposite side of the boiler, which said flue passes to the rear end of the boiler and thence to the chimney.—Patent abandoned.

210 W. E. GEDGE, Wellington-street, Strand. *Slate quarry machines.* Dated January 22, 1869.

This movement of these machines takes place as follows:—When a rotary motion has been given to the tool holder by means of a lever fitted to it, a rod connected to and drawn by the lever comes against another lever which it causes to pivot, the result of this action being the uplifting of a driver resting on the toothed wheel of a windlass to which it gives a rotary motion. A chain fixed to the end of the tool holder, and passing over a pulley on the framing, winds on the above mentioned windlass or axletree, and thereby causes the tool holder to rise a certain regulated distance after each stroke of the cutter.—Patent completed.

211 W. DENNIS, Aldermanbury. *Letter-boxes, &c.* Dated January 22, 1869.

This invention consists in constructing the box with or without a fan wheel at the aperture and dividing the box at about the centre thereof with two pieces of metal of a triangular form somewhat similar to the letter V and either with or without a flap joint near the point thereof; the flap joint may be shut by a hinge and made to balance and close of itself, after a letter in its descent has pushed it open, and passed through into the bottom of the box.—Patent abandoned.

212 W. BURGESS, Newgate-street. *Mincing machines.* Dated January 22, 1869.

The inventor coats the interior surface of the casing with tin. For this purpose he first coats each of the two parts of the cast iron casing with zinc, by what is known as the galvanizing process, and as the parts of the case are taken out of the melted bath of zinc they are well shaken about to remove all superfluous zinc and to leave only a thin even coating upon the parts of the case. The parts of the case are afterwards cleaned with acid, by preference hydrochloric acid; they are dried and dipped quickly into a bath of melted tin, where they are allowed to remain only just so long as is required for the metal to take upon the surface. The articles are taken from the tin bath and shaken or by preference drained for a few moments in hot grease to remove the excess of metal.—Patent completed.

213 J. BEATTIE, Surbiton. *Buffing apparatus.* Dated January 22, 1869.

This consists in forming the sockets or guides in such a manner that they may serve as stuffing boxes, through which the buffer rods pass, and which can be adjusted from time to time when requisite, so as to prevent the lateral or vertical movement of the buffer rods. The inventor packs the recesses in the sockets with rope or cotton packing, or he uses india-rubber packing rings lined with metallic rings. He also forms on the base of the sockets one or more suitable projections (through the central one of which the buffer rod works), which he inserts into corresponding recesses formed in the carriage framing, and by these means the bolts which attach the sockets to the framing are relieved from lateral strain.—Patent completed.

214 J. MILWARD, Birmingham. *Sawing stone machinery.* Dated January 23, 1869.

A machine, constructed in accordance with this invention, in one of the simplest forms, viz., with one saw and two drills, has a plate or frame of a rectangular or other suitable shape, capable of being screwed by lewis bolts or other fastenings directly to the quarry face or attached to the engine or prime mover. A driving shaft (receiving a continuous rotary motion from an engine or other motor) is mounted at right angles with the frame in a bearing fixed in an opening in a central position in the frame, and the inner end projects on the front or acting side of the machine, and carries a crank, from which, by means of a connecting rod and slide, a reciprocating motion is imparted to the saw frame. The saw frame is composed of the blade or cutter bar for its lower side, the end bars and a top rod or bar having screws and nuts at the ends to tighten the blade in the usual way by means of an intermediate bar forming a fulcrum. It has in its upper division a central vertical rod, upon which is fitted a slide block, and this slide block is also fitted to work upon a horizontal rod attached to the face of the machine frame, and is connected by a rod of a length about equal to the crank connecting rod to the slide block of the crank motion, but sufficiently far out to be clear of the crank motion. In this arrangement the saw frame, when in the middle of its path, is about central with the crank shaft, and while receiving its reciprocating motion therefrom is free to descend as it cuts. The bearing of the crank shaft is made adjustable to a certain extent, so that the saw blade may be made to cut more or less on either side. The saw blade or cutter bar is furnished with a number of teeth of diamond or other very hard substance, the end ones being fixed at the lower corners of the ends of the blade which project somewhat beyond end bars of the frame. All the teeth may be arranged to cut the full width of the channel or the intermediate ones on alternate sides of the blade.—Patent completed.

215 J. ORTTON, Wandsworth-road. *Steam graduating machinery.* Dated January 23, 1869.

To a lever, called the reversing lever, the inventor attaches an additional lever, which he calls a graduator, supplied with a graduating quadrant and connected in such a manner with the reversing lever and its connecting rod that the smallest movement of the rod by means of the reversing lever can be subdivided into a lesser movement to any required degree by means of a graduator. When the reversing lever connecting rod is connected with the lower end of the reversing lever instead of at an intermediate point in its length, as in the before mentioned case he attaches a bell crank lever or graduator at the lower end. This graduator is attached at its centre to the lower end of the reversing lever, and at its two extremities respectively to the connecting rod and hand gear or graduating quadrant connection. In this case the movement of the handle is transmitted to the reversing rod by means of the bell crank lever, thus giving the same result.—Patent completed.

216 E. SIMONS, Sheffield. *Communication between passengers, &c.* Dated January 23, 1869.

Inside or outside the roof of each carriage, extending in a longitudinal direction from end to end thereof, is fixed a tube of metal, gutta-percha, or other suitable material. Inside each compartment is a small branch tube provided with a mouthpiece, and at each end of the carriage a piece of vulcanized india-rubber or other flexible and elastic tubing is connected to the longitudinal tube above mentioned, forming a continuation thereof, and provided with a screwed socket or other simple and rapid means of making a flexible and airtight join between the tubes when the carriages are connected together. On each side (before and behind) of each branch tube the main tube is provided with a valve or stop opening by means of a spring, but capable of being compressed and closed by means of a button or other simple contrivance, so that by closing one of these valves or stops and leaving the other open the passenger can communicate by means of the mouthpiece and tube in either direction—backwards to the guard or forwards to the engine-driver.—Patent abandoned.

217 W. HUGGINS, Halstead. *Millstone dressing.* Dated January 23, 1869.

This invention has special reference to dressing millstones by means of diamonds or other hard substances, and an important feature in this invention consists in making the "cracks" or "dress" of the stones in segments of a circle instead of in the usual rectilinear direction up or down the lands or grinding surfaces of the millstones. The "cracks" or "dress" may consist of a

series of continuous segmental curves from the eye or centre of the stone to the periphery, but two several concentric series of such curves may be used when thought desirable.—Patent completed.

218 L. CROSSLEY, Halifax. *Steaming printed yarns.* Dated January 23, 1869.

The inventor forms an outer shell or jacket, partly or entirely round the framework of the steam chamber as hitherto used, which framework thus furnishes the inner casing of the vessel, leaving a hollow space between for the introduction of the steam, and by this means, the inner casing being kept constantly at a great heat, the condensation of the steam when admitted within the inner portion of the chamber where the yarns are placed will be nearly or altogether obviated. The steam can either be admitted within the inner chamber direct from the space between this and the outer shell by means of a valve, or it may receive the steam direct from a pipe passing through the outer casing into the inner part of the vessel, without being first admitted to the hollow space between the two shells.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated August 10, 1869.

2383 E. A. Curley, Bartholomew-close, City. The better or more direct and effective application of reciprocating or intermittent motive power under certain circumstances, and which is especially applicable to lathes, sewing machines, velocipedes, and a great variety of manual and pedal apparatus.

2384 R. Longdon, Manchester. Improvements in safes and refrigerators for preserving and cooling food and other articles.

2385 T. Hancox, Sheffield. Improved machinery or apparatus for rolling metallic axles for wheels, and for rolling guns, shafts, or other circular articles in malleable iron or steel.

2386 C. Lockman, Hamilton, Wentworth, Ontario, Canada. Sewing cloth, being an improvement on sewing machines, which consists of a self-adjustable thread regulator, constructed so as to permit the sewing of cloth of different degrees of thickness without adjustment in changing from one to the other, to be known as Lockman's automatic thread regulator for sewing machines.

2387* E. T. Hughes, Chancery-lane. Improvements in the construction of rock boring machinery, and in air compressors for working the same, part of which improvements are applicable to other purposes.

2388 C. W. Zenger, C. L. Strube, and L. Merlett, Buckau, Prussia. A globular-cylinder manometer with double capillary lock.

2389 S. Hutchinson, Leeds. Improvements in machinery or apparatus for striking out leather.

2390 J. E. Holmes, Buckingham-street, Strand. Improvements in cutting and dressing stone.

2391 T. S. Blair, Tavistock Hotel, Covent Garden. Improvements in the manufacture of iron and steel.

2392 T. S. Blair, Tavistock Hotel, Covent Garden. Improvements in the treatment of conglomerates of cast iron and other substances, and in apparatus employed for that purpose.

2393 J. Caddick, Birmingham. Improvements in candlesticks, and in manufacturing parts of candlesticks.

2394 F. Mazet, Allees de Meilhan, Marseilles, France. An improved match box candlestick.

2395 S. J. Woodhouse, Holbeck, Leeds. Improved apparatus for purifying and regulating the supply of gas to burners, and also for an improved standard tap.

2396 W. Wright, Birmingham. Improvements in knobs and spindles.

2397 H. Bessemer, Queen-street-place, Cannon-street, City. Improvements in the methods and apparatus employed in the fusion of metals and metallic alloys, and in founding or casting the same.

2398 C. D. Watson, Liverpool. Improvements in waterproofing fabrics, and in the manufacture of compositions suitable for this purpose.

2399 A. H. Brandon, Rue Gaillon, Paris. Improvements in metallic cartridges.

Dated August 11, 1869.

2400 J. Tenwick, Spittlegate Ironworks, Grantham, Lincolnshire. Improvements in lubricators.

2401 A. B. Brown, Alfred-road, Birkenhead, Cheshire. Improvements in hydraulic printing or copying presses.

2402 J. B. Austin, Victoria Wharf, Earl-street, Blackfriars, City. Producing and applying black, white, or coloured and shaded patterns of needlework on vellum, cloth, paper, or other material, with perforations for displacing the same from the material, whether canvas, cotton, silk, satin, velvet, or other substances, on which they are worked.

2403 C. Crossley and B. Whipp, Manchester, and T. Crossley, Rochdale. Improvements in the manufacture of size.

2404 J. Cross and J. M'Cann, Farnworth. Improvements in the manufacture of dry soap for washing, cleansing, calendering, and finishing cotton and cotton fabrics, wool and woollen fabrics, and mixtures of the same

2405 G. White, Queen-street, Cheapside, City. Improvements in pipes for smoking tobacco.

2406 F. H. Needham, Mortlake, Surrey. An improved apparatus to be applied to casks or other vessels containing liquid, to preserve the liquid while on draught.

2407 J. Mayer, Brooklyn, New York, U.S.A. An improvement in hoop skirts.

2408 A. M. Clark, Chancery-lane. Improvements in the manufacture of phosphate of ammonia.

2409 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of iron and steel.

Dated August 12, 1869.

2410 J. F. E. Martin and L. G. Le Quay, Randan, France. An improved construction of submarine and other tunnels.

2411 W. Davis, Great Yarmouth, Norfolk. Improvements in machinery or apparatus for stamping, crushing, and grinding ores and such like substances.

2412 J. Parrish, Bolton, Lancashire. Improvements in the construction of skips, hampers, and other baskets.

2413 D. Barker, Northfleet, Kent. Improvements in the manufacture of artificial fuel.

2414 W. E. Newton, Chancery-lane. Improvements in centrifugal pumps.

2415 J. Deas, Glasgow, and R. C. Rapier, Westminster Chambers, Westminster. Improvements in lifting jacks for lifting railway rails.

2416 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for charging gas retorts.

Dated August 13, 1869.

2417 H. Hudson, Oaks-crescent, Wolverhampton. An improved apparatus for effecting communication between railway passengers, guards, and engine drivers.

2418 D. A. Gibbs, Milton-street, City. Improvements in compositions for coating or covering the sides and bottoms of ships and vessels.

2419 E. J. Grabham, Shepherdess-walk, Middlesex. Improvements in machinery or apparatus for plaiting or folding textile fabrics, paper, and other like materials.

2420 O. E. Brooman, Fleet-street. Improvements in treating the waste of wool, silk, horn, and other nitrogenized animal matters to be used as manure. (A communication.)

2421 E. J. Hill, Victoria Station, Pimlico, and R. Davis, Craven-street, Strand. An improved signalling apparatus used in hand signal lamps.

2422 T. Beckwith, Stockton-on-Tees. Improvements in reaping and mowing machines.

2423 L. E. Woolf, New Bond-street. Improvements in castors.

2424 J. Cowan, Barnes, Surrey. Improvements in the manufacture of soap.

2425 J. Lewis, Fenwick-street, Liverpool. Improvements in extracting copper from its ores.

2426 J. Hampton, Wednesbury, and S. Partridge, Darlaston, Staffordshire. Improvements in velocipedes.

2427 W. Richards, Birmingham. Improvements in breech-loading firearms and in cartridges to be used therewith.

Dated August 14, 1869.

2428 T. Sagar and T. Richmond, Burnley, Lancashire. Certain improvements in looms for weaving.

2429 J. Kenyon, Blackburn, Lancashire. Improvements in apparatus for consuming smoke and saving fuel.

2430 L. D. Newall, Chancery-lane. Improved apparatus for diminishing the effects of the oscillation of vessels and for preventing sea sickness.

2431 W. Matt, Homerton, Middlesex. An improved compound or composition in imitation of marble, veneer, and other substances, to be used in the manufacture of fancy and other articles.

2432 H. T. Yates, Nottingham. Improvements in the manufacture or production of cops and spoles.

2433 T. Coad, Truro, Cornwall. Improvements in the construction of sewing machines.

2434 S. Smith, Halesworth, Suffolk. Improvements in common road carriages.

2435 E. H. C. Monckton, Threadneedle-street. Improvements in agricultural machinery and in appliances for harvesting and preserving crops.

2436 J. B. Rushbrook, St. Andrew's-street North, Bury St. Edmund's, Suffolk. An improved hurdle for folds for lambs and sheep.

2437 G. Ash, Great Marlborough-street. An improved denture or appliance for carrying and supporting artificial teeth in the mouth by suction.

Dated August 16, 1869.

2438 T. Ward and W. S. Black, King's Lynn. Improvements in machinery for twisting tobacco.

2439 J. Mitchell, Bradford, Yorkshire. Improvements in kilns for burning bricks, lime, and articles of earthenware.

2440 H. Pinkus, Camden-road, Camden Town. Improvements in furnaces and other heating apparatus, and in the methods of applying and using therewith certain elements of combustion, and in the combinations therewith of the processes with materials to be used in the manufacture of metals and other things and uses, and in the mechanical constructions necessary therefor.

2441 J. Blyde, Sheffield. Improvements in scissors or apparatus especially suitable for gathering flowers and fruit.

2442 H. Dupland, Boulevard Bonne-Nouvelle, Paris. A system of coatings against dampness and saltpetre.

2443 J. G. Dale and E. Milner, Warrington, Lancashire. An improved method of producing white pigments from lead.

2444 G. Sunderland R. J. Midgley, Halifax, Yorkshire. Improvements in machinery or apparatus for spinning and doubling or twisting worsted, silk, or other fibrous substances.

2445 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in the process of charging and discharging fuel in gas retorts or other gas distilling apparatus.

2446 H. H. Trenor, New York. An automatic passenger register or apparatus for recording the number of individuals entering any place or vehicle or passing over such apparatus.

2447 S. Harvey, Dale-road, Haverstock Hill, Middlesex. Improvements in apparatus for indicating signals between passengers and guards in railway trains.

2448 F. Ransome, Queen-street-place, City. Improvements in the manufacture of artificial stone.

2449 J. Lawson and E. G. Fitton, Leeds. Improvements in spinning flax, hemp, jute, and tow, and in machinery for these purposes.

LIST OF SPECIFICATIONS PUBLISHED

For the week ending August 14, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3757	0 4	3861	0 10	24	0 4	47	0 4	64	0 4	77	0 4
3820	6 6	3869	0 8	31	0 4	49	0 4	66	0 4	78	0 4
3821	0 6	3873	0 10	32	0 4	51	0 4	68	0 4	79	0 4
3825	1 6	3876	1 6	33	0 4	52	0 4	69	0 4	81	0 4
3830	0 10	3884	0 10	39	0 4	53	0 4	72	0 4	82	0 4
3843	1 4	3887	1 0	40	0 4	55	0 4	73	0 4	84	0 4
3845	1 8	3910	0 10	41	1 0	56	0 4	74	0 4	85	0 4
3848	2 6	3920	0 6	43	0 4	58	0 4	75	0 4	106	0 4
3853	0 8	3933	0 8	44	0 4	62	0 4	76	0 4	164	0 6
3860	0 10	23	0 4								

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2060 M. A. Muir and J. M'Ilwham
2269 E. Nelson

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2297 C. E. Spagnoletti
2327 W. Whittle

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," August 17, 1869.

969 W. Marston	1138 J. H. Johnson
1000 F. Schafer	1184 E. T. Hughes
1009 E. Wilson	1199 A. V. Newton
1020 G. A. Ermen	1216 W. F. Reynolds
1023 J. U. Askham	1232 J. H. A. Bleckmann
1024 J. Fletcher	1256 H. E. Newton
1026 W. G. White	1279 W. R. Lake
1039 B. B. Hooper and T. and H. R. Nickson	1287 A. V. Newton
1042 W. Goodreds	1328 W. Spence
1048 W. E. Gedge	1406 A. J. Murray
1068 A. Stewart and J. Wotherspoon	1447 A. Vickers
1071 D. and G. Hallas	1644 J. Ingham and I. Butterfield
1073 A. Fryer	1674 O. E. Brooman
1080 J. Denis	1689 O. Barrett and G. P. Wheeler
1091 P. Jensen	1726 E. T. Hughes
1094 E. Brasier and J. E. Hodgkin	1792 J. Blair
1099 J. M. Hetherington	1802 E. T. Hughes
1101 P. Headridge	2044 J. B. Rogers
1103 E. C. C. Stanford	2065 T. James
1106 J. H. Johnson	2075 J. Walker and P. A. Godefroy
1107 J. Parry and R. Morris	2091 Q. Dunlop, T. J. Martin, and W. Orr
1108 E. T. Hughes	2130 J. and J. Leeming
1113 J. H. Dales and J. F. Maygrove	2237 W. Morris
1122 A. d'Azambuja	2274 J. Winship
1128 W. Brock	2303 F. Jackson
1130 C. Turner	2329 J. Bapty and A. Hall
1133 W. Gillespie	2368 W. R. Lake

LIST OF SEALED PATENTS.

Sealed August 12, 1869.

465 T. Winder	511 A. Henry
467 T. Billyeald	517 A. M. Clark
470 V. A. Houdaille	521 W. R. Lake
471 G. W. R. Pigott	522 M. MacLennan
474 H. Tylor	532 J. H. Morl
481 J., B., and R. Wood	535 F. G. Fleury
482 E. T. Hughes	542 J. O. C. Phillips
488 W. R. Lake	586 W. E. Newton
489 H. D. Bowyer and J. L. Norton	590 W. R. Harris
493 A. Bartholomew	628 J. Hadley
494 A. Munro and W. B. Adamson	709 W. R. Lake
496 J. D. Nicoll and J. Eckersley	1046 G. S. Chase
501 D. G. FitzGerald	1096 H. A. Bonneville
508 W. M. Cochrane	1197 H. Aitken
510 E. Dorsett	1822 J. G. Tongue
	1850 G. W. Fox
	1923 R. Caunce and M. G. and B. Bradley

Sealed August 17, 1869.

497 C. Brook, L. Barker, and M. Thompson	626 D. Davies
505 M. Vary	649 W. Howes and W. Burnley
513 J. Loader	657 M. G. Cole
515 T. Smith	707 W. R. Lake
520 J. Barton	745 W. H. Clapp
527 J. Mabson	797 W. A. Lyttle
528 A. Jacob	835 E. A. Inglefield
537 R. Foster	1156 C. T. Swanston
538 J. E. Lucas	1352 C. T. Liernur
540 W. Ibbotson, W. W. Ladelle, and A. G. Southby	1467 W. A. Lyttle
541 S. Osborn	1610 R. Wheble
563 J. Neilson and J. Marshall	1773 V. J. Four
585 W. Parkinson	1826 A. W. Moss
591 W. T. Eley	1861 J. Kirk, S. Shelmerdine, and C. Froggatt
	1941 F. C. Lecoultre

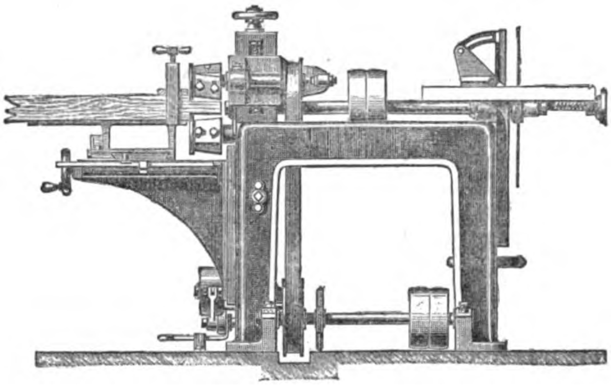
PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1296	2122	2262	2292	2301	2309	2320	2327
1735	2143	2266	2293	2302	2312	2321	2330
2020	2153	2273	2294	2303	2314	2322	2336
2063	2157	2281	2295	2304	2316	2323	2340
2065	2213	2283	2297	2305	2317	2324	2342
2075	2219	2285	2298	2306	2318	2325	2344
2104	2222	2289	2299	2307	2319	2326	2346
2117	2260	2291	2300	2308			

A. RANSOME AND CO.'S
NEW PATENT "GENERAL JOINER."

(PATENT DATED FEBRUARY 17, 1869.)



PATENT GENERAL JOINER AS ARRANGED FOR RIPPING-OUT AND TENONING.

In introducing their new Patent General Joiner to the public, A. Ransome and Co. describe briefly a few capabilities of this most useful machine, viz. :—

SAWING. It will Work Saws up to 20in. in diameter, and saw stuff up to 7in. thick.

CROSS-CUTTING. It will Cross-cut wood of any length, up to 4in. thick.

PLANING. It will Plane both sides and Thickness, in one operation, boards up to 7in. wide.

MOULDING. It will cut single or double mouldings of any pattern, in any kind of wood, up to 5in. wide.

GROOVING. It will cut grooves from $\frac{1}{8}$in. to $1\frac{1}{2}$in. in width.

TENONING. It will make perfect Planed Tenons in one operation.

MORTISING. It will make Mortises from $\frac{1}{8}$in. to 2in., of any length, in any kind of timber.

BORING. It will Bore Holes from $\frac{1}{8}$in. to 2in. diameter.

In addition to the above, A. R. and Co.'s Patent General Joiner may be used for Rebating and Moulding Sash Frames, &c., Mitreing, Chamfering, Tongueing, Beading, and a great variety of other purposes. It is worked by two lads, and will do the work of at least *thirty skilled joiners.*

IT POSSESSES THE FOLLOWING ADVANTAGES OVER OTHER MACHINES OF THIS CLASS :—

1.—The Tenoning, Planing and Thicknessing, and Moulding operations can be carried on without interfering in any way with those that are done at the Sawing end of the Machine, such as Ripping-out, Cross-cutting, Squaring-up, Tongueing, Grooving, &c.

2.—The Tenons are formed at one operation by *cutters*, which finish them much more accurately than is the case where saws are employed for this purpose, as in other machines of this class.

3.—The wood to be Tenoned, which may consist of several pieces up to a total width of 18in., is cramped in a horizontal position upon a light sliding plate, instead of each piece being fixed separately in a vertical position, as is the case in other General Joiners.

4.—Tenons can be formed with shoulders of unequal lengths, by simply altering the position of one of the Tenoning blocks on its spindle.

5.—It will plane both sides at once, and thickness boards up to 7in. wide, and will cut single or double mouldings of any pattern in any kind of wood. In other machines of this class one side only can be planed at a time.

6.—The wood being planed is fed through by *a pair* of revolving feed rollers, *both of which are driven*, by which means a greatly increased propelling power is obtained, and the rollers being perfectly smooth, do not indent the wood. This advantage cannot be overrated, as the injury done to boards by the grooved roller used in other machines is very considerable.

7.—The top feed roller rises and falls to suit the irregularities in a rough board, and, at the same time it is always exerting its full feeding power. The rate of feed can also be varied from 5 to 12ft. per minute, whilst the machine is in full work, and the lad working at this portion of the machine can retard or accelerate the feed, according to the nature of the wood about to pass under the cutters.

8.—Ins tead of the long and cumbrous fence, which in other "General Joiners" is required to carry the tenoning slide, a light fence is substituted, which is arranged to turn over and hang down below the table, thus enabling the machine to be used as a Cross-cut Saw Bench for any length of stuff without interfering with the work going on at the other end of the machine. In other Joiners this is impracticable on account of the difficulty in removing the fence.

In addition to the advantages described above, and which alone would render this Machine far superior to any other of its class, A. Ransome and Co. guarantee their Patent General Joiner to be fully as effective in performing all the other operations usually done by General Joiners.

ALLEN RANSOME & CO.,
SAW MILL ENGINEERS AND WOOD MACHINISTS,
304, KING'S ROAD, CHELSEA, LONDON, S.W.

B 157

Printed by ROBERT SMILES, and Published by him at the Office of Robertson, Brooman, and Co., 166, Fleet-street, in the Parish of St. Dunstan-in-the-West, in the City of London.—Friday, August 20, 1869.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 27, 1869.

THE AIR OF MANUFACTURING TOWNS.

IN these days a reputation can be cheaply and easily made by abusing the water supplies of various towns. The materials required by a popular writer are all found for him, and he has only to make the utmost of the "impurities" by multiplying them into sufficiently large amounts to strike terror into the minds of his readers. The air we breathe has not yet received so much attention. It is more difficult of examination, and there is no chance of getting up an agitation for placing the supply in other hands. So quacks have little to work upon, and interested agitators have nothing to work for. If, however, it were asked which is of the greater importance, pure air or pure water, there is no one, we believe, who would not reply without hesitation, pure air. The amount of water which even an enthusiastic teetotaller drinks is very small, and the quality of that he washes in, and which goes down his closets, is of little consequence. But a man must breathe and take into his lungs thirty or forty gallons of air a day, and surely it is of the first importance that the very source of life should be kept as pure as possible. Few restrictions, it may be said, have been put on the direct pollution of the atmosphere. Black smoke is an offence at law, but local boards, who set the law in action against black smoke, allow untrapped drains in every street, and so permit the far more dangerous emanations from the sewers to poison the atmosphere all over London.

But it is not with London that we are now concerned. We have before us the fifth report of the inspector of alkali works, which gives us an account of the state of the atmosphere in some of our centres of industry. Perhaps the best information we can get as to the condition of the air of any particular locality is afforded by an examination of the rain water which falls on the spot. In this we shall find all the impurities which water can wash from the atmosphere, and the dirt of the air is found in the water-butt, just as the dirt of the clothes is left in the wash-tub. When rain water therefore is examined a variety of impurities are discovered, the amount of which it may be said at once mainly depend upon the quantity of coal consumed in the locality. The first in amount is sulphuric acid, which is partly free and partly combined with ammonia, and it may be with soda. Rain water caught close to some chemical works gave Dr. Smith 5 grains of sulphuric acid in the gallon; the rain at Liverpool yielded 2½ grains; at Newcastle-on-Tyne, 3 grains; at Manchester, 3¼ grains. Much of this acid must be free, for we are told that rain water at Manchester always reddens test paper. But besides sulphuric, rain always contains some hydrochloric acid. The proportion of this acid is much greater in the "pure" air of the seaside, and is obviously derived from the common salt which is carried up from the sea. Of course, the quantity of sulphuric acid sent into the air depends upon the quantity present in the coal. The coal of South Lancashire contains an average of 1·37 per cent. of sulphur, and Staffordshire coal still more. "Smoke from such coal," Dr. Smith says, "is injurious to plants," and if to plants, surely to animals also. It is worth noting here that Dr. Smith, who examined the air of Manchester in 1851, finds a much larger quantity of sulphuric now than he did then.

Besides the acids mentioned ammonia is found in rain water. Most of this is also produced by the combustion of coal, but some must be the products of animal and vegetable decomposition. Rain caught in Manchester in December, 1868, had about 100 grains of ammonia in the ton. Newcastle rain contained about as much, Glasgow a little less, and rain caught in London in February of this year had about half the quantity. Other matters found in rain water we must dismiss very briefly, though they are not the least important. When rain is evaporated, and the solid residue is burnt, it smells of substances which have but one origin, the decomposition of animal matter. They are sewage matters in fact, and often the most virulent of all poisons; and in the last outbreak of cholera in Holland the disease was almost as fatal to those who drank rain as to those who used the foulest drain water.

The examination of rain gives us, however, no idea of the proportion of the impurities to the bulk of air. To ascertain this, measured quantities were washed with pure water. The measurements of air, we are told, are not to be relied upon as perfectly exact, so we must accept the results as only approximate. With this reserve we may say that about a million cubic feet of air in Manchester on a fine November morning contained 4,008 grains of sulphuric and 59 grains of hydrochloric acid. At St. Helens also on a fine day about the same quantity of air contained 2,293 grains of sulphuric and 199 grains of hydrochloric acid. The large quantity of hydrochloric acid found in this latter place is owing to the number of alkali and glass works on the spot. In contrast to these we may place the air of the Lancashire watering place Blackpool, in which, assuming the same measurement, only 20 grains of hydrochloric and 155 grains of sulphuric acid were found.

We have only space to allude shortly to smoke. Black smoke everyone knows to be a nuisance and a waste, and Dr. Smith clearly shows us the reason. He obtained permission to make some black smoke in Manchester, and submitted it to analysis. Putting the analyses together we may say that 100 cubic feet of black smoke contained 900 grains of water, 18¼ grains of soot, and 33½ grains of sulphurous acid. The soot in this analysis only represents a portion of the waste, for among the gases to be found in black smoke are carbonic oxide, olefiant gas, and occasionally marsh gas and other hydrocarbons, the products of the distillation rather than the combustion of coal. The proportion of oxygen found in the smoke proves that it is not from want of air that the smoke is not burnt. Too great draught is indeed the cause; and patentees, who nearly all, says Dr. Smith, have confined themselves to the supply of air, must turn their thoughts in another direction.

On another occasion we may call attention to one or two other matters mentioned or suggested by this report, but at present we must conclude by saying that, as regards the Alkali Act, it is clearly shown to be working with the utmost success; but the report at the same time makes it equally clear that the atmosphere is enormously polluted from other sources than alkali works.

STEAM CRANE BOILERS.

THE increasing number of boilers used for steam crane and other similar portable purposes renders it important that any dangerous defects to which these boilers are liable should be generally known. The explosion of these boilers has become by no means unfrequent; and, as they are now constantly used in the erection of public buildings, and sometimes in close proximity to crowded thoroughfares, the subject becomes of increasing importance. We, therefore, take the present opportunity of placing before our readers a few points in connection with this class of boilers which are referred to by Mr. Fletcher in a recent report to the Manchester Steam Users' Association. The boiler to which reference was specially made was of the internally-fired vertical class, cylindrical in the external casing, as well as in the internal firebox, and domed on the top, while the flames from the firebox passed off to the chimney through a single central uptake tube, which formed a most important tie between the crown of the firebox and that of the external casing. Boilers of this type are very simple in construction, and well calculated, when new, to resist a high pressure, so that they are very generally adopted. The dimensions of the one under consideration were—height, 8ft. 9in.; diameter, 3ft. 6in. in the external shell and 2ft. 9in. in the firebox, while the thickness of the plates was 5-16in., and the load on the safety valve per square inch 70lb. In this boiler there was found a deep groove or furrow running entirely round the inner casing of the firebox at the bottom of the water space, and eating into the metal to a depth varying from 1-8in. to 3-16in., so that more than half the strength of the plate was gone. This is not a peculiar case; others very similar have been met with, and especial danger arises from the fact that these grooves are very difficult to detect. They take place so low in the water space as to be very nearly, if not entirely, concealed by the blocking ring at the bottom, while the only opportunity of examining them is through one or two small sight holes cut through the outer casing.

It is frequently supposed that because boilers are small therefore they are safe, whereas the fact of their being small makes them dangerous. Small boilers cannot be inspected as larger ones can, since they do not admit of access for a man, and, therefore, they are to a greater or less extent apt to be worked on at a risk. The internal examination of portable boilers, so important to their safety, is a question which hitherto has not received that consideration which it deserves, but the subject should no longer be neglected. It is well worthy of the attention of engineers to endeavour to construct such portable boilers as are too small to admit of a man's getting inside so that they may be taken to pieces for examination, and it becomes imperative either that arrangements should be made for doing this, or that these boilers should not be allowed to work on for more than three or five years without being cut open for examination, whatever the inconvenience might be. No doubt, if the attention of engineers were directed to this subject inventive talent would soon construct boilers that could without much difficulty be taken to pieces so as to be examined internally, and thus their safety ensured.

HYDROSTATIC STEERING APPARATUS OF H.M.S. "ACHILLES."

IN our impression for the 6th instant we inserted a letter from Rear-Admiral Inglefield upon the subject of steering gear. This letter contained a reference to the gallant Admiral's own labours in improving this class of machinery. It has attracted considerable attention, and we have been requested to publish further particulars of the Admiral's invention, which we now have much pleasure in doing. We may premise that in designing this apparatus Admiral Inglefield has taken advantage of that great natural power which every floating vessel carries with it, viz., the hydrostatic pressure of the water which sustains it. He thus has at his command an agent ready to be brought into action at a moment's notice. In such a vessel as H.M.S. "Achilles" the pressure of the external water amounts to a load of about 8lb. per square inch at the level of the work-

ing cylinder, viz., on the floor of the screw alley or the tunnel through which the screw shaft is conducted to the stern of the vessel. To move such a mass as the rudder of the "Achilles" against the resistance of the water when the vessel is going at 14 knots per hour requires very considerable power, and the problem to be solved was how to utilise the constant pressure of 8lb. per square inch, magnifying it so as to obtain sufficient force to overcome the resistance of the rudder. We will describe the manner in which this is effected by the Admiral, remarking that similar machinery may be adapted to any vessel.

A large cylinder, fitted with a piston and slide valve like that of a steam engine, is fixed horizontally in the lowest available part of the vessel. The external water is admitted to this cylinder through a Kingston valve guarded by a sluice valve. A powerful water engine is thus formed ready to be set in action as occasion may require. Special arrangements for working the slide valve with unfailing certainty have been applied. A barrel is fixed at each end of the cylinder, and the piston rod extending on either side of the piston works in these barrels, which thus form powerful hydraulic pumps. These pumps are connected by pipes with two hydraulic cylinders fixed one on either side of the tiller on the lower deck. The rams of these cylinders are connected together by a crosshead carrying a strong steel pin entering a block, which slides in a groove attached to the under side of the tiller. Thus the tiller can traverse its full arc in either direction, while the rams move rectilinearly to and fro. The water in its course from the hydraulic pumps to the tiller cylinders passes through a valve box fitted with a regulating or directing slide. This slide is worked by a rod extending upwards to the wheel house on deck, and passing downwards to wheels on the lower decks, one of which may be on the screw alley far below the water line. The wheels are worked by hand like an ordinary steering wheel, one man moving them with ease. When the wheel is in its middle position the water is cut off from the pumps, but the two tiller cylinders communicate freely; thus the rudder is left free to right itself. By turning the wheel through one third of a revolution either way the water pressure is turned on to one or other of the tiller cylinders, and the rudder is put hard over to port or starboard as may be required. When the wheel is turned only half its stroke in either direction the water is locked in the tiller cylinders, and thus the rudder is held fast in the position to which it had been brought.

It will thus be seen that one man at either of the steering wheels does what it requires generally twenty-five men to do at the ordinary steering wheel. By means of the sliding block, acted on by a hand screw on the tiller, the hydraulic apparatus can be disconnected in less than a minute, and the tiller can thus be left free to be worked in the ordinary way; but this is not necessary, for by putting the directing slide in its middle position the tiller is left quite free, and can be worked by the ordinary steering wheels and tackle, which need never be disconnected. Thus the hydraulic steering gear may either act independently or it may be employed as a force auxiliary to the men without in any way interfering with the normal condition of the steering apparatus. It may be readily understood from the construction that the working power acts only when it is wanted. When the rudder has to be moved the hydrostatic cylinder or water engine acts; when the rudder is fixed in any position the water engine ceases to move, but remains ready to start into action the moment it is required with its full force. Our readers will now understand the general construction of the apparatus which has been found so successful in H.M.S. "Achilles." We need scarcely say that there were numerous details of construction which required great consideration in applying it. The whole apparatus, however, is extremely simple, easy of application, and not liable to derangement from accident or wear. We understand that it is cheaper than any other mechanical steering apparatus yet tried. The power which it utilises costs nothing, and is always ready to hand for use. These points, taken in conjunction with its success in the "Achilles," should be the means of opening the eyes of the Admiralty authorities to its value.

A MATHEMATICAL PIE.

It is well known that the negro mind works arithmetical calculations upon a different principle to that usually followed by the more favoured white men and brethren. Arithmetic, it is true, is called a science, but in reality, it is scarcely deserving the title. It is, in fact, a knack, which is partly intuitive and partly acquired, and the reverence for its possessor has completely died out. A "calculating boy" is regarded now more in the light of an intelligent juggler—a mental prestidigitateur—than a person to constitute a good engineer. We do not go so far as to assume that Mr. James Smith, in the volume now before us,* works out his unique value for π upon the principle of the negro mind, for in that case we might be considered to accuse him of being a follower of the "black art," but we are sorely afraid that from arguing so energetically about circles, he has ended by arguing in a circle. The transition is natural and effected with facility, more especially when it is borne in mind that our author is a willing sojourner in the mathematical labyrinth of his own creation. What a pity it is that we cannot have a whole without its part, or, to speak more scientifically, that an integral number should be capable of subdivision into fractional portions. There is no question but what Mr. James Smith proceeds upon sound data. The rule in science, as well as in ordinary mundane affairs, is to proceed from the complex to the simple. Look at our first attempts at engines and machinery. One single specimen possessed a greater number of component parts and complicated details, than half-a-dozen of the same species produced in more modern times. So it is with the received value of the Greek "Pi," usually symbolized by the letter π. "Recognized mathematicians," to use our author's term. and, indeed, all mathematicians, in their calculations take π equal to 3·141592, and as many more decimals of the right figures as you may choose to employ. In all practical estimates, the fraction 22-7 is a very neat value to use. An eminent mathematician has calculated the exact value of π to—we are afraid to say how many places of decimals, but of course he never arrived at it. But our author has. Oh! yes. He assumes, as a man should do under similar circumstances, that we are all wrong; we are the persons, *quibus lumen ademptum*. In fact, Mr. Smith is a mathematical radical of the first water. He not only will not allow this unfortunate "pie" to have the infinite number of decimal parts that have belonged to it from time immemorial, but he actually denudes it of the twenty-four that the choral traditions of the nursery have allotted to it, we may say, also from time immemorial.

In the cause of arithmetical inquiry and that thirst for mathematical investigation which, it is to be hoped, will always prevail among our students and elderly gentlemen, we do not for a moment deny our author the right to examine for himself into the contents of any scientific comestible. It is, however, just possible that ancient gentlemen rejoicing in sonorous and classically sounding names, such, for example, as Archimedes, might object were they able, poor souls, to a member of posterity, *cui nomen est* Smith, having a finger in their Greek pie, more especially when his object is to dock it of its fair proportions. After confounding premises and conclusions in a manner that would drive a logician to the confines of insanity, our author infers, deduces, concludes, and reinfers that the proper number of component parts to be allowed to the article in question is three and one-eighth, or, expressing it algebraically, $\pi = 3·125$.

Although we admire the disinterested manner in which Mr. Smith has given his invention to the world, we almost regret he has not kept it to himself. Just imagine how useless all our recognized tables for shortening the labour of calculation have become. All our ratios of areas, circumferences, diameters, and other circular functions must be recalculated. Our whole arithmetical system is upset. It is worse than the adoption of the decimal currency, or the revision of the Bible.

After perusing the treatise under notice, and balancing up the pros and cons of the arguments and controversial statements included therein, we are strongly of opinion that if the gentleman who finds "Euclid at fault" and cannot agree with the late talented author of "Quaternions" were to eat a little humble pie, he would perhaps be able to arrive at a more accurate knowledge of the Greek "Pi."

* The Geometry of the Circle and Mathematics as applied to Geometry by Mathematicians shown to be a Mockery, Delusion, and a Snare. Letter to G. C. Stokes, Esq., M.A., F.R.S., D.C.L., President Elect of the British Association for the Advancement of Science, 1869-70. By James Smith, Esq., Member of the Mersey Docks and Harbour Board, Ex-Chairman of the Liverpool Local Marine Board. Liverpool: Edward Howell, Church-street. London: Simpkin, Marshall, and Co., Stationers' Hall-court. 1869.

MR. MACFIE ON THE ABOLITION OF PATENTS.

In common, we presume, with most of the scientific periodicals of the day, we have received a copy of Mr. Macfie's compilation upon the abolition of patents. A glance at the heterogeneous mass of spasmodic matter forming its contents served to show us its importance, and we at once placed it at the bottom of a few books which are awaiting review on our table. Our purpose was to have noticed the volume with our next batch, inasmuch as we notice every book sent for that purpose, although a very few lines would have sufficed for it. But as we have found in the "Engineer" a critical review of Mr. Macfie's production, we shall for once allow another paper to discuss the book for us in our own pages. We need hardly state that a second inspection of the book enables us to endorse fully the opinions expressed in the notice in our contemporary, which runs as follows:—

The degree of influence Mr. Macfie may have reached amongst his constituents, and the weight attached to his speech in the House of Commons, we, of course, do not know. It is with the honourable gentleman as an author that we have now to do, and we congratulate him on having composed a remarkable book: composed, not written, seeing that the scissors and paste-pot have so largely contributed to the portly volume now before us. When Mr. Macfie does condescend to original composition, the liberties he takes with Queen's English are, for audacity at least, equal to his lucubrations; and, as if this were not enough, the hon. member must needs insult our gracious sovereign by writing her down as of the neuter gender. "The sovereign voluntarily puts itself," writes Mr. Macfie at p. 74 of this last contribution to patent literature. Very generously, the author informs his readers that "no rights are reserved." This is at least consistent, emanating as it does from one who gives his readers to understand, by quotations and otherwise throughout his book, that copyright, no more than patent law protection, commends itself to his free trade appreciation.

Bad as the volume before us may be, and is, it would be impossible to compose 332 octavo pages even on the scissors and paste-pot system, without contributing to the field of thought one or more leading ideas. Mr. Macfie's leading idea our readers already know. He denies that invention is property further than the law makes it property; and, on that ground of abstract ratiocination, he denies to inventors any sort of moral proprietary right. Still, for peace and quietness' sake—also, perhaps, to illustrate what kindly benevolence is hidden in capitalists' money bags—he would give honoraria to inventors of important things, varying in amount from £10,000, as a possible maximum, to a certificate of honour at the other end of the scale. To this purpose he would see £200,000 allocated yearly by Parliament; the sum to be raised as a general tax and distributed by some immaculate commission. From this prospective arrangement it would follow that—the sum being fixed, whilst the field of invention is infinite—candidates for honoraria must be prepared for diminution of reward according to scale, in any particular year when inventors might crowd most thickly. The hon. member is equal to the emergency. Under these circumstances, he hints that the Crown might distribute orders and ribbons. Why did he not add babies' coral, gum rubbers, rattles, and penny whistles?

The analogies of copyright have ever been a stumbling block to gentlemen who take a view of patent matters identical with Mr. Macfie. If it be not consonant with justice, and for the common weal, that proprietary rights in an idea should be secured to the first elaborator to working practice, in things mechanical and chemical, through letters patent or their equivalents—then how can it be consonant with justice and common weal that the same should be conferred on the elaborators of ideas into books? Gentlemen of Mr. Macfie's way of thinking endeavour to establish a radical difference in this manner, viz.—that whereas no conceivable book could be composed in its identity by two authors, one and the same invention may come out simultaneously under the auspices of different inventors. Those who put this distinction most prominently forward are not least unaware of the weakness of their case; and thus we commonly see they would abolish copyright also if they dared. Mr. Macfie is unable to veil under the sophistry of Scotch metaphysics run mad—a sophistry further obscured by bad English—that he at least is no friend to copyright. Mr. Macfie is welcome to any opinion on this topic that he may hold, for any influence he may command, or harm he may do. So long as peers and members of Parliament and other men influential in the land, write books, we shall be under no apprehension for the maintenance of some law of copyright sufficiently protective of that property. As to invention and inventors, the social conditions differ; and thus we find a crusade in which "money bags against brains," to quote an expression of John Stuart Mill, may go in for a small tilting match, great folks tranquilly looking on to see what may come of it. What strikes us most forcibly, in considering the debates initiated by Sir William Armstrong, and continued by Mr. Macfie, is the social audacity of the movement. The fact must be only too evident to every thinking man who has dispassionately viewed the aspects of social matters, and speculated on their issues, that the question, what is property, is one concerning which the million—the mass—may come to agitate in a way not favourable to existing conditions. Mr. Macfie tells us that invention is only made property by the operation of law—the same he affirms of copyright. Will he have the goodness to explain in what other way—through what different operation—land is made property? For our part, we confess inability to perceive, and men who have brains enough to make inventions will be equally unable with ourselves. Before the hon. member next takes scissors and paste-pot in hand, we advise him to reflect on this matter. Having done us the honour to reproduce one of our own articles bodily, we fear—were we to give him permission to do the same by this—his appropriative faculty might cease to experience a charm, for the reason that actuated a certain French lady, who regretted that eating an ice was not sinful, because—then—it would be so much more nice!

One word in conclusion. The price of this book is five shillings, postage fivepence. On the outside cover the author gives this to be understood Every representative book is good in a way. Mr. Macfie's comes under this denomination. As the worst specimen of book making we ever saw, on any subject, by any person—man or woman—it is a curiosity worth having. If a prize were offered for the production of a worse book the compiler might labour in vain.

PROCEEDINGS OF THE BRITISH ASSOCIATION.

THE British Association has just concluded its thirty-ninth annual meeting, under the presidency of Professor Stokes, an abstract of whose inaugural address appeared in our last number. We now proceed to give our usual report of the papers read, classifying them under the several sectional heads. We shall for the most part give only abstracts of these papers, but in some instances, where papers of special interest to our engineering readers are read, we shall supplement the abstract by the paper, *in extenso*, in a future number. At the meeting of the General Committee Mr. J. P. Gassiot, F.R.S., read the heads of the report of the Kew Committee for 1868-9. The first part of the report was divided into two portions, the first having reference to work done by the Kew Observatory under the direction of the British Association, and the second to work done at Kew as the Central Observatory of the Meteorological Committee. It is part of the business under the first head to verify barometers and thermometers; during the year 157 barometers and 1,153 thermometers had been verified. The attention of meteorologists was directed towards an instrument devised by Mr. Beckley, mechanical assistant at Kew, for the purpose of registering the rainfall automatically. An illustrated description of this instrument appeared in the MECHANICS' MAGAZINE for July 9 last. The last paragraph of the report is as follows:—In conclusion, the Kew Committee desire to bring under the notice of the British Association that the system of automatic records established and in actual work at the Kew Observatory comprehends magnetic, barometric, and thermometric observations, as well as those of the direction and velocity of the wind, to which an electric self-recording instrument will soon be added. They think that it would be very advantageous to magnetical and meteorological science if a fully illustrated work were published descriptive of these instruments, and of the method of working them, together with the method of reductions actually employed.

From the Kew balance sheet it appeared that the total expenses for the year were £1,178 7s. 11d., of which the Association supplied £600, and the rest was made up of allowances from the Meteorological Office and from various items of income such as charges for verification of instruments, &c. In the appendix were a description of the means adopted by the Meteorological Committee for ensuring accuracy in the numerical values obtained from their self-recording instruments, with tables, a code of regulations adopted by the Meteorological Committee for ensuring accuracy in the results derived from their self-recording instruments, &c.

The report was adopted.

A meeting of the General Committee was held in the Albert Memorial Museum on Monday afternoon, the President, Professor Stokes, in the chair. The object of the meeting was to determine the place of meeting for next year, and to nominate a president.

Mr. Griffith, the Assistant-General Secretary, read the invitations received from Edinburgh, Liverpool, Brighton, and Bradford, to hold the meeting for 1870 in those respective towns.

Mr. Drake proposed, and Mr. Freeland seconded, that Brighton's invitation should be accepted.

Upon being put to the vote, only 14 hands were held up for Brighton, and a large number against, and the President declared that Brighton was lost. Upon the hands being held up for Edinburgh and Liverpool, the numbers were so near that the President said he could not decide with any certainty. A division was then taken, after which the President announced that the numbers were—Edinburgh, 86; Liverpool, 91; majority for Liverpool, 5. The Association will, therefore, go to Liverpool in 1870.

On the proposal of Sir Stafford Northcote, seconded by Sir John Lubbock, Professor Huxley was elected for the presidency.

The vice-presidents, besides the *ex officio* members appointed, were—Lord Stanley, M.P., Mr. W. E. Gladstone, M.P., Mr. Graves, M.P., Mr. Joseph Mayer, Sir Philip Egerton, Mr. Joule, F.R.S., Mr. Whitworth, F.R.S.

The secretaries, treasurer, and auditors were reappointed, and their services in the past year were spoken of in high terms of approbation.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

PRESIDENT—Professor J. J. Sylvester, M.A., LL.D., F.R.S. Vice-Presidents—Professor J. C. Adams, M.A., D.C.L., F.R.S.; J. P. Gassiot, F.R.S.; William R. Grove, M.A., F.R.S.; Professor Bartholomew Price, M.A., F.R.S.; Rev. T. R. Robinson, D.D., F.R.S. Secretaries—Professor G. C. Foster, B.A., F.R.S.; R. B. Hayward, M.A.; W. K. Clifford, B.A.

At the close of the President's address, Mr. W. R. Birt, F.R.A.S., read the following—

REPORT OF THE LUNAR COMMITTEE.

IN introducing this report, Mr. Birt referred to the progress of selenographical research since the Committee was appointed at Bath in 1864. It appears that a surface of 100 square degrees, *i.e.*, 10 degrees of south latitude, and 10 degrees of west longitude, has been carefully and critically surveyed during the period; the outlines of 433 objects laid down on a scale of 200in. to the moon's diameter; and a catalogue prepared, which contains numerous notices of important and interesting phenomena bearing on questions which have lately been mooted relative to the physical aspect of the moon's surface. "The great question of continued lunar change," says the report, "either transient or permanent, as contrasted with apparent change dependent upon illuminating and visual angle is one most likely for posterity to settle. If, in geological science, a region undergoing a series of changes—during the progress of which, through a long period of geological time, lakes have been drained, volcanoes have burst forth, extensive plateaux of igneous ejections formed, and vast denudations of softer material effected—has retained its grander and more imposing features in their integrity, so in selenological science we may rather look for small, and in many cases to us almost inappreciable, changes in and around well recognized and imposing lunar forms than expect to witness the obliteration of some very striking object as an evidence of change." The report treated somewhat largely on the general question of change on the moon's surface, and several instances were adduced as proofs that the surface of our satellite had undergone successive changes during its past history. Chacornac's three great eras of lunar formation—the ancient, during which the larger craters were produced; the intermediate, or that of the overspreading of the lower levels with the material forming the grey plains or so-called seas; and the comparatively modern—restricting the term to pre-historic times—were slightly glanced at, and the existence of a series of changes analogous, but prior, to those described by Chacornac, was pointed out, and the region in which they occur considered as one of the most ancient on the moon. At a much later period of the moon's history, in a locality bordering upon this ancient tract, a series of severe successive changes was mentioned—the first being an elevation of a somewhat considerable tract of high land; the second, a fault traversing this high land; third, the formation of a crater of rather considerable magnitude; fourth, the formation of a valley on the east of this crater; fifth, the production of a line of cliffs on the north of the high land, most probably occasioned by the subsidence of a large tract still further northward; sixth, the opening of a much larger crater on the east of the crater already formed on the high land, which, having a furrowed flank on the east, the furrows were abruptly terminated, and the valley on the east interrupted by the production of this larger

crater; seventh, the upheaving of a mountain wall on the edge of a neighbouring crater on the west, this mountain wall being the highest rock in the locality. "The determination of these successive changes," says the report, "rests on the strong indications afforded by a careful study of photograms, of the priority and posteriority of well marked features, which can only be realised by contemplating the lunar picture in the seclusion of the study. While the telescopic view is far superior to the photographic, the continual changes of illuminating and visual angle prevent that appreciation of the relations of different features to certain epochs of production which can be so well studied in the photogram, the detail thus seized upon by the aid of photography is vividly realised by the eye at the telescope when the surface of the moon is suitably illuminated." The report alluded in the next place to certain differences between the photograms employed, particularly one with respect to a certain crater figured by Lohrmann, which is found on De la Rue, but not a vestige can be discovered on Rutherford. The comparison of photograms appears to open up a line of investigation of great promise. Some attention has also been given to apparent changes of brightness and tint, a subject to which Webb called attention a few years since. Three or four somewhat conspicuous spots were adduced as exhibiting these alternations, which appear to be independent of any agencies with which we are acquainted.

SECTION B.—CHEMICAL SCIENCE.

PRESIDENT—Dr. H. Debus, F.R.S., F.C.S. Vice-Presidents—Dr. Gladstone, F.R.S.; Dr. W. A. Miller, F.R.S.; Dr. Voelcker, F.C.S.; Dr. Williamson, F.R.S., Pres. C.S. Secretaries—Professor A. Crum Brown, F.R.S.E., F.C.S.; Dr. W. J. Russell, F.C.S.; Dr. Atkinson, F.C.S.

PRESIDENT'S ADDRESS.

I BELIEVE it has been the custom with many of my predecessors in this office to place before the members of the British Association a report of the progress of chemistry during the year preceding their election. In attempting to follow their example, I soon found that it would be impossible for me, without making too great a demand upon your time, to give even a bare outline of the more important chemical work done during the year. A science, the report of whose yearly advances fills about 1,000 large octavo pages, cannot by any powers of mine have its progress chronicled in an address of half an hour's duration. The best course open to me under such circumstances is to direct your attention to the ideas which at present guide chemists in their researches; to place in a clear light the objects they are striving to attain; and to indicate the direction of the scientific thought of our time. To do this is by no means an easy task; for the more manifold and diversified the objects of a science become, the more numerous and extensive its relations with other branches of knowledge, the more difficult it becomes to draw a picture of its actual condition.

It is always an excellent recommendation of a theory or hypothesis when among the cultivators of the science to which it pertains very little difference of opinion exists as regards its admissibility and scientific value. This is in a high degree the case with regard to the atomic theory. The vast majority of chemists, I believe, accept this theory as the most suitable exponent of the fundamental truths of their science; and certainly if the quality of the tree may be judged by its fruit there is no other view which furnishes a clearer image to our minds of the chemical constitution of bodies, and at the same time conducts to the discovery of so many important facts and relations. On Dalton's profound hypothesis all bodies are supposed to be composed of atoms of infinitely small dimensions. But these atoms are supposed not to be single: two or more of them are held together by certain forces and thus constitute what is called a molecule. One atom of carbon, one atom of calcium, and three atoms of oxygen, joined together by the force called chemical affinity, constitute a molecule of carbonate of lime. Vast numbers of such molecules bound to each other by the force of cohesion form a visible piece of chalk. If a chemist wishes to examine a body, his first endeavour is to ascertain of what sort of atoms the body is formed. This is a mere matter of experiment. He next determines how many of such atoms are contained in each molecule of the body; and finally he ascertains how these atoms are arranged, or, more correctly, combined within the molecule; for it is quite clear that a substance like saltpetre, which contains one atom of nitrogen, one of potassium, and three of oxygen, may have these atoms arranged in very different manners and still have the same composition. We might assume the potassium and nitrogen in more intimate union, nearer to each other than they are to oxygen, or we might consider nitrogen and oxygen more closely packed together, and, so to speak, attached as a whole to the potassium; in both cases, saltpetre would have in each molecule the same number of atoms, and the weight of the molecule would be the same.

The three determinations just mentioned are of fundamental importance to the chemist; not that such inquiries are the only ones which interest him, for we shall in the sequel notice others of almost equal importance. Nor must it be supposed that questions of this nature are of quite a modern date; for Leucippus, 500 B.C., appears to have sought to explain the nature of things by the assumption that they are formed by the union of small particles, which latter received the name of atoms from Epicurus. It is true the notion of atoms as conceived by the Grecian philosophers is not quite the same as ours, but their speculations contain our notions pretty much in the same way as the acorn contains the oak tree. The determination of the quality of the atoms in a molecule, or the analysis of the latter, has not undergone many changes during the last few years, and the same may be said about the finding of the relative weight of a molecule, or the determination of the number of atoms which are contained in it. With regard to the latter point, however, it may be mentioned that Avogadro's hypothesis, according to which equal volumes of gaseous substances, measured at the same temperature and pressure, contain the same number of molecules, guides us chiefly in assigning to each molecule its relative weight and its number of atoms; this hypothesis has won more and more the confidence of chemists, and it is now admitted to hold good in nearly all well-examined cases. Our views relative to the manner in which atoms are arranged in molecules, and our methods of ascertaining this arrangement, have, however, undergone great alterations and received great additions during the last ten or fifteen years. To a consideration of these changes, I will now, for a short time, invite your attention. Since our modern views, however, originated in a great measure in the study of organic bodies, and since the majority of chemists now devote their time and labour thereto, I shall confine my remarks principally to the organic branch of the subject.

Eighteen years ago Professor Williamson read before the members of this Association a remarkable paper which contained the germ of our modern chemical views, and was the cause of many important discoveries. He proposed to regard three large classes of bodies—acids, bases, and salts—from the same point of view, and to compare their chemical properties with those of one single elected substance. For this term of comparison he chose water. Now water is composed of three atoms, two of hydrogen and one of oxygen. Williamson showed that all oxygen acids, all oxygen bases, and the salts resulting from a combination of the two, can, like water, be considered to be composed of three parts or radicals, two of the radicals playing the part of the hydrogen atoms in water, and the third that of the atom of oxygen. Potassic hydrate is water which has one of its atoms of hydrogen replaced by an atom of potassium, hydric nitrate is water which has one atom of hydrogen replaced by nitric oxide, and potassic nitrate is water with one of its hydrogen atoms replaced by nitrate oxide and the other by potassium. This speculation, as every chemist knows, is well supported by experiments; it embraces three large classes of bodies which till then had been considered as distinct. Mr. Gerhardt, in 1853, extended Williamson's views by distinguishing two other types of molecular structure represented respectively by hydrogen and ammonia; and succeeded, by help of the radical theory, in arranging the majority of the then known substances under one or the other of the three types already mentioned. Like every theory which is in harmony with experience, the above considerations led to results of unexpected importance. For it soon became apparent that the radicals which thus replace hydrogen in water are not at all of the same chemical value. The learned gentleman entered into an elaborate and technical explanation in proof of this statement, and then went on to say:—Thus every year produces results which improve our conceptions of the atomic and molecular constitution of bodies. And as our knowledge improves, new questions suggest themselves, and our power over the elements increases. It has already become possible to prepare in the laboratory bodies of a very complex character, and which a few years ago were only found in the bodies of animals or plants. Alizarin, the beautiful compound of the madder root, has been obtained by artificial means in the course of the year by Messrs. Liebermann and Græbe. Results of such a nature render it highly probable that, at no distant period, it will be in our power to prepare artificially nearly all, if not all, the substances found in plants and animals. Here I must not be misunderstood. Organic structures, such as muscular fibre or the leaves of a tree, the science of chemistry is incapable of producing, but molecules like those found in a leaf or in the stem of a tree, will no doubt one day be manufactured from their elements.

I must not conclude this address without reference to two or three papers of great importance. Professor Bunsen, of Heidelberg, has published a paper on the washing of precipitates. Every one acquainted with practical chemistry knows how much time is often lost in waiting for a liquid to pass through a filter. Bunsen found the rate of filtration nearly proportional to the difference between the pressures on the upper and lower surfaces of the liquid. If, accordingly, the funnel be fixed air-tight by means of a perforated cork to the neck of a bottle, and the air exhausted in the bottle, the liquid will run faster through the filter in proportion to the diminution of the pressure in the bottle. Comparative experiments, some made according to the old, and others made according to the new method, showed that the filtation, washing, and drying of a precipitate, which took seven hours by the old plan, could be performed by filtration into an exhausted bottle in thirteen minutes. But a saving of time is not the only advantage of the improved method of collecting and washing precipitates. A more perfect washing, with less water than is required by the common way of proceeding, is by no means the least recommendation of Bunsen's ingenious method. A very important paper has been published by Professor Liebig on the improvement of the nourishing qualities of bread. Certain quantities of phosphates and other salts form necessary ingredients of wholesome food. Now, it is well known that most of these salts, which naturally exist in wheat, remain with the husk. Liebig proposes to add salts, of a nature similar to those remaining in the husk, to the flour, and at the same time to substitute for the carbonic acid developed by fermentation gas liberated from sodic carbonate. The bread prepared according to Liebig's recommendation is said to be of excellent quality, and to exceed in value bread made by the ordinary method. Mr. Graham, of Her Majesty's Mint, has continued his researches in the absorption of hydrogen by palladium. Palladium appears to be able to absorb more than 900 times its volume of hydrogen, and to form a combination which consists of nearly equal equivalents of the two elements. Hydrogenium, as Mr. Graham calls the combined hydrogen, acts in this case like a metal, and thus the opinion held by some scientific men, that hydrogen constitutes the vapour of a metal, receives confirmation. The specific gravity of hydrogenium, as contained in the alloy, was found to be 1·95. These experiments are remarkable in more than one respect. The palladium which absorbs and combines with the hydrogen does not change its state of aggregation, but remains solid and expands as if it had been heated. The nodules of the palladium have consequently changed their relative positions and combined with hydrogen, whilst the continuity of the metal remained intact. The last paper to which I have to draw your attention is to the beautiful paper by Professor Tyndall, on a new method of decomposing gaseous substances by means of light. Tyndall's experiments bring us face to face with the motions of atoms of molecules, and the relation of these motions to chemical decomposition. They will no doubt, at some future time, furnish valuable materials to chemical dynamics.

MANUFACTURE OF CHLORINE.

BY MR. WALTER WELDON.

THIS was an elaborate paper on the manufacture of chlorine by means of perpetually-regenerated manganite of calcium. What has hitherto been the ordinary process of manufacturing chlorine consists in digesting ores containing peroxide of

manganese with hydrochloric acid. The chloride of manganese, which is a residual product of this process, has hitherto been ordinarily thrown away. Mr. Weldon decomposes this chloride of manganese by lime, and another equivalent of lime, and then blows air through the resulting mixture of hydrated protoxide of manganese, lime, and solution of chloride of calcium. The protoxide of manganese absorbs oxygen from the injected air, thereby becoming converted into peroxide, which combines with the equivalent of lime used in excess of the quantity required to decompose the chloride of manganese, forming therewith the compound which the author calls manganite of calcium, and believes to be a new compound. The compound thus produced is employed instead of manganese ores for the liberation of chlorine from hydrochloric acid, and is then reproduced from the resulting solution of chloride of manganese, and so on continually, the same manganese being thus employed over and over again perpetually. Last year there were made in this country and on the continent about 120,000 tons of bleaching-powder, which is the chief commodity in the manufacture of which chlorine is employed, and this bleaching-powder costs on an average about £5 per ton for native oxide of manganese. Mr. Weldon's process produces bleaching-powder at a cost of only 15s. per ton for manganite of calcium, and enables much more chlorine to be obtained from a given quantity of hydrochloric acid than has hitherto been usually obtained therefrom. It is being very extensively adopted both in this country and on the continent. The author exhibited samples of manganese which had already generated chlorine about fifty successive times.

[We have the above paper in type *in extenso*, but want of space obliges us to omit it from the present number.]

SECTION C.—GEOLOGY.

PRESIDENT—Professor R. Harkness, F.R.S., F.G.S. Vice-Presidents—R. A. C. Godwin-Austen, F.R.S., F.G.S.; Sir P. Egerton, Bart., F.R.S., F.G.S.; Professor Phillips, F.R.S., F.G.S.; Professor Huxley, F.R.S., F.G.S.; Edward Vivian, F.G.S. Secretaries—W. Pengelly, F.R.S., F.G.S.; W. Boyd Dawkings, F.R.S., F.G.S.; Rev. H. H. Winwood, M.A., F.G.S.

PRESIDENT'S ADDRESS.

IT has of late become the custom to open the several sections of the British Association with an introductory address. This custom had, I believe, its origin in this section when the Association met at Aberdeen; and upon that occasion Sir Charles Lyell made the important discovery of M. Boucher de Perthes, of the occurrence of flint weapons with the bones of large extinct mammals in the gravels of the Valley of the Somme, the subject of his opening address. In some instances no matter of importance in connection with geology has furnished materials for the opening address; but more frequently subjects of local interest have supplied the matter for this purpose; and it is in connection with the latter that I shall occupy for a short time your attention. In no portion of Great Britain have we a better development of the series of rocks which forms the link between the well established Devonian formation and the succeeding well recognised carboniferous group than in this county. The rocks which form the link I refer to are known to geologists as the Pilton beds, deriving their name from the locality in Devonshire where they are best developed. These rocks have been made the subjects of investigation by Sir Roderick I. Murchison, Professor Sedgwick, Sir H. J. de la Beche, Mr. Weaver, Mr. Godwin-Austen, Professor Phillips, and others; and of late they have been carefully examined by Mr. Jukes, Mr. Salter, Mr. Townshend Hall, and Mr. Etheridge. My reason for referring to these rocks is to point out their relation to certain strata which are very well exhibited in the south-west of Ireland, and which occur in a horizon corresponding to the Pilton Shales. The Irish representatives of the Pilton Shales are marked by a mineral aspect very nearly allied to their equivalents in this country; and they contain organic remains of a type very closely approximating such as are found in the Pilton rocks. Before alluding to the Pilton beds, I will refer to their Irish representatives, and to the rocks upon which these repose. In doing so, I shall avail myself of the labours of the late Mr. Jukes and the other officers of the Irish branch of the Geological Survey, who were for several years engaged upon these rocks. Before doing so I must, however, pay a passing tribute to the memory of one who has so recently been removed from the scene of his labours. For more than eighteen years the late Mr. Jukes filled the office of Director of the Geological Survey of Ireland; and the numerous maps and memoirs which have emanated from this survey while under his control speak alike of the labour and accuracy with which this work has been done. Every geologist personally acquainted with the late Mr. Jukes must know how ready he was on every occasion to impart all the knowledge he possessed to those who sought it; and that earnest love of his subject and kindness of heart which so distinguished him caused him to be beloved by all who had the pleasure of his acquaintance. On many occasions this section of the British Association has had valued communications from him; and many who are now present will well remember the apt and vigorous manner of Mr. Jukes when he had anything to address to this section.

The portion of Ireland nearest Devonshire where we have rocks which can be compared with those of this county is the neighbourhood of the town of Wexford. Here are strata reposing upon Cambrian rocks, which have been assigned to the old red sandstones by the officers of the Irish Survey, attaining a thickness of about 200ft. At the western extremity of the county of Wexford, at Hook Point, the old red sandstones are from 600ft. to 700ft. thick. In the Comeragh Mountains to the north-west they have a thickness of not less than 1,700ft; and south-west from the Comeraghs, near Dungarvon, they are upwards of 3,000ft. in thickness. In the west of the county Cork we have from 5,000ft. to 6,000ft. of old red sandstones exposed; and here the upper portion is denuded and the base is not seen. In the Glengariff and Killarney country from 8,000ft. to 10,000ft. of these strata are exhibited, and here also their base is not visible. On the south side of the Dingle promontory the old red sandstones occur under different circumstances. They are here from 3,000ft. to 4,000ft. thick, and are seen resting unconformably on rocks which are of a reddish purple colour, and being at least 10,000ft. thick. These reddish purple beds repose comformably on the representatives of the Ludlow series. The strata of the South of Ireland which represent the old red sandstones, and which in the neighbourhood of Glengariff and Killarney attain a greater thickness than 10,000ft., are extremely barren in organic remains. Several thousand feet of strata, consisting of purple, red, and green beds, which, from being well developed in the district of Glengariff, have received from the Irish Geological Survey the name of "Glengariff Grits," have never yet afforded a fossil. It is only in the upper portions of the series, which is comparatively thin, and which consists of yellow sandstones, that organic remains occur; these consist of remains of plants, which at Kiltorkin, in the county Kilkenny, are in a beautiful state of preservation. Fish remains are also found referable to the genera *Coccosléus* and *Gyrolepis*; likewise a very characteristic shell, *Anodon Jukesii*, and crustacean remains in the form of a species of *Eurypterus*. In Ireland the strata which succeed conformably the yellow sandstones have been called by Sir R. Griffiths the lower limestone and shales. In the south of Ireland these strata have a great thickness, and when they possess a slaty cleavage the term "carboniferous slate" has been applied to them. These strata in the eastern portions of the county Wexford, where the old red sandstones are thin, have no distinct existence. In the western part of the same county, at Hook Point, where the old red sandstone deposits are thicker than in the eastern portion of Wexford, the lower limestone shales make their appearance as a distinct group, separating the yellow sandstones below from the carboniferous limestones above; and here their thickness is between 10ft. and 20ft.

We have already seen how the old red sandstones have increased in thickness in the neighbourhood of Dangarvon. The carboniferous slates also attain a much greater development here than at Hook Point, for the officers of the Geological Survey give their thickness at 700ft.; and near Youghal, still further westwards, they have a thickness of about 900ft. On the western side of Cork Harbour, we have examples of a still greater development of the carboniferous slates, for here they are at least 1,500ft. thick. At the Owl Head of Kinsale, 6,500ft. represent their thickness; and still further westward, they attain to even a greater development. In the county of Cork, gritty bands make their appearance in the carboniferous slates. In the eastern portion of the area, where the grits first occur, they are thin and very irregular. They become very thick in the western portion of the county; and in Coomholn Glen they have their greatest development, being at least 3,000ft. in thickness. These gritty beds have been termed "Coomholn grits." They contain some peculiar fossils, and they have others in common with the carboniferous slates. They are interstratified with slate bands; and, although most extensively developed near the base of the carboniferous slates, they are merely local members of this series, emanating from conditions somewhat different from those whence the great mass of the carboniferous slates originated.

Having described generally the arrangement of the rocks of the South of Ireland which represent the Pilton beds, and also the deposits which support them, we have now to refer to North Devon. On the north side of Boggy Point, and eastward thereof, there are hard purple sandstones, possessing many of the features of the sandstones of the South of Ireland, which immediately underlie the "yellow sandstones," and upon those in North Devon are light-coloured beds, which represent the Irish yellow sandstones. In the neighbourhood of Marwood, reposing on the equivalent of the yellow sandstones, are greenish-grey grits, affording a group of fossils intimately allied to those contained in the Coomholn grits; and among these are plant remains identical with such as occur near the base of the carboniferous slates. These have been obtained by the Rev. Mr. Mules. The mineral nature and the fossil remains place the Marwood sandstones and the Coomholn grits on the same horizon. The fossil plants which occur near the base of the carboniferous slate, and in the Marwood sandstones, are specifically identical with such as are found at the base of the carboniferous formation in the north of England. Here *Felicites liniaris* and *Sagenaria Velthemiana* occur, and these are the forms which the base of the carboniferous slates afford. The Pilton rocks succeed the Marwood sandstones, and these Pilton rocks, in their mineral nature, are intimately allied to the carboniferous slates. The strata which make up the Pilton group consist of shales and slates, generally of a dark colour, with associated sandstones and gritty beds, and occasional thin bands of limestones full of corals. The fossils of the Pilton rocks are very closely connected with those of the carboniferous slates. Forms, however, occur in the Pilton beds which have not yet been recognized in their Irish representatives. There are species of *Phocops*, *Strophalosia productoides*, and a few other species. But such fossils as are most abundant in the Pilton rocks are those which are most common in the carboniferous slates. There is an idea prevalent among many English geologists that the Coomholn grits are a series of rocks distinct from and lying beneath the carboniferous strata; and this idea has, I believe, given rise to erroneous impressions concerning this series. I have pointed out that this is not the conclusion of the officers of the Irish Geological Survey, and my own observations have led me to results similar to theirs. I hope this meeting will afford more information concerning the Marwood beds and the Pilton rocks; and that we shall have further evidence which will enable geologists to say whether these strata shall be referred to the Devonian group or to the carboniferous formation. A band of pale slates, with a few bivalves, lies between the purple sandstones of Mort Bay and the greenish-grey grits of the Marwood series. It is desirable that further information should be afforded concerning these strata and their fossil contents. It appears to me that the boundary between the Devonian or old red sandstones and the carboniferous formation is, in the British Isles, placed in different horizons. In Ireland, the carboniferous slates and the interbedded Coomholn grits are referred to the latter, while, in this country, the equivalents of these are looked upon as appertaining to the Devonian formation.

Besides the Marwood sandstones and the Pilton rocks, there are other matters of great interest in connection with the geology of Devonshire. The Triassic strata of this county in the neighbourhood of Budleigh Salterton has within it some peculiar pebble beds, which have been described by Messrs. Salter and Vicary. These pebble beds abound in fragments containing fossils similar to those which the Silurians of Normandy offered. Recently these Triassic strata have yielded to Mr. Whitaker important palæontological evidence in the form of reptilian remains, which Professor Huxley has referred to the genus *Hyperodapedon*. This evidence goes a long way towards supporting the conclusion that the Lossie-mouth sandstones near Elgin are of a much newer age than their stratagraphical arrangements would seem to indi-

cate; and that they belong to the triass rather than to the old red sandstones, to which they have previously been referred by many geologists. In Devonshire also we have a better development of the Miocene strata than is to be found elsewhere in the British Isles, and the locality where these strata occur is within a short distance of Exeter. I refer to Bovey Tracey and its lignite beds. The plant remains which have been obtained therefrom have been described by the eminent Swiss botanist, Dr. Oswald Heer; and, thanks to the generosity of that noble-hearted lady, Miss Burdett Coutts, who is alike desirous to promote science and to alleviate human suffering, the fossils obtained from these Bovey Tracey lignites are now well known to geologists. The plant remains which these strata contain are the relics of a vegetation which, during the lower Miocene epoch, spread over a large portion of the continent of Europe, and extended into the arctic regions of America; a vegetation which clothed not only Europe with lofty forest trees and a rich undergrowth of smaller plants, but which also covered Greenland and Spitzbergen, lands which are now the abode of ice and snow, with an equally rich vegetation. This extensive diffusion of similar forms of plants during the old Miocene period speaks to us of a widely extended uniform climate, contrasting strongly with the climates which now prevail in the temperate and arctic regions of the northern hemisphere. There is another matter connected with the geology of Devonshire which has special interest. This is the caves of this county, and their contents. These have been made the subjects of many valuable communications to this section by Mr. Pengelly and the gentlemen who are associated with him in the committee for the exploration of Kent's Hole. But as we now are in a locality so near the source whence so much of interest has come, I believe that this section will again have before it important matter referring to Kent's Hole, and other Devonshire caverns. Geology and archæology are now shading into each other, and although the early history of man remained for a long time like distant land, dim and ill-defined, of late, owing to the labour of Sir Charles Lyell, Sir John Lubbock, and others, we are now acquiring a clearer conception of our early ancestors, of their mode of life, and the conditions under which they existed.

SECTION D.—BIOLOGY.

President.—George Busk, F.R.S., F.L.S., F.G.S. Vice-Presidents—Professor Balfour, F.R.S.; C. Spence Bate, F.R.S., F.L.S.; Dr. Hooker, F.R.S.; Sir John Lubbock, Bart., F.R.S.; Dr. W. Ransome; E. B. Tylor; A. R. Wallace, F.R.G.S.; Professor E. Perceval Wright, M.D. Secretaries—Dr. Spencer Cobbold, F.R.S.; Professor Michael Foster, M.D.; E. Ray Lankester; H. T. Stainton, F.R.S., F.L.S.; Rev. H. B. Tristram, M.A., LL.D., F.R.S.; Professor Lawson.

On taking the chair the President apologised for not delivering an address. He had been obliged to forego giving an address on the present occasion because he occupied the chair only on account of the absence of a much more worthy occupant, his eminent friend Dr. Rolleston, who had been prevented attending; and it had now fallen to his lot, and that at such brief notice, at a time when he was much engaged, so that he had been quite unable to prepare any address which would be worthy of their attention. He had, however, a few observations to make as to the arrangements of the section. They had followed the arrangements of the last two or three years, in dividing the section into two different departments, which were, first, one including all subjects of natural history, botany, zoology, and ethnology; and the second included the subjects of human and comparative anatomy and physiology. With respect to the ethnology it was determined by the committee that the subject should be added to the first of the classes into which the section had been divided, because the subject had been separated from its somewhat unnatural union with the geological section last year. It had long been thought, and sometimes warmly debated, whether such union of ethnology with geology should be allowed to remain this year. However, the word ethnology had not been coupled with the geological section, and as it did not appear desirable that so highly important a study as the study of the human race and their history should be left out of the proceedings they had taken it up. It was perfectly clear that it was as important a subject as could be brought before them, and it was one which, year after year, acquired greater importance, and for that reason it had been added to their list of subjects. On the present occasion it happened that the number of subjects upon ethnology was not sufficient to justify their occupying a separate apartment, and as the inconvenience attending that course was considerable, it had been determined that two days out of the week should be given to ethnological subjects.

The section then divided and sat in two departments—one for zoology and botany, under Mr. Spence Bate, and the other, anatomy and physiology, under the president of the section, Mr. Busk.

In the Zoological and Botanical Room, presided over by Mr. C. Spence Bate, the first report read was by Mr. H. E. Dresser, of the "Close Time" Committee. Mr. Dresser advocated a close time being secured for various birds in the same manner as is secured in foreign countries. The discussion was principally remarkable for the remarks of Professor Huxley against having a close time at all, and against the Preservation of Animals, &c., Act, particularly in its application to the deep sea fisheries. The learned Professor contended that that Act was useless, mischievous, and meddling, and stated that the gulls, which had been protected by recent legislation, were of no further use, and could be put to no higher service, than when they furnished their plumage to surmount the bonnets of the interesting sex. The learned Professor generally ridiculed the idea of having a legislative "close time" for such birds. Opposite views were advocated by the Rev. H. B. Tristram, Mr. Wallis, and Professor Newton, and Miss Becker. Some very interesting examples were given by Mr. Smith of the effect of the preservation of birds in the Scilly Isles. He had preserved birds there for many years, and found that while some would increase others would decrease, being pushed out by stronger and more rapacious kinds of birds. The Rev. H. B. Tristram read a paper on the "Effect of Legislation on the Extinction of Animals," strongly advocating legislative means being used to prevent the extinction of wild animals, and particularly birds. In the discussion which ensued, the opinions generally expressed were in favour of this view.

SECTION E.—GEOGRAPHY.

President—Sir Bartle Frere, F.R.G.S., K.C.B., G.C.S.I., LL.D. Vice-Presidents—Sir G. Grey, K.C.B., F.R.G.S.; A. G. Findlay, F.R.G.S.; General Sir A. Scott Waugh, R.E., F.R.S; Captain Richards, R.N., F.R.S.; Admiral Sir E. Belcher, K.C.B., F.R.G.S. Secretaries—H. W. Bates, Assistant-Secretary, R.G.S.; Clements R. Markham, F.R.G.S.; J. H. Thomas, F.R.G.S.

President's Address.

In opening the proceedings of this section, I have no intention to attempt any systematic summary of the progress, present state, or prospects of geographical science generally. My object will be simply to state the proposed course of our proceedings in this section of the Association, and to inform you very briefly on what particular points we may expect to hear from the associates, or from visitors who honour us with their presence, information which may be either new in itself or may form the basis of useful discussion.

Polar discovery seems by universal consent to have a sort of precedence in all classification of recent geographical inquiry, and in this branch we cannot expect much that is new to be laid before our present meeting. We are now in the midst of the very brief season during which an Arctic summer allows the navigator for a few weeks only any chance of making fresh discoveries, and cannot for some weeks longer hear what measure of success may have attended attempts like that of Mr. Lamont to extend our knowledge of the regions adjacent to the North Pole, and especially to solve the present great Arctic problem as to the existence of a great open Polar basin, and we must not expect too much. We may, however, hope to hear something of interest to geographers with regard to the prospects of Antarctic discovery in connection with the preparations for observing the coming transits of Venus. Geographers and astronomers will sympathize less than other taxpayers with the Chancellor of the Exchequer when he finds even the heavenly bodies moving for a parliamentary grant. We may wonder with Mr. Lowe that even Venus cannot arrange a transit without an application to the British Treasury, but we may hope that Parliament, when the application does come before them, will not be less liberal than they were in the days of Cook, exactly a century ago, and that they will regard the investigation as one of really national importance.

There are amongst us, I am glad to hear, more than one geographer who will represent that vast Russian empire whose territories extend in so many directions into regions comparatively unknown, and whose government has long been so honourably distinguished by the aid it has afforded to geographical science. It may, I believe, be truly said that along the line of thousands of leagues which form the southern boundary of the Russian empire in Asia, there are scarcely a hundred miles regarding which our knowledge is as complete as could be desired. We shall have among us Mr. Douglas Forsyth, honourably distinguished among those who, like Captain Montgomery and his fellow labourers, have led the way in geographical discovery to the north of India, and contributed to lift the veil which has for so many generations separated the inhabitants of Tartary and Thibet from those of India. He will give you, I hope, much interesting information regarding the trade routes towards Thibet and Eastern Chinese Tartary, and will satisfy you that he is actuated by no motive dangerous to us or our neighbours, but by a sincere desire to extend the peaceful domain of commerce, and, as a handmaid thereto, to aid the cause of geographical discovery. He will give you the latest intelligence of that enterprising traveller Mr. Shaw, who is at Yarkand, well treated, and apparently a special favourite with both rulers and people.

Mr. Trelawney Saunders will read a paper in which he has combined some of the latest information acquired by Captain Montgomery and his intelligent and enterprising assistants, the Pundits, and applied it to illustrate the general geography of the Himalayan range. Much as has been written about that vast chain, it can hardly be said that even professed geographers have any adequate conception of the bulk and importance of that great mountain mass. Its length may be said to be still almost a matter of conjecture, for its eastern and western terminations have both still to be defined. Its breadth, as Captain Montgomery, who may be said first to have spanned it, tells us, is more than 400 miles at its narrowest, or about eight times the average width of the Alps, with a summit ridge, the passes over which average about 15,000ft. in height.

The Association will recollect that the latest intelligence regarding the course of the Sanpoo, the great river which runs so far from west to east in a course nearly parallel to the general direction of the main Himalayan range, has revived a former discussion as to whether that river rises in the upper stream of the Burrumpootra or of the Irrawaddy. The supposition that it was identical with the Irrawaddy has long been considered as set at rest, and some of our best authorities, such as Drs. Hooker, Thomson, and Campbell, would, I believe, scout the notion that there was any present doubt on the subject. Still it is certain that some Chinese and Thibetan informants have assured later travellers that the Sanpoo is the upper stream of the Irrawaddy, and we are almost destitute of any accurate data regarding the course of the Burrumpootra much higher up than the Sudiya. It is clear, then, that there is need of further inquiry before the question can be said to be finally set at rest.

The glory of being the first, in modern days, actually to traverse the almost unknown region between the Indo-Chinese races and China Proper has been reserved for our neighbours the French. The summary of the results of this great French expedition was given by our President in his last anniversary address, wherein Sir Roderick Murchison described the general course of a journey almost unparalleled in modern days—a journey of 6,200 miles from the tidal waters of the Cambodgia River to Shanghai, 2,480 miles of the distance having been traversed on foot; the whole distance, with very few exceptions, being almost entirely new to modern European travellers. I am not sure whether we are likely to hear from any of our visitors any details of this expedition beyond what has been already published in the French geographical periodicals, but we cannot doubt that whenever the scientific results of such a journey are published, they will prove of surpassing interest. A country so rich and varied in soil, with a rainfall probably in parts exceeding that of almost any known portion of the globe and a great variety of temperature, which has been hitherto almost cut off from civilized Europe, while it approximates geographically to some of the most interesting regions of India and the Eastern Archipelago, must possess a fauna and flora of great novelty and interest.

It is a great disappointment that another year should have passed without revealing, as far as I am aware, a single new fact which would throw light on the fate of Livingstone. The additional information which we have received since last the Association met is purely negative, and adds literally nothing to what was then laid before you in the masterly sketch of Livingstone's ascertained progress contained in Admiral Richard's address. We still only know that, up to December, 1867, he was alive and well, and in good spirits, travelling westward from the neighbourhood of Lake Nyassa, and that he disappeared in the obscurity of the regions beyond. Further than this all is conjecture —whether we may hear of him in the Nile Basin from Sir Samuel Baker's expedition, or on the west coast, must for the present be pure subject of speculation.

There can be little doubt that great results may be looked for from the Egyptian expedition up the Nile under Sir Samuel Baker, which is so totally unlike in its conception and objects to anything of modern days, and for any parallel to which in its difficulties and in the important results it may produce, we must go back to the days of our earliest English, Spanish, and Portuguese discoverers. I am assured Sir Samuel's hopes point to passing next Christmas on Lake Nyanza—and if he does that he will have achieved more than, with such a great expedition, could be expected even from his skill, energy, and enterprize.

In West Africa, Mr. Winwood Reade, under the auspices of the Royal Geographical Society, and Mr. A. Swanzey, one of those liberal merchants to whom geographical discovery on that coast owes so much, is on his way to the sources of the Niger. Mr. Sterling will give you an account of his visit to the holy city of Fez, which has been long kept so sacred from the foot of any but Mahommedans that I believe few European travellers in modern days, except Lord St. Maur, have visited it. We cannot turn from Africa without a passing tribute to the great French engineer who has reversed the geological revolutions of ages before the birth of history, and restored Africa to that insular position which the vast continent occupied in the geography of times preceding the early dawn of authentic history. Mons. Lesseps' great work itself may seem to belong of right to another section of this Association, but geographers must recollect how much of our geographical discovery is due to the closing of this ancient route to the East. Had the action of the Moslem powers not interfered with the Genoese and Venetian trade with the East, the discoveries of Columbus and Vasco di Gama and Magellan, and even those of Hudson, Baffin, and Frobisher, might have been delayed for generations; and now, such are the insatiable demands of commerce, no sooner has the genius and energy of M. Lesseps removed one great barrier to this ancient trade route, than mercantile men turn their attention to others still shorter, and investigate the long-forgotten geography of those lines by which the commerce of the Persian Gulf and India used to reach Tyre and Palestine in a route via Tadmor and the valleys of the Tigris and Euphrates.

In South America Mr. Chandlers is carrying out single-handed, and I believe at his own expense, his wonderful surveys of the tributaries of the Amazon. I trust Mr. Bates will give us some account of labours with the value of which, as well as with the difficulty attending them, no man is better acquainted than our indefatigable secretary. In North America, the Great Pacific Railway, which has just been opened, must exercise a very important influence in making us better acquainted with the little known regions which, for hundreds of miles, lie on both sides of its course.

Turning from the land to the sea, we find almost every month adding to our knowledge of the depth and conditions under which animal life is sustained in the great ocean beds. The extraordinary results obtained by Dr. Carpenter and his companions in their examinations of the deep-sea soundings of our Northern Ocean will be fresh in the recollection of associates, and I trust we may at this meeting hear some of the details of their labours. The laying of the French electric telegraph line, also, cannot fail to have furnished many new facts regarding the ocean bed which the cable—at present, I believe, the longest in the world—passes over, and there are other examinations of ocean beds in the Eastern Seas, commenced with the contemplated laying of the cable to India from Suez, which cannot fail to be new and interesting, on which our indefatigable associate, Captain Sherard Osborne, if he is present, would be able to enlighten us. Information of this kind is likely, as ocean electric cables multiply, to increase in value. When first such cables were laid, it was usual to select comparatively shallow portions of the ocean bed for the cable to traverse, and the deep ocean valleys and hollows were, as far as possible, avoided. But experience shows that in the deepest water the cable is safest from injury, especially in latitudes where there is risk of icebergs which may ground and destroy the cable. Hence our electric telegraph cable companies are likely to become valuable allies to geographical exploration in all that relates to our deepest ocean cavities.

The President concluded a lengthy address by enumerating several distinguished foreign geographers and stating their claims to a warm welcome. He then said:—I have been commissioned by Sir Roderick to state how deeply he regrets that he has been prevented being present this day to offer to these distinguish foreigners the expression of that hearty appreciation and welcome which would come more fitly from the President of our Royal Geographical Society, and you will all join with me in my regret that our venerated friend and leader is not here himself to give to that welcome the personal weight which it would derive alike from his official position and from his scientific standing among the first of living European geographers.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

PRESIDENT—The Right Hon. Sir Stafford H. Northcote, Bart., C.B., M.P. Vice-Presidents—T. D. Ackland, M.A., D.C.L., M.P.; Lord Stanley, F.R.S., M.P.; Lord Houghton, D.C.L., F.R.S.; Sir W. Tite, F.R.S., M.P.; Dr. William Farr, D.C.L., F.R.S.; Professor J. E. Therold Rogers, M.A. Secretaries—Edmund Macrory, M.A.; Frederick Purdy, F.S.S.

PRESIDENT'S ADDRESS.

THE PRESIDENT read an introductory address. After dwelling at some length on the range and method of Economic Science, the right hon. baronet made the following remarks with respect to Devonshire:—And here may I venture as a Devonshire man, while bidding you heartily welcome to the county, to bespeak your indulgent consideration of the circumstances of my compatriots? We Devonians do not hurry on in the race of life quite so rapidly as some of our fellow-countrymen. Perhaps I may venture to say without offence that, as compared with north countrymen, we live slowly. Our birth-rate is below the average of England, and so is our marriage-rate; but then it must be remembered that our death-rate is also low. If you compare us with Lancashire, for instance, you will find that, for less than 32 births per 1,000 in proportion to the population here, there are more than 38 per 1,000 there (the precise figures for 1867 are—Devon, 31·75; Lancashire, 38·19); that, for less than 16 marriages per 1,000 here, there are more than 19 per 1,000 there (Devon, 15·72; Lancashire, 19·04). But then, for less than 20 deaths per 1,000 here, there are nearly 27 per 1,000 there (Devon, 19·72; Lancashire, 26·83). So again, you will find that our children die less rapidly than theirs, and our old people attain to greater ages. The proportion which the deaths of children under five years of age bears to the births in the year is, in Devonshire 19 1-3 per cent., and in Lancashire 32½; while the proportion of deaths of people over 65 years of age is, in Devonshire 18¼ per cent., and in Lancashire 8¾ per cent. Our marriages, too, take place at a more advanced age than do theirs. Of our men only 6·05 per cent. marry under 21 years of age; of theirs 8·45 per cent. do so. For women, the proportions are, in Devonshire 16·81 per cent., and in Lancashire 21·10. In short, we are born, we marry, and we die more slowly than they do. But we are not behind them in all things. If the state of education is to be judged of by the proportion of married people who can write their names, we may hold up our heads even by the side of Lancashire. Of our bridegrooms (in 1867) 82·7 per cent. wrote their names like men; of theirs only 76·8 per cent. Our brides did still better in proportion: 78.6 of them wrote their names, while in Lancashire only 56·0 did so. In the matter of wealth no doubt we are behind them; our assessment to the Schedules A, B, D of the income-tax comes to only £10 12s. per head of our population, while theirs comes to £18 14s. On the other hand, I doubt whether we have a very much larger number of paupers in proportion to our population than they have (on the average of the three years 1866-7-8 they seem to have had 65 able-bodied paupers to every 10,000 of the population, while we had 69). As regards criminals, we fall far short of their ratio; the proportion of persons committed or bailed for trial in 1867 having been in Devonshire less than 4 to 10,000 and in Lancashire 12 to 10,000. There are many other points on which it would be interesting to compare the two counties; and the comparison would be rendered still more valuable by extending it to other counties, of which these might be taken as the types. But time forbids my entering into the details which would be requisite. I refer to the point principally for the purpose of reminding you that observations which might have been applicable in one part of England may be very much out of place in another; that each county has lessons of its own to teach, as well as to receive; and that Devonshire, though she does not aspire to the position of Lancashire, as the standard-bearer of British manufacturing and commercial enterprise, is not without her own claims to respect and admiration in regard to many of the essentials of human happiness. In the concluding portion of his address, Sir Stafford entered elaborately into considerations of the question of Free Trade, and the question closely related to it of the carrying on of great enterprises, like the telegraph and the post-office, by Government, rather than by individuals, remarking upon the increasing tendency of things in that direction in Great Britain.

SECTION G.—MECHANICAL SCIENCE.

PRESIDENT—C. W. Siemens, F.R.S. Vice-Presidents—G. P. Bidder, C.E.; C. Vignoles, C.E. F.R.S., F.R.A.S.; Professor W. M. Rankine, F.R.S.; Professor Willis, F.R.S.; C. H. Gregory, Pres. I.C.E.; Admiral Sir E. Belcher, K.C.B.; Captain Douglas Galton, R.E., C.B.; J. F. Bateman, F.R.S.; F. J. Bramwell. Secretaries—P. le Neve Foster, M.A.; W. Smith, C.E.; H. Bauerman.

PRESIDENT'S ADDRESS.

IN prefacing our proceedings with a few remarks on the leading subjects of the day of special interest to our section I can scarcely pass over the somewhat hackneyed question of technical education. The great International Exhibitions proved that although England still holds her ground as the leading manufacturing country, the nations of the continent have made great strides to dispute her pre-eminence in several branches, a result which is generally ascribed to their superior system of technical education. Those desirous of attaining a clear insight into that system, and the vast scale upon which it is being carried out under Government supervision, cannot do better than read Mr. John Scott Russell's very able volume on this subject; they will no doubt agree with the author in the necessity of energetic steps being taken in this country to promote the work of universal education, although I, for one, think that objection may fairly be made against the plan of merely imitating the example of our neighbours. The polytechnic schools of the continent, not satisfied to impart to the technical student a good knowledge of mathematics and of natural sciences, pretend also to superadd the practical information necessary to constitute them engineers or manufacturers. This practical information is conveyed to them by professors lacking themselves practical experience, and tends to engender in the students a dogmatical conceit which is likely to stand in the way of originality in the adaptation of new means to new ends in their future career. On this account I should prefer to see a sound "fundamental" education, comprising mathematics, dynamics, chemistry, geology, and physical science, with a sketch only of the technical arts, followed up by professional training, such as can only be obtained in the workshop, the office, or the field. The universal interest evinced throughout the country in the work of education, by Parliamentary enquiries, by the erection of colleges and professorships, and by the munificence of a leading member of our section in endowing a hundred scholarships, are proofs that England intends to hold her place also in this question of education among the civilised nations, and I am confident that she will accomplish this object in a manner in unison with her practical tendencies and independence of character.

Closely allied to the question of education is that of the system of letters patent. A patent is, according to modern views, a contract between the commonwealth and an individual who has discovered a method, peculiar to himself, of accomplishing a result of general utility. The State, being interested to secure the information and to induce the inventor to put his discovery into exe-

(*To be continued on page* 156.)

COAL-GETTING MACHINE.

BY MR. J. S. WALKER.

FIG. 1.

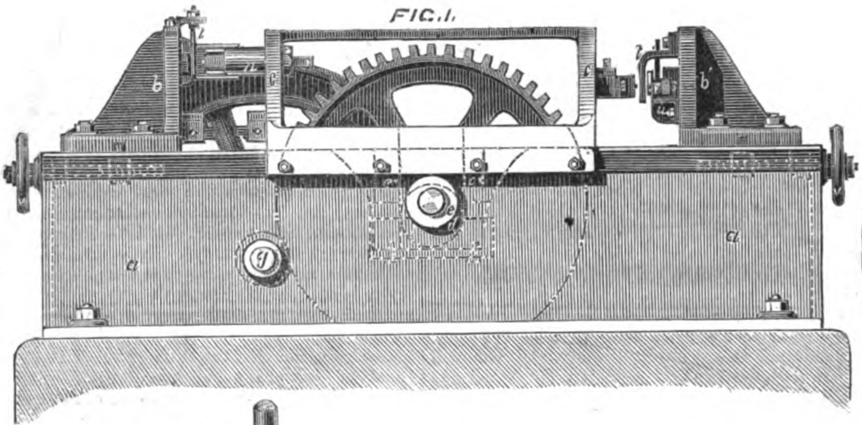


FIG. 2.

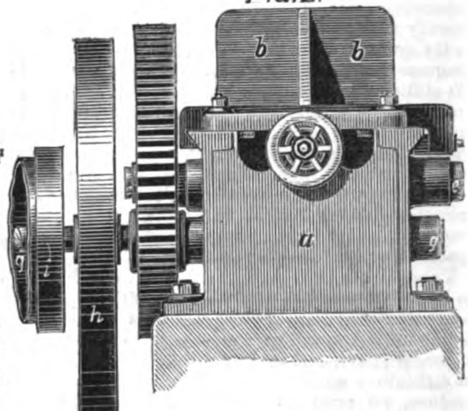


FIG. 3.

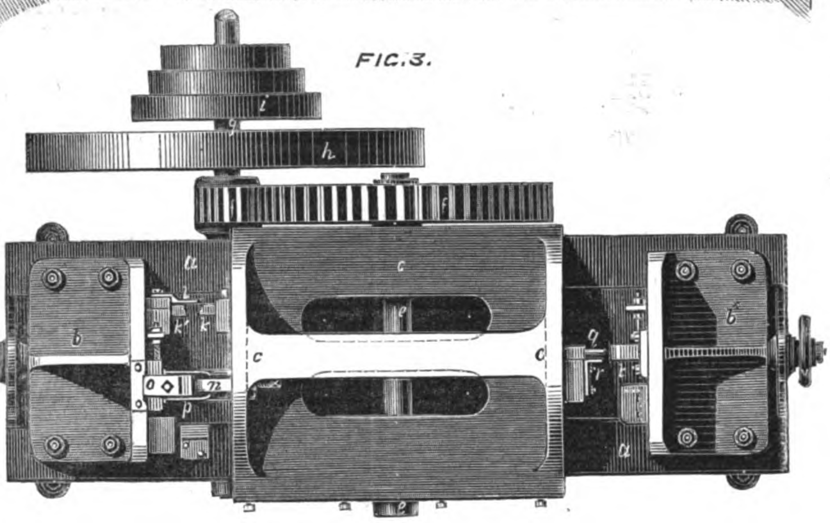
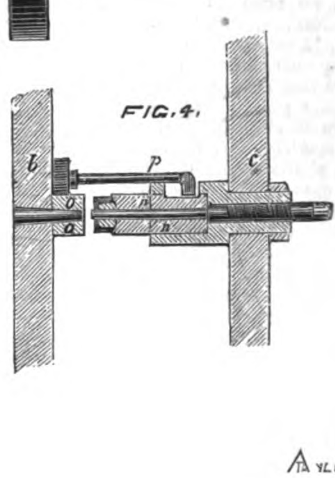


FIG. 4.



MACHINERY FOR GETTING COAL.

THE invention illustrated in the accompanying engraving relates to a method of getting coal, ironstone, or other similar mineral by the process called undermining or holeing, wherein a recess or channel is cut or grooved out near the bottom or floor. When the support is thus removed, the upper part of the coal or mineral is detached and brought down by inserting wedges above. The invention, which has been patented by Mr. J. S. Walker, of Wigan, consists principally in the employment of a peculiar form of disc cutter, mounted horizontally on a short vertical shaft and driven by bevel gearing actuated by a compressed air engine, the whole being mounted on a carriage supported on wheels running on a tramway and propelled slowly along the face of the coal or mineral by means of worms and worm wheels, also actuated by the same or an auxiliary compressed air engine. In our engraving, fig. 1 is a longitudinal section, and fig. 2 a plan view of this apparatus.

The framework *a a* of the machine is of wrought iron, carried by flanged wheels *b b* on the tramway *c c*. This framing supports the cylinder *d d* (see also face view fig. 3), crank shaft *e e*, and other parts of a compressed air engine of the ordinary construction. The crank shaft *e e* turns in bearings, and has keyed near one end the toothed pinion *f f*, the teeth of which are slightly tapered to enable it to gear with the open radial teeth *g g* formed between the inner and outer rims of the cutter wheel *h h**, the boss of which turns on a vertical stud *i i* carried by the frame *a a*. The outer rim of the cutter wheel *h h* is provided on its periphery with snugs or projections, between which the cutters *k k* are fixed by means of keys. In front of each cutter is bolted a piece of metal * * which acts as the brake iron of a carpenter's plane, and prevents the cutters from attacking the coal too deeply at once. This piece is lined with wood, which can be easily pared away as the cutters become worn. The cutters are mounted in groups of four or five, following each other, so formed and arranged that each successive cutter attacks a different part of the groove or channel cut by the wheel, and the whole group leaves no part uncut, the face of the widest cutters being wider than the rim of the wheel so as to allow of sufficient clearance, and the spur teeth *g g* are open or slotted completely through the wheel *h h** so as to allow the cuttings to fall through the openings and thus prevent the choking of the cutting wheel. The wheel *h h** is made in two parts, bolted together when in use by means of plates *l l* (see fig. 3, and also the detached sections, figs. 4 and 5). The boss of the part *h* turns on the stud *i i*, whilst the boss of the other part *h** is of a larger diameter and fits outside on the former, so that, upon unbolting and removing the plates *l l*, and lowering the stud *i i*, by unscrewing the bolt *m m*, as seen at fig. 4, the half *h** of the wheel can be turned half way round and brought over the half *h*, so that the whole of the wheel lies beneath the frame, and the width of the machine is reduced by nearly one-half. The object of this arrangement is to facilitate the transport of the machine from place to place, and to enable it to pass through parts of the mine where it would be impossible to introduce it with the cutter wheel in its entire state. *n n* are four screws, by means of which a certain amount of inclination may be given to the machine if desired, or whereby the machine may be levelled if preferred, notwithstanding any inequality in the level of the rails or tramway. *o o*, fig. 1, is a sheet-iron cover, which may be applied to the machine.

The machine may be caused to progress by driving one of the axles slowly by means of a worm and wheel, actuated either by the same compressed air engine, or by a small auxiliary air engine carried in the vacant space of the frame *a a* in front of the rear axle. Mr. Walker, however, prefers to fix a rope to the front part of the machine and draw it forwards by means of a winch or crab placed in advance. When the machine is upon a slight incline, it will advance without any external aid. By a slight modification, this machine can readily be adapted to hole or cut the coal or other mineral at the sides or near the top of the seam if required.

We are informed that this machine is daily at work with very satisfactory results. In coal without "bone" it will hole at the rate of from 30 yards per hour and upwards with 20lb. pressure, and requiring the attendance of one man only. We hope shortly to place before our readers some authenticated results of continuous working of this useful apparatus.

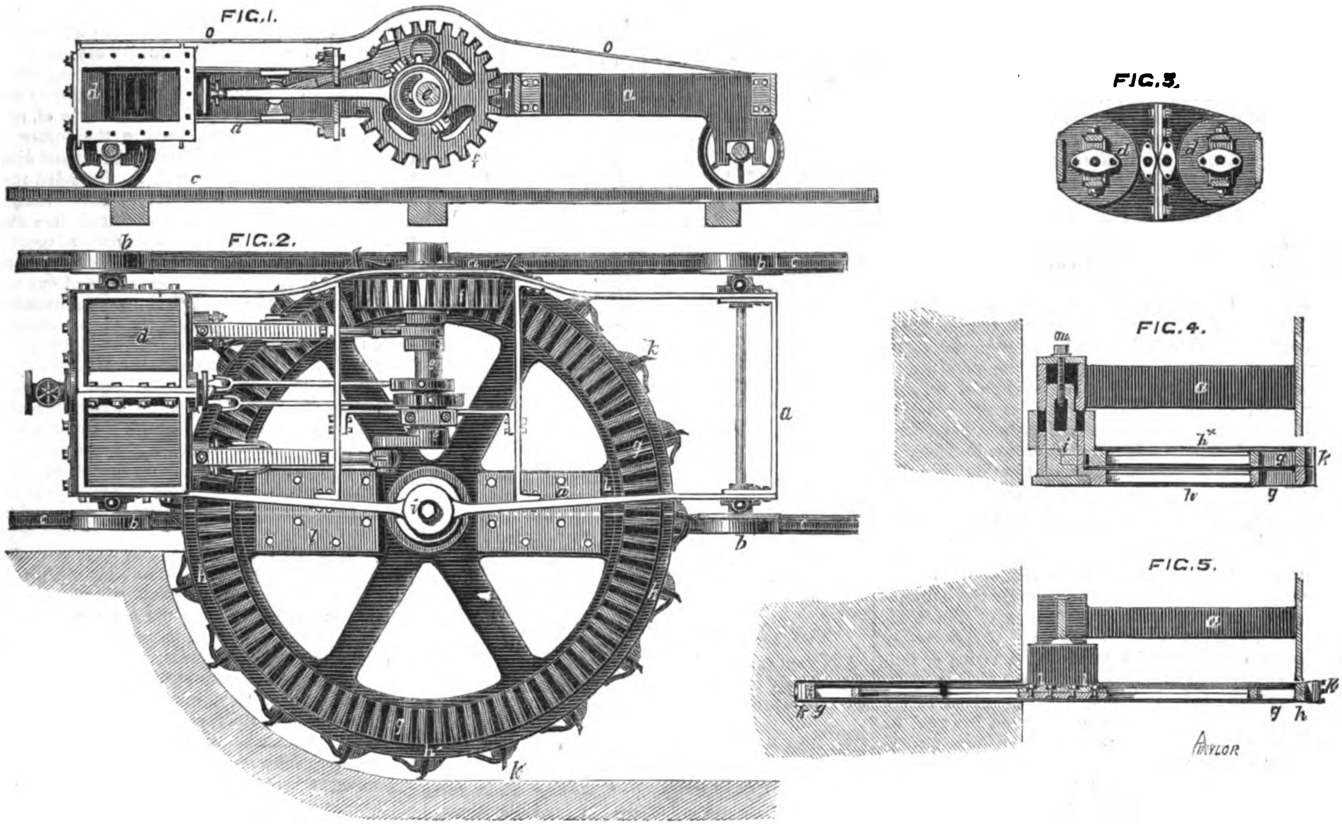
MACHINERY FOR FORGING NUTS.

MR. J. W. BRIERLEY, of Oldham, has patented some improvements in machinery for forging nuts. The invention consists of a machine which, by the simple movement to and fro of a headstock upon a slide or bed, shapes, flattens, and cuts off the nuts from a heated bar and delivers them sufficiently hot for the workman to finish them with a few strokes of the hammer on a swage attached to the anvil. The machine consists mainly of three parts, viz., a bed or slide, a fixed headstock, and a moving headstock. The latter slides to and fro on the bed, and is actuated by means of an eccentric cam or crank on the main driving shaft, which revolves with a slow motion. Attached to the sliding headstock are the tools or dies, and to the fixed headstock are attached the counterparts. The first is a die or swage, which indents the sides of the heated bar so as to form four sides of an hexagonal nut. The second is a compound tool forming a pair of squeezers or flatteners for pressing the top and bottom of the nut so as to bring it to the required thickness, and snapping the edges, and which at the same time punches out the centre and cuts off the nut.

The machine requires two attendants, a feeder and a finisher. The feeder takes a heated bar of the requisite width and presents its edges to the dies or swages, which at one movement indent the edges and form four sides of the nut. He then turns the bar on edge and places the sides between the squeezers or flatteners, which give the nut the required thickness and flatten it and snap the edges, at the same time punching out the hole in the centre and cutting off the nut from the bar. As the nut falls off, it is taken up by the finisher on a rod which fits the hole and finished (without reheating) by a few blows of the hammer on a swage of the proper form fixed on the anvil. Gauges or stops are affixed to the first and second tools, against which the feeder thrusts the end of the bar, thus ensuring the uniform size of the nuts and correct position of the central hole. These gauges are adjustable and the tools also are capable of being changed so as to make various sized nuts with one machine. For square nuts only one compound tool is required. The machine may be made double-acting by causing the moving headstock to slide between two fixed headstocks and having a similar set of tools at each end. The

MACHINERY FOR FORGING NUTS.

BY MR. J. W. BRIERLEY.

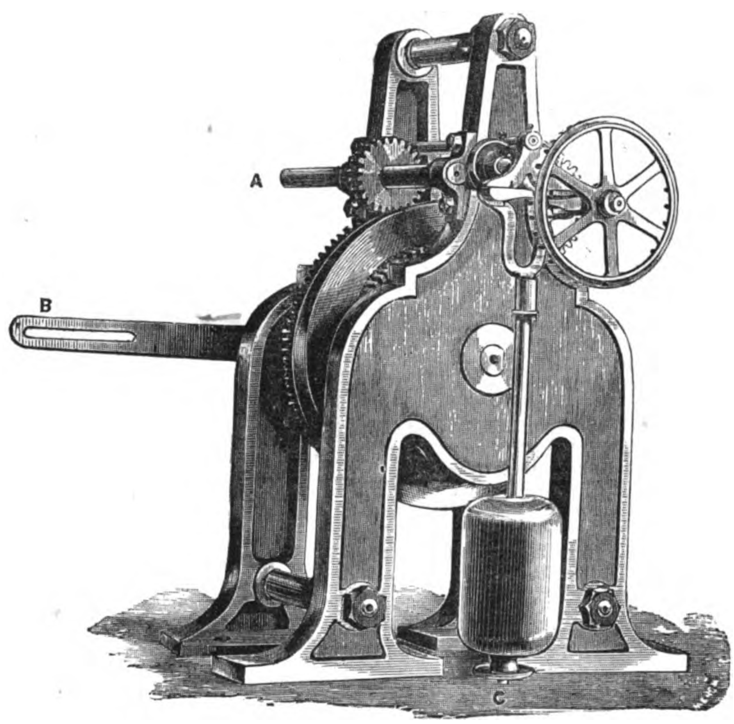


machine may be adapted to make hexagonal or octagonal nuts at one end and square nuts at the other. If the furnace is so arranged that the feeder can heat a sufficient length of his bar at a time, he can form and cut off several nuts at one heat, in which case more than one finisher will be required for each feeder in order to finish the nuts off without reheating as quickly as the machine can produce them.

Our engraving represents at fig. 1 a side elevation, at fig. 2 an end view, and at fig. 3 a plan of Mr. Brierley's machine as arranged in the double-acting form for making hexagonal nuts at one end and square ones at the other. *a a* is the bed of the machine; *b b**, the fixed headstocks; and *c c*, the moving headstock, which works on V slides on the bed as seen at fig. 2. The under side of the moving headstock is formed with two jaws *c* c** (see dotted lines in fig. 1), between which works an eccentric *d d*, keyed fast on the main driving shaft *e e*, which latter is driven with a slow motion by means of the spur wheel and pinion *f f* from the first motion shaft *g g*, which is provided with a flywheel *h h* and speed pulleys *i i*. Attached to the moving headstock at the left-hand side of the machine, fig. 3, is a die or swage *k*, its counterpart *k** being attached to the fixed headstock *b*, and provided with a stop *l*. This die, when the end of a heated bar is placed against the stop *l*, indents the edges of the bar and forms the four angular sides of an hexagonal nut, also partially forming two sides of the next nut. As the headstock recedes, the bar is then withdrawn and placed on edge between the compound tool *n n* and its counterpart *o o*. This tool (as seen enlarged in the detached view, fig. 4) is so formed that, on the return of the headstock, it squeezes or flattens the nut and snaps the edges at the same time that it punches the hole through the centre and cuts the nut off the end of the bar. As the headstock again recedes, the claws *p p* draw the nut off the punch, and the operator proceeds as before. At the right-hand end of the machine, which is arranged for making square nuts, only one tool and its counterpart will be required. The tool consists of one punch *q* and shear and cutter *r*, the counterpart attached to the fixed headstock *b** consisting of a block *s* with a hole in the centre corresponding with the punch; one edge of the block acting as the other blade of the shears; *t t* is the claw for removing the nut from the punch, and *u u* is the adjustable stop against which the end of the bar is held, and which determines the length of the piece cut off. The whole of the tools and counterparts are changeable and adjustable for different forms and sizes of nuts, and the fixed headstocks are also capable of adjustment by means of hand wheels and screws *v v*.

CHRONOMETRICAL REGULATOR.

BY MESSRS. J. BAILEY AND CO.



THE CHRONOMETRICAL REGULATOR.

IN the annexed engraving we give a perspective view of Messrs. Maynard and Grimes' chronometrical regulator for steam engines, which we found at the Manchester Show. It was there exhibited by Messrs. J. Bailey and Co., of the Albion Works, Salford, who are the manufacturers of the apparatus. In this machine the regulator is a pendulum, which, in a most simple manner, is actuated by the engine, and in connection with it is a lever, which maintains a perfectly fixed position so long as the speed of the engine is exactly uniform with the strokes of the pendulum. This lever is connected to the throttle valve or starting gear in combination with any ordinary governor, and the moment the engine varies, by the friction of a stroke from the pendulum, the lever immediately acts upon the valve and prevents further irregularity. The steam engine, by means of this invention, is under as perfect a control as a good clock or watch, and it will perform with

the same regularity; indeed, so exact must the number of strokes of an engine be per day, that when the chronometrical regulator is once set, there cannot be more variation than there is in the performance of a well-regulated clock; hence its name. The importance of regular speed does not require to be enforced; when machines are suddenly stopped, the speed acquired by the engine has often resulted in serious accidents, and always in loss of steam, irregular production, and great wear and tear of the driving gear.

In our engraving, A is the wheel driven by the engine shaft, B the differential lever, which is raised or depressed the moment the engine increases or decreases in speed, and this is done in exact proportion to the increase or decrease; C is the regulating screw of the pendulum, by which the speed of the engine may be adjusted, increased, or diminished. The principle of the chronometrical regulator being a pendulum, it is consequently unvarying in speed, and should the engine vary, either from a change in the power required to be driven, or from any alteration in the pressure of the steam, the lever B at once rises or falls as required, therefore so long as the engine revolves at its proper speed the lever maintains a fixed position. But should any change occur to alter its relative speed, the lever changes its position accordingly, until the speed of the engine is again uniform with the pendulum. As will be seen, the action of the ordinary or ball governor, at the other end of the combination lever, in rising or falling with any variation in the speed of the engine, is almost the same as with the chronometrical regulator, but the effect of the combination of the two is as follows:—As already explained, the lever B, in rising or falling, as required, not only checks the engine by its own action, but at the same time gives to the ordinary governor balls a changeable fulcrum on which they act, and whereby they are always ready to assist the chronometrical regulator under all circumstances, whether the engine is fully or partially loaded, or whether the pressure of the steam is high or low, the only provision being that there shall be steam of sufficient pressure to drive the engine at the required speed; and, however much higher the pressure may be got, or however much weight may be taken off, even down to the empty engine, the speed of the same will be unchanged, and it will work as steadily and with as complete safety as when fully loaded. To put the explanation in a simple form, suppose the chronometrical regulator to be a clock, and the engine engaged in winding it up the regulator or clock having the lever in lieu of weight; should the engine wind it up faster or slower than it can go by virtue of the length of its pendulum, the difference is at once communicated to the throttle valve. The consequence is that, although more steam may be created than is required, or the machinery may be suddenly thrown off, the engine will still perform its duty regularly, and with scarcely any perceptible variation. This invention is of importance to all users of steam power, and its merits entitle it to take a leading position amongst steam governors.

We may add that Messrs. Bailey and Co. have put up these regulators with very satisfactory results at Mr. Hadfield's cotton mills, at Oldham, also at the flax mills of Messrs. Marshall, at Leeds. Others are at work in various parts of the country, and the experiments with them show that very heavy machinery may be suddenly stopped with scarcely any perceptible variation of the speed of the engine. Indeed, so exactly are the revolutions governed that the makers inform us that with or without the load their number is the same taking any five minutes either way.

STEAM FIRE ENGINE FOR THE CITY OF HAMBURG.

THIS engine, constructed by Shand, Mason, and Co., was tried on Wednesday last, at the Grand Surrey Canal, in the presence of a number of eminent engineers and other gentlemen connected with and interested in fire engines and fire brigades. It is the first this firm have made of their newly patented equilibrium steam fire engines, for which a silver medal was awarded at the Agricultural Show held at Edinburgh, and which has since been tried in public at various provincial towns. The general arrangements of the engine are the same as in their engines used by the Metropolitan Fire Brigade. The forepart of the carriage is reserved to carry the firemen, and the hose and implements. The boiler, with the fire engine works fixed to it, is placed close to the hind axle; the whole, mounted on springs and high wheels, is drawn by a pair of horses at great speed. The boiler, by a novel arrangement of inclined water-tubes, combines the greatest rapidity in generating steam with economy of fuel, and is extremely simple in construction. We are informed that 100lb. pressure of steam has been frequently raised from cold water in 6min. 40sec.

The engine consists of a set of treble pumps, an arrangement found by long experience to be the most perfect for raising water under pressure. They are worked directly by a corresponding set of treble steam cylinders, the whole being fixed to the boiler, and forming a very compact and equable steam fire engine. The flow of water through the hose and suction pipe is perfectly uniform, producing a jet as steady as those obtained by pressure from gravitation, and avoiding all shocks to the engine. All present were highly gratified with the rapidity with which the steam was raised, and the manner in which it was increased after the engine was set to work, and maintained during the trial, and the perfectly smooth and quiet working of the engine.

The following are the details of the experiments:—The materials for the fire having been laid, and the boiler supplied with cold water, steam was raised to a pressure of 100lb. to the square inch in 7min. and 4sec. The engine was then started with two jets 10-16ths and 12-16ths of an inch in diameter, afterwards with four jets, being two each 10-16ths and 12-16ths of an inch in diameter, throwing the water to a height of 120ft. Afterwards a jet oflso a diameter was thrown to a height of 180ft., a con- jet of 1½in. to over 100ft. The experiments king cluded with one of 1¾in., the engine wor eam throughout with the greatest regularity, the st being generated so freely that the door of the ur- nace was open a greater part of t time.

AN IRON TANK SHIP.

AN iron tank molasses brig called the "Novelty" lately returned in safety to Boston, U.S., with a cargo of molasses in bulk. The event was a leading theme of conversation in commercial circles. The "Novelty" was built at the Atlantic Works, East Boston, and was fitted with square iron tanks to carry molasses in bulk. She had her tanks filled with water when she left Boston for Cuba, by way of experiment, to see how she would work with a liquid cargo, and also to test the tanks. On her arrival at Matanzas, her tanks were pumped out in a day, and the vessel was then ready to receive cargo, which she took on board at the rate of 200 hogsheads per day. The cargo of the "Novelty" consists of 84,075 gallons, which was pumped by steam power from the vessel into pipes connecting with an iron tank at the Oxnard Sugar Refinery. It is calculated that when the cargo is all ready at the point of shipment it will require only four days to load her when it is received from lighters, and, under favourable conditions, the round voyage can be performed in thirty days. The saving by the use of tanks is estimated at about 2,000dols. on the cargo of the "Novelty." The success of this experiment is due to the enterprising firm of Messrs. Nash, Spaulding, and Co., of Boston, who have persevered against many obstacles before reaching the present successful termination of their efforts. The greatest difficulty to overcome was to allow for fermentation, which is usually equal to 10 per cent. To ensure safety it was necessary to keep the tanks full, or otherwise the rolling of the vessel would destroy them by the swashing of the molasses; so over each tank a turret was constructed, holding about 12 per cent. of the cargo, and when the article was in a fermented state it would naturally rise to the turret, a hole in it being made for the purpose, and, when it subsided, it would fall. Thus, by having molasses in sufficient quantity in the turret, it ensured a full measure for the tank. This successful experiment is likely to revolutionise the carrying trade of molasses.

The "Novelty," however, is by no means a novelty in tank shipbuilding, that feature being confined to the turret, which is an excellent idea. Twenty years since, a tank vessel named the "Cornelia" was engaged in the tar trade, carrying that article from port to port in bulk. At the present time, the "Retriever," a tank vessel of 52,000 gallons holding capacity, is running between the Patent Fuel Company's Works at Deptford and Swansea, Liverpool, and other ports. Her cargo is tar, and she is loaded and unloaded with the greatest rapidity by means of an air pump and vacuum apparatus. The "Retriever," it will be remembered, is the first vessel which was successfully worked in England with liquid fuel furnaces, which are upon Dorsett's system.

A NUMBER of metal images, supposed to be upwards of 800 years old, and to be Hindoo idols, have been dug up in the Fort of Gwalior.

(*Continued from page* 153.)

cution, grants him the exclusive right of practising it, or of authorising others to do so, for a limited number of years, in consideration of his making a full and sufficient description of the same. Unfortunately, this simple and equitable theory of the patent system is very imperfectly carried out, and is beset by various objectionable practices which render a patent sometimes an impediment to, rather than a furtherance of, applied science, and sometimes involve the author of an invention in endless legal contentions and disaster, instead of procuring for him the intended reward. These evils are so great and palpable that many persons, including men of undoubted sincerity and sound judgment on most subjects, advocate the entire abolition of the patent laws. They argue that the desire to publish the results of our mental labour suffices to ensure to the commonwealth the possession of all new discoveries or inventions, and that justice might be done to meritorious inventors by giving them national rewards.

This argument may hold good as regards a scientific discovery, where the labour bestowed is purely mental, and carries with it the pleasurable excitement peculiar to the exercise and advancement of science on the part of the devotee; but a practical invention has to be regarded as the result of a first conception, elaborated by experiments, and their application to existing processes in the face of practical difficulties, of prejudice, and of various discouragements, involving also great expenditure of time and money, which no man can well afford to give away; nor can men of merit be expected to advocate their cause before the national tribunal of rewards, where, at best, only very narrow and imperfect views of the ultimate importance of a new invention would be taken, not to speak of the favouritism to which the doors would be thrown open. Practical men would undoubtedly prefer either to exercise their inventions in secret, where that is possible, or to desist from following up their ideas to the point of their practical realisation. If we review the progress of the technical arts of our time, we may trace important practical inventions almost without exception to the Patent Office. In cases where the inventor of a machine or process happened to belong to a nation without an efficient patent law, we find that he readily transferred the scene of his activity to the country offering him the greatest encouragement, there to swell the ranks of intelligent workers. Whether we look upon the powerful appliances that fashion shapeless masses of iron and steel into railway wheels or axles, or into the more delicate parts of machinery, whether we look upon the complex machinery in our cotton factories, our print works, and paper mills, or into a Birmingham manufactory, where steel pens, buttons, pins, buckles, screws, pencil cases, and other objects of general utility are produced by carefully elaborated machinery at an extremely low cost; or whether we look upon our agricultural machinery, by which England is enabled to compete, without protection, against the Russian or Danubian agriculturist, with cheap labour and cheap land to back him, in nearly all cases we find that the machine has been designed and elaborated in its details by a patentee who did not rest satisfied till he had persuaded the manufacturers to adopt the same, and had removed all their real or imaginary objections to the innovation. We also find that the knowledge of its construction reaches the public directly or indirectly through the Patent Office, thus enlarging the basis for further inventive progress.

The greatest illustration of the beneficial working of the patent laws was supplied, in my opinion, by James Watt when, just about a hundred years ago, he patented his invention of a hot working cylinder and separate steam engine condenser. After years of contest against those adverse circumstances that beset every important innovation, James Watt, with failing health and scanty means, was only upheld in his struggle by the deep conviction of the ultimate triumph of his cause. This conviction gave him confidence to enlist the cooperation of a second capitalist, after the first had failed him, and for asking for an extension of his declining patent. Without this opportune help Watt could not have succeeded to mature his invention. He would, in all probability, have relapsed into the mere instrument maker, with broken health and broken heart; and the invention of the steam engine would not only have been retarded for a generation or two, but its final progress would have been based probably upon the coarser conceptions of Papin, Savory, and Newcomen.

It can easily be shown that the perfect conception of the physical nature of steam, which dwelt like a heaven-born inspiration in Watt's mind, was neither understood by his contemporaries, nor by his followers, up to very recent times, nor can it be gathered from Watt's imperfect specification. James Watt was not satisfied to exclude the condensing water from his working cylinder and to surround the same by non-conducting substances, but he placed between the cylinder and the non-conducting envelope a source of heat in the form of a steam-jacket filled with steam, at a pressure somewhat superior to that of the working steam. His successors have not only discarded the steam-jacket, and even condemned it on the superficial plea that the jacket presented a larger and hotter surface for loss by radiation than the cylinder, but expansive working was actually rejected by some of them on the ground that no practical advantage could be obtained by it. The modern engine, notwithstanding our perfected means of construction, had, in fact, degenerated in many instances into a virtual steam meter, constructed apparently with a view of emptying the boiler in the shortest possible space of time. It is only during the last twenty years that the subtle action of saturated steam (in condensing upon the sides of the cylinder when under pressure, and of re-evaporating when the pressure is relieved toward the end of each stroke) has been again recognised and insisted upon by Lechatelier and others, who have shown the necessity of a slightly superheated cylinder in order to realise the expansive force of steam. The result has been a reduction in the consumption of fuel in our best marine engines from 6lb. or 8lb. to below 3lb. per gross indicated horse-power.

It is a hopeful circumstance that during the next session of Parliament the whole question of the patent laws is likely to be inquired into by a special committee, who, it is to be hoped, will act decidedly in the general interest without being influenced by special claims. They will have it in their power to render the Patent Office an educational institution of the highest order.

In viewing the latest achievements of engineering science two works strike the imagination chiefly by their exceeding magnitude, and by the influence they are likely to exercise upon the traffic of the world. The first of these is the great Pacific Railway, which, in passing through vast regions hitherto inaccessible to civilised man, and over formidable mountain chains, joins California with the Atlantic states of the great American republic. The second is the Suez shipping canal, which, notwithstanding adverse prognostications and serious difficulties, will be opened very shortly to the commerce of the world. These works must greatly extend the range of commercial enterprise in the North Pacific and the Indian Seas. The new waterway to India will, owing to the difficult navigation of the Red Sea, be in effect only available for ships propelled by steam, and will give a stimulus to that branch of engineering.

Telegraph communication with America has been rendered more secure against interruption by the successful submersion of the French Trans-atlantic cable. On the other hand, telegraphic communication with India still remains in a very unsatisfactory condition, owing to imperfect lines and divided administration. To supply a remedy for this public evil the Indo-European Telegraph Company will shortly open its special lines for Indian correspondence. In northern Russia the construction of a land line is far advanced to connect St. Petersburg with the mouth of the Amoor River, on completion of which only a submarine link between the Amoor and San Francisco will be wanting to complete the telegraphic girdle round the earth. With these great highways of speech once established a network of submarine and aerial wires will soon follow to bind all inhabited portions of our globe together into a closer community of interests, which, if followed up by steam communication by land and by sea, will open out a great and meritorious field for the activity of the civil and mechanical engineer.

But while great works have to be carried out in distant parts still more remains to be accomplished nearer home. The railway of to-day has not only taken the place of high roads and canals for the transmission of goods and passengers between our great centres of industry and population, but is already superseding bye-roads leading to places of inferior importance; it competes with the mule in carrying minerals over mountain passes, and with the omnibus in our great cities. If a river cannot be spanned by a bridge without hindering navigation a tunnel is forthwith in contemplation, or, if that should not be practicable, the transit of trains is yet accomplished by the establishment of a large steam ferry.

It is one of the questions of the day to decide by which plan the British Channel should be crossed, to relieve the unfortunate traveller to the conti nent of the exceeding discomfort and delay inseparable from the existing most imperfect arrangements. Considering that this question has now been taken up by some of our leading engineers, and is also entertained by the two interested Governments, we may look forward to its speedy and satisfactory solution.

So long as the attention of railway engineers was confined to the construction of main lines it was necessary for them to provide for a heavy traffic and high speeds, and these desiderata are best met by a level permanent way, by easy curves and heavy rails of the strongest possible materials, namely, cast steel; but, in extending the system to the corners of the earth, cheapness of construction and maintenance, for a moderate speed and a moderate amount of traffic, become a matter of necessity. Instead of plunging through hill and mountain, and of crossing and recrossing rivers by a series of monumental works, the modern railway passes in zigzag up the steep incline, and conforms to the windings of the narrow gorge; it can only be worked by light rolling stock of flexible construction, furnished with increased power of adhesion and great brake power. Yet by the aid of the electric telegraph, in regulating the progress of each train, the number of trains may be so increased as to produce, nevertheless, a large aggregate of traffic; and it is held by some that our trunk lines even would be worked more advantageously by light rolling stock.

The brake power on several of the French and Spanish railways has been greatly increased by an ingenious arrangement conceived by M. Lechatelier, of applying what has been termed "Contre vapour" to the engine, converting it for the time being into a pump, forcing steam and water into the boiler.

While the extension of communication occupies the attention of, perhaps, the greater number of our engineers, others are engaged upon weapons of offensive and defensive warfare. We have scarcely recovered our wonder at the terrific destruction dealt by the Armstrong gun, the Whitworth bolt, or the steel barrel consolidated under Krupp's gigantic steam hammer, when we hear of a shield of such solidity and toughness as to bid defiance to them all. A larger gun or a hard bolt by Palliser or Grüson is the successful answer to this challenge; when again defensive plating, of greater tenacity to absorb the power residing in the shot, or of such imposing weight and hardness combined as to resist the projectile absolutely (causing it to be broken up by the force residing within itself) is brought forward.

The ram of war, with heavy iron sides, which a few years since was thought the most formidable, as it certainly was the most costly, weapon ever devised, is already being superseded by vessels of the "Captain" type, as designed by Captain Coles, and ably carried out by Laird Brothers, with turrets (armed with guns of gigantic power) that resist the heaviest firing, both on account of their extraordinary thickness and of the angular direction in which the shot is likely to strike.

By an ingenious device Captain Moncrieff lowers his gun upon its rocking carriage after firing, and thereby does away with embrasures (the weak places in protecting works), while at the same time he gains the advantage of re-loading his gun in comparative safety. It is presumed that in thus raising formidable engines of offensive and defensive warfare the civilised nations of the earth will pause before putting them into earnest operation, but if they should do so it is consolatory to think that they could not work them for long without effecting the total exhaustion of their treasuries, already drained to the utmost in their construction.

While science and mechanical skill combine to produce these wondrous results the germs of further and still greater achievements are matured in our mechanical workshops, in our forges, and in our metallurgical smelting works; it is there that the materials of construction are prepared, refined, and put into such forms as to render greater and still greater ends attainable. Here a great revolution of our constructive art has been prepared by the production, in large quantities and at moderate cost, of a material of more than twice the strength of iron, which, instead of being fibrous, has its full strength in every direction, and which can be modulated to every degree of ductility, approaching the hardness of the diamond on the one hand and the proverbial toughness of leather on the other. To call this material cast steel seems to attribute to it brittleness and uncertainty of temper, which, however, are by no means its necessary characteristics. This new material, as prepared for constructive purposes, may indeed be both hard and tough, as is illustrated by the hard steel rope that has so materially contributed to the practical success of steam ploughing.

Machinery steel has gradually come into use since about 1850, when Krupp, of Essen, commenced to supply large ingots that were shaped into railway tyres, axles, cannon, &c., by melting steel in halls containing hundreds of melting crucibles. The Bessemer process, in dispensing with the process of puddling, and in utilising the carbon contained in the pig iron to effect the fusion of the final metal, has given a vast extension to the application of cast steel for railway bars, tyres, boiler plates, &c. This process is limited, however, in its application to superior brands of pig iron, containing much carbon and no sulphur or phosphorus, which latter impurities are so destructive to the quality of steel. The puddling process has still, unless the process of decarburisation of Mr. Heaton takes its place, to be resorted to, to purify these inferior pig irons, which constitute the bulk of our productions; and the puddled iron cannot be brought to the condition of cast steel except through the process of fusion. This is accomplished successfully in masses of from three to five tons on the open bed of a regenerative furnace at the Landore Siemens Steel Works, and at other places. At the same works cast steel is also produced, to a limited extent as yet, from iron ore, which, being operated upon in large masses, is reduced to the metallic state and liquefied by the aid of a certain proportion of pig metal. The regenerative gas furnace—the application of which to glass houses, to forges, &c., has made considerable progress—is unquestionably well suited for this operation, because it combines an intensity of heat, limited only by the point of fusion by the most refractory material, with extreme mildness of draught and chemical neutrality of flame.

These and other processes of recent origin tend toward the production, at a comparatively cheap rate, of a very high class material that must shortly supersede iron for almost all structural purposes. As yet engineers hesitate, and very properly so, to construct their bridges, their vessels, and their rolling stock of the material produced by these processes, because no exhaustive experiments have been published as yet fixing the limit to which they may safely be loaded in extension, in compression, and in torsion, and because as yet no sufficient information has been obtained regarding the tests by which their quality can best be ascertained. This great want is in a fair way of being supplied by the experimental researches that have been carried on for some time at her Majesty's dockyards at Woolwich under a committee appointed for that purpose by the Institution of Civil Engineers. I have also the pleasure to announce an elaborate report by Mr. Wm. Fairbairn on this subject. In the meantime excellent service has been rendered by Mr. Kirkaldy in giving us, in a perfectly reliable manner, the resisting power and ductility of any sample of material which we wish to submit to his tests. The results of Mr. Whitworth's experiments tending to render the hammer and the rolls obsolete by forcing cast steel, while in a semi-fluid state, into strong iron moulds by hydraulic pressure, are looked upon with great interest. But, assuming that the new building material has been reduced to the utmost degree of uniformity and cheapness, and that its limits of strength are fully ascertained, there remains still the task for the civil and mechanical engineer to prepare designs suitable for the development of its peculiar qualities. If in constructing a girder, for example, a design were to be adopted that had been worked out for iron, and if all the scantlings were simply reduced in the inverse proportion of the absolute and relative strength of the new material, as compared with iron, such a girder would assuredly collapse when the test weight was applied, for the simple reason that the reduced sectional area of each part, in proportion to its length, would be insufficient to give stiffness. You might as well almost take a design for a wooden structure, and carry it out in iron by simply reducing the section of each part. The advantages of using the stronger material become most apparent if applied, for instance, to large bridges, where the principal

strain upon each part is produced by the weight of the structure itself, for, supposing that the new material can be safely weighted to double the bearing strain of iron, and that the weight of the structure were reduced by one-half accordingly, there would still remain a large excess of available strength in consequence of the reduced total weight, and this would justify a further reduction of the amount of the material employed. In constructing works in foreign parts the reduced cost of carriage furnishes also a powerful argument in favour of the stronger material, although its first cost per ton might largely exceed that of iron.

The inquiries of the Royal Coal Commission into the extent and management of the coal fields appear to be re-assuring as regards the danger of their becoming soon exhausted; nevertheless, the importance of economising these precious deposits in the production of steam power, in metallurgical operations, and in domestic use, can hardly be over-estimated. The calorific power residing in a pound of coal of a given analysis can now be accurately expressed in units of heat, which again are represented by equivalent units of force or of chemical action; therefore, if we ascertain the consumption of coal of a steam engine, or of a furnace employed in metallurgical operations, we are able to tell by the light of physical science what proportion of the heat of combustion is utilised and what proportion is lost. Having arrived at this point we can also trace the channels through which loss takes place, and in diminishing these by judicious improvement we shall more and more approach those standards of ultimate perfection which we can never reach, but which we should, nevertheless, keep steadfastly before our eyes. Thus, a pound of ordinary coal is capable of producing 12,000 Fahrenheit units of heat, which equal 2,240,000 foot-pounds, or units of force; whereas the very best performances o our pumping engines do not exceed the limit of 1,000,000 foot-pounds of force per pound of coal consumed. In like manner 1lb. of coal should be capable of heating 33lb. of iron to the welding point of (say) 3,000deg. Fah., whereas, in an ordinary furnace, not 2lb. of iron are so heated with 1lb. of coal. These figures serve to show the great field for further improvement that lays yet before us. Although heat may be said to be the moving principle by which all things in nature are accomplished, an excess of it is not only hurtful to some of our processes, such as brewing, and destructive to our nutriments, but to those living in hot climates or sitting in crowded rooms an excess of temperature is fully as great a source of discomfort as excessive cold can be. Why, then, may I ask, should we not resort to refrigeration in summer as well as to calorification in winter if it can be shown that the one can be done at nearly the same cost as the other? So long as we rely for refrigeration upon our ice cellars, or upon importation of ice from distant parts, we shall have to look upon refrigeration as a costly luxury only; but by the use of properly-constructed machines it will be possible, I believe, to produce refrigeration at an extremely moderate expenditure of fuel and labour. A machine has already been constructed capable of producing 9lb. of ice, or its equivalent, for 1lb. of coal; whereas the equivalent values of positive heat developed in the combustion of 1lb. of coal, and of negative heat residing in 1lb. of ice, is about as 12,000 to 170, or as one to seventy. This result already justifies the employment of refrigerating machines upon a large scale, but it is hard to say what practical results may yet be reached with an improved machine on strictly dynamical principles, because such a machine seems not tied in its results to any definite theoretical limits. In changing, for example, a pound of water from the liquid into the gaseous state, a given number of units of heat are required that may be produced by combustion of coal or by the expenditure of force, but in changing the same pound of water into ice, heat is not lost but gained in the operation, which heat must be traceable to another part of the machine, either as sensible heat or as developed force. It would lead me too far to enter at present into particulars on this question, which is one not without interest for the physicist and the mechanical engineer.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

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Naval, Military, and Gunnery Items.

The "City of Paris," time from Queenstown to Halifax, with Prince Arthur on board, was six days twenty-one hours and a half; or, adding difference of time, at the rate of thirteen and a half knots or fifteen and a half miles per hour.

The old buildings in the fort of Agra, some of the finest specimens of Mahommedan architecture in the country, are to be put in repairs. Some of them have already suffered considerably from the inroads of time and the mischievous propensities of visitors.

In view of the forthcoming opening of the Suez Canal, the Trieste Chamber of Commerce have granted, upon the urgent solicitation of a deputation from the Bourse of that town, permission for a line of steamships to be established and to be subsidised by the State, to run between Trieste and Bombay, via the Suez Canal.

The "Kron Prinz," Captain Werner, iron-plated frigate, belonging to the Prussian navy, went out of Portsmouth harbour on Saturday morning, after having had her hull, below the high water line, cleaned and covered with five different anti-fouling compositions, for the purpose of testing their respective merits. It had been intended to make a trial of her speed at the measured mile in Stokes Bay, but the foremost stokehole having been filled with surplus coal, steam could not be got up in the foremost boilers, and the trial was, therefore, abandoned. She anchored for a short time at Spithead, and Captain Werner and officers visited the "Monarch," iron-plated turret ship. The "Kron Prinz" afterwards left for Kiel.

The interesting ceremony of "trooping the colours" took place at the camp at Aldershott on Monday morning. The troops, composing the Guards and picquets for divisional duty, assembled in the south camp general parade ground at 9·30., and were formed up in eight divisions, under the direction of the brigade major on duty, Captain Brett. At ten o'clock, the general officer on duty, Major-General Lysons, C.B., came on the ground, when the ceremony was at once commenced. After the colours had been trooped the troops gave a general salute, and marched past General Lysons. The Guards were then formed, and marched off to their respective posts by the field officer on duty, Major Montgomery, 2nd battalion 13th Light Infantry.

Major Fosberry, V.C., of the Bengal Staff Corps, who has made several improvements upon the Montigny gun, will have a trial with the weapon in a few days, in competition with other guns, and which is expected to produce most wonderful effects. Major Fosberry is sanguine that he can, at 1,000 yards distance and upwards, strike an object of small dimensions with certainty, and so annoy an enemy in advancing as to cause him fearful loss. When it is considered that 370 rifle-bullets can be discharged from the "mitrailleur" in a minute, the destruction caused by such a terrific fire upon an opposing force would create sad havoc in the ranks, and must ultimately lead to an alteration in the present tactics of war.

Her Majesty's Government have awarded a gold medal to Monsieur Louis Adolphe Bernard, and a silver medal to M. Thadie Legros, for their brave and humane conduct on the occasion of the wreck of the schooner "Gemini," of Hull, near Fecamp, on March 19, 1869. The master, his two children, and a seaman were drowned soon after the "Gemini" was stranded, and the remainder of the crew (four in number) were saved mainly through the exertions of the above two men, assisted by two others, named Oscar Bracklin and Alfred Benard, to whom pecuniary rewards of £2 each have been awarded. M. Louis A. Bernard is reported to have most particularly risked his life on the occasion, and Thadie Legros also risked his life in the very heavy sea that was running, which was beating about broken pieces of the wreck.

The old Portsmouth yacht, which for a long series of years was placed at the disposal of successive admiral superintendents of Portsmouth Dockyard, was taken into No. 6 dock at Portsmouth on Monday to be broken up, it having been determined that in future the admiral superintendent shall not be provided with a craft of this description. It was determined, we believe, that the expenditure for dockyard craft should be reduced, and the late admiral superintendent (Vice-Admiral G. G. Wellesley, C.B.) offered to relinquish the further use of the yacht during his term of office. A strong opinion prevails that a reduction of this kind was so paltry as to have been scarcely worth making, and that an officer occupying the important position of admiral superintendent might fairly have been allowed a privilege which has been extended to the occupants of that office for a great number of years past.

Referring to a paragraph which appeared in our journal a few weeks since, stating that the gun carriages of the "Monarch" worked admirably, a correspondent, who was present at the trials, writes us as follows:—The programme was to fire 40 rounds from one carriage to test it, 20 rounds to be 50lb. charges and 20 rounds to be 67lb. charges. After 20 rounds of 50lb. and 6 of 67lb. charges had been fired, on trying to raise the gun and alter the elevation it could not be moved. The hydraulic was found to be broken and the lifting screws damaged. After some time the hydraulic was repaired, but two hours elapsed before the carriage could be used again. On firing 4 more rounds it was again rendered unserviceable. The other gun in the turret was taken to complete the remaining 10 rounds, after which, on endeavouring to raise the gun, the carriage was found to be damaged and nearly as unserviceable as the other.

Miscellanea.

The gasworks at Peking have come into operation, and the Customs Yamen is lighted from them.

The anthem at Exeter Cathedral on Sunday, when that venerable edifice was crowded with the *savans* attending the Congress of the British Association, was Boyce's—"Oh, where shall wisdom be found!"

The Compagnie des Chantiers de la Seyne have received an order from the Ottoman Government for an iron girder bridge of boats, 6,000ft. in length by 100ft. in width, which is intended to unite Stamboul to Galata.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending August 21, was 5,367. Total number since the opening of the Museum, free daily (May 12, 1858), 1,626,988.

Two gentlemen left Abergavenny on Saturday last, at six a.m., upon a tricycle built on an original plan by one of the party, and arrived at Cheltenham, a distance of about 60 miles, at one p.m. After refreshing they retraced their steps as far as Monmouth, another 40 miles, which they reached about seven in the evening, thus doing the 100 miles, including stoppages, in 13 hours.

A letter from Cairo reports that Sir S. Baker's expedition, 1,700 strong, was to start for the White Nile and Soudan on the 18th inst. Baker Pacha himself, accompanied by Lady Baker and his personal staff, is to follow in a few days. Most of the baggage and stores of the expedition, and a large quantity of merchandise, had already been sent on in advance of the troops.

At the meeting of the Agricultural Society of New South Wales, Sydney, in May last, the first prize, class 205, for portable steam engine suitable to agricultural requirements, was awarded to the 12-horse power portable steam engine of Clayton and Shuttleworth, with enlarged fire box for burning wood, and otherwise adapted for agricultural purposes, to P. N. Russell and Co., Sydney.

The Council of the Working Men's Club and Institute Union have arranged a visit to the Outfalls of the London Sewerage at Crossness Point and Barking Creek, on Saturday, the 28th inst. A special steamer has been engaged. This evening, a lecture explanatory of the whole system of the sewerage of the metropolis will be given by Mr. Hall, at 8 o'clock, in the great room of the Society of Arts.

Arrangements have been made for a visit of the Society of Engineers to the new works of the Chartered Gas Company, at Beckton, on Friday, September 3, 1869. A special steamer (the "Sibyl") has been engaged for the conveyance of the members to Beckton and back to London Bridge, starting from Westminster Bridge at 12 a.m., and calling at London Bridge at 12·30. Tickets, 4s. each, exclusive of refreshments, are to be had of the secretary, at the office of the society, No. 6, Westminster-chambers, on or before Wednesday next.

The number of visitors to the South Kensington Museum during the week ending August 21, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 17,083; Meyrick and other galleries, 2,723; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,051; Meyrick and other galleries, 233; total, 22,090. Average of corresponding week in former years, 12,405. Total from opening of Museum, 8,717,908.

BY the new act, to "kill seeds" by destroying the vital power, or to "dye seeds" by colour, to give them the appearance of another seed, is punishable by a fine of £5 for the first offence, and £50 afterwards, with publication of the offender, at his expense, in newspapers.

IT appears that in 1868 new lines were opened upon the principal Italian lines—the upper Italy, the Roman, the South Italian, and the Calabro-Sicilian to the extent of $258\frac{3}{4}$ miles. To this aggregate the South Italian Railway alone contributed $150\frac{5}{8}$ miles. The average length of line worked by the four companies last year was $3,199\frac{3}{4}$ miles, as compared with $3,068\frac{5}{8}$ in 1867. The traffic appears to have increased last year to the extent of 1·98 per cent. per mile worked, as compared with 1867.

THE Deputy-Keeper of the Public Records reports that the six volumes published in 1868 of the chronicles and memorials of Great Britain and Ireland during the Middle Ages make a total of 92 volumes, and that more than 20,000 copies of these volumes have been sold, and more than 3,000 copies have been presented to home, foreign, and colonial libraries. This great national publication has materially contributed to the assistance of historical enquirers. Nineteen more volumes are now in the press.

THE construction workshops of Belgium appear now to have plenty of employment. Both pig and iron show an upward tendency on the markets of the east of France. One establishment of that district is now constructing twelve new puddling furnaces. The proprietors of two other French works—one belonging to the eastern, and the other to the central group—are also erecting some blast furnaces, from 60ft. to 80ft. in height. Rolled puddled iron from mixed pig has realized £8 12s. per ton in the Haute-Marne; ditto, from coke-made pig, £8 4s. to £8 8s. per ton. A good demand for rough pig has continued in the Meurthe and the Moselle; the forges are also actively employed.

CHILDREN under fourteen, in Connecticut, by a recent law, cannot be employed to labour in any manufacturing establishment, or in any other business, unless each child shall have attended for three months out of the twelve some public or private day school, under the charge of a teacher qualified to instruct in orthography, reading, writing, English grammar, geography, and arithmetic. Any person employing any child under fourteen, contrary to the provisions of this act, is liable to a penalty of 100 dollars for each offence. This law is a revival of the provisions of three months' schooling each year, which were required to be inserted in indentures of apprenticeship. It will be observed that the child must be allowed to attend a day school. In old times a night school was considered sufficient.

THE great railway bridge over the Rhine, near the village of Hamm, a little above Dusseldorf, is progressing rapidly, and will probably be completed before the end of November. The bridge is to consist of four arches, the upper part of which will be made of iron. The ironwork of each arch will weigh 14,000 centners. The bridge is united to the main line on the left bank by a viaduct consisting of fifteen stone arches, but this viaduct does not immediately join the bridge; it is separated from it by a revolving drawbridge, so that the line can be rendered impassable at any moment. On the right bank a fort is being built which will command the whole bridge. The first arch of the great bridge is already completed, and on the 15th the workmen engaged in the undertaking celebrated their success in company with their masters.

A TOTAL quantity of 49,016,585lb. unmanufactured tobacco was imported into the United Kingdom during the past year, 28,708,262lb. of which came from the United States, 648,208lb. from the Hanse Towns, 5,852,258lb. from Holland, 875,044lb. from Greece, 8,502,956lb. from Turkey Proper, 4,748,768lb. from the Philippine Islands, 212,829lb. from Japan, 248,644lb. from Cuba, 2,287,415lb. from New Granada, and 1,937,706lb. from other countries. No unmanufactured tobacco was imported into this country from Uruguay or the countries of the Argentine Confederation in 1867 or 1868, and there is a total diminution of imports in 1868 as compared with the previous year amounting to 8,569,702lb. Comparative statistics indicate an increase of imports from New Granada, the Philippine Islands, and Turkey Proper, and a decrease from the Hanse Towns, the United States, Holland, and Japan.

THE blast furnace proprietors who have adopted one or other of the different methods employed for bringing down the gases report satisfactorily of the result. This with regard to one plant of furnaces is seen in the circumstance that between 250 tons and 300 tons of fresh drawn slack heretofore required in raising the steam for their blowing engines and for heating the blast is now being offered for sale. The concern is that of the Parkfield Iron Company at Wolverhampton. If the practice should be extended throughout the whole of the district, and the proportionate saving equal to that here stated, a large amount of economy will have resulted; for notwithstanding that in some cases the adaptation even of the least expensive method is regarded as costly, still the ultimate saving is very marked. Speaking of this one case in particular, the saving may be put as equal to the developing of 500-horse power out of nothing!

A CLYDESDALE mare was recently drowned and a post mortem examination of her stomach disclosed the following fact. According to the "Glasgow Herald," there were taken from it the following articles, viz.:—6 horse nails broken; 8 round nails, from 1in. to 2in. long; 10 single flooring nails, 24 $1\frac{1}{4}$in. nails, 97 broken nails, various sizes, 35 $1\frac{1}{4}$in. nails, 11 1in. zinc nails, 55 $\frac{3}{8}$-inch to one-inch tack nails, 16 shoe tackets, 8 slate nails, 4 screw nails; the total number of nails was thus 269. There were also four common pins $1\frac{3}{8}$in. long each; one blue bead, one brass button, one pearl button, five metal buttons marked V.M., 25 small pieces of galvanized wire, three copper nail heads, four small metal washers, one hook (of hooks and eyes), one hair pin, one-half of a needle, one small piece of lead, seven pieces of zinc—in all 55 articles; or including the 269, 314 articles weighing 1lb. In addition there were found gravel and sand weighing 2lb. $11\frac{1}{2}$oz.

DURING last week a novel use was made of steam power on the farms of Messrs. Howard, at Bedford. A steam ploughing engine, which is also used for traction purposes, is now employed in drawing waggon trains of corn. Many farmers who use steam power for cultivating the land have thought that if the dormant power in the engine could be used during harvest to facilitate operations in fine weather, they would be able to reduce their stud of horses all the year round, and thus save their keep, amounting from £20 to £25 a horse per annum, besides their first cost. It has now been proved satisfactorily that not only the breaking up of the land, but the seeding or drilling can be done most expeditiously and economically by steam. In utilizing its power at harvest time the missing link has, so to speak, been found, so that on a large farm the few horses kept are used as an auxiliary to steam, instead of employing a greater number with steam as an auxiliary, as is now the general practice.

AMONGST the marvellous array of figures contained in the annual report of the Postmaster-General, there is one set which cannot fail to make heavy draughts on the credulity of the reader. "No less than 13,833 letters were posted during the year without any address, and of these 13,833 letters, 281 were found to contain money to the amount of £6,337." Such a fact as this may well be regarded as amongst the curiosities and incredible things of daily life. But the item is never absent from the Postmaster-General's annual report, and the annual number of letters and amounts of money contained therein are quantities almost as uniform as the results of the operation of any known law, so certain is it that a certain proportion of the whole number of letters posted in a year will be posted without any address, and of this number a certain smaller proportion will contain money to a given amount. It may not, however, be generally known that the fund resulting from this source is annually divided amongst the Post Office employes in part payment of their Life Assurance premiums.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—264, 266
BUILDINGS AND BUILDING MATERIALS—227, 229, 236, 237, 242, 243, 244, 245 252, 274, 282, 283, 287, 293, 296, 297
CHEMISTRY AND PHOTOGRAPHY—None
CULTIVATION OF THE SOIL, including agricultural implements and machines—241, 258, 273
ELECTRICAL APPARATUS.—None
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—221, 226, 231, 258
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—230, 232, 235, 246, 285
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—220. 224, 233, 259, 265, 267
GENERAL MACHINERY—225, 234, 238, 239, 249, 254, 262 284, 301
LIGHTING, HEATING, AND VENTILATING—276
METALS, including apparatus for their manufacture—219
MISCELLANEOUS—223, 228, 240, 248, 250, 256, 257, 260, 270, 272, 275, 277, 280, 281, 289, 294, 299, 303
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—247, 292, 302
SHIPS AND BOATS, including their fittings—251, 261, 263, 278, 279, 295
STEAM ENGINES—271, 300
WARFARE—None

219 H. H. MURDOCH, Staple Inn, London. *Smelting copper.* Dated January 23, 1869.

This consists in the use of a blast furnace of an improved form, similar to an ordinary ironfounder's cupola furnace, with the exception that a high pressure blast is used and distributed in a zone or belt around the furnace just above the cupola part by means of numerous air passages or tuyeres made through the lining or side of the furnace at an angle to the horizon, instead of a low pressure blast being introduced through a hole, as in the ordinary cupola furnace. The tuyeres are supplied with air by means of an air channel running round the exterior of the furnace and communicating with the said tuyere holes, into which channel air of the required pressure is forced. In smelting or reducing copper regulus according to this invention the regulus is charged into the above described furnace, and the melted regulus is allowed to rise above the tuyeres, and is subjected to the action of the air, which is forced through the said tuyeres into and through the said regulus.—Patent completed.

220 B. MOUNTAIN, T. RICHMOND, and G. DUFFIELD Leeds. *Boot and shoe apparatus.* Dated January 23, 1869.

To the upper side o a bracket (within which revolves the shaft of a vertical cutter) they affix a guard, placed in such a position as partially to encircle the cutter. This guard may be of semicircular form and has a notch cut in the centre, whilst the bottom part (which clips the cutter shaft) is recessed or hollowed out, so that the bottom of the cutter, which is of ordinary construction, is lower than the edge of the bottom of the notch referred to.—Patent completed.

221 J. DINSDALE, Skipton. *Spinning and twisting machinery.* Dated January 23, 1869.

The object is to economise time in the doffing of frames and in again starting them, also to adopt one flyer to the two-fold purpose of spinning and twisting. For these purposes the inventor dispenses with the male and female thread usual, and makes the upper end of the spindle (upon which the flyer rests) of conical formation. He also places a pin on either side or through the same corresponding recesses, and the conical formation in the flyer head admits of its passing the pins. The flyer head is also filed or cut down in a slope on the upper edge on either side of each of the opposite recesses.—Patent abandoned.

223 W. M. WELLING, New York. *Composition like ivory.* Dated January 25, 1869.

The basis of this compound is shellac. The inventor prefers the bleached shellac, and with this he mixes kaolin or impalpable (acetate of lead precipitated by sulphuric acid) or other preparation of lead, to give the proper colour. If the articles require to be light or about the gravity of ivory, but little or no lead may be used, and a larger quantity of kaolin or the impalpable white or pigment may predominate or form the principal ingredient with the shellac, and ivory dust or bone or wood dust may be mixed in with the other materials, to produce the desired quality of material; a small quantity of camphor helps to make the articles combine, and where different colours are required suitable pigments may be introduced.—Patent completed.

224 C. TOUCHEVIEUX, Paris. *Hinges for earrings.* Dated January 25, 1869.

To the back of the ornament, and usually at the lower end thereof, the inventor secures, preferably by solder, a bent arm or rod, the upper end of which is hollow to receive the lower end of a bent rod, the upper end of which forms the hook. The portion entering the hollow or socket has a groove formed on and round it, and to secure the two pieces together the metal of the outer rod is pressed into the groove formed on the inner, so that the top part forming the hook is free to turn, but cannot leave the socket. The other end of the bent portion or hook enters a notch formed at the back of the upper portion of the ornament.—Patent completed.

225 C. B. PARKINSON, A. and J. METCALFE, and W. H. HEALD, Preston, Lancashire. *Spinning mules.* Dated January 25, 1869.

To one end of an ordinary mule carriage is attached a rod. This rod is connected at its other end to a bracket which is fixed to a radius rail. A radius arm, one end of which is fitted to (and works on a centre in) the framing, has attached to it a bowl or pulley which works or runs on the radius wheel. A chain is connected to the radius rail and runs on to the chain drum, and at the lower part of the radius rail is placed a movable bracket forming a cop, nose, peg, or plate.—Patent abandoned.

226 R. G. LOWNDES and M. M. CALLUM, Renfrew *Fabric machinery.* Dated January 25, 1869.

The clamping apparatus consists of a specially formed plate or bar of metal or other material which constitutes the lower jaw of the clamp. On it two or more brackets, each constituting the lower eye or half of a hinge joint, are fixed. The upper half of the clamp consists of a bar somewhat similar to the lower one, and also provided with eyes corresponding to those in the lower bar or plate. By means of a pin or pins passing through these eyes, the two bars or plates constituting the clamping jaws are coupled together. The front part of the jaws is lined with wood, ebonite, metal, or other suitable material, between which the fabric to be stretched, stented, or finished is held. At the back of the bar or plate constituting the lower jaw a vertical stud is situated, on which a movable handle or lever is placed.—Patent completed.

227 C. E. BROOMAN, Fleet-street. *Cocks and valves* Dated January 25, 1868.

This consists of a cylindrical or other shaped case or box, either of metal, wood, porcelain, or other material, formed at one end or both ends with a flange, to which flange the end of a flexible pipe, through which the fluid is free to pass, is secured. One end of another flexible pipe is also connected to the flange of the cylinder. This pipe forms a continuation of the first mentioned pipe; the cylindrical case is furnished with a threaded rod, which passes through it. The inner end of the rod has a plate fitted to it, which, when raised, enters an aperture or chamber in the case. The other end carries a handle or small wheel, by which it may be turned. The plate on the inner end of the threaded rod is caused to press when the handle is turned upon that portion of the pipe which passes through the cylindrical case, whereby the pipe is compressed and the flow of fluid regulated or entirely stopped.—Patent abandoned.

228 W. E. Newton, Chancery-lane. *Sheet metal stamps.* Dated January 25, 1869.

The sheet metal-plate to be worked into a sunken form is placed on and over a die of suitable configuration according to the article to be made, and a holding plate or block (carried by a series of pistons) is brought down to bear on the margin or portion of the sheet metal plate outside of and around the hollow of the die. The sheet metal plate thus held is then subjected to the action of a stamp operated by a central or main piston arranged to work through the holding block to press the sheet metal plate (or portion of it lying within the inner edges of the holding block) into the hollow of the die. The several pistons may be operated either by steam, air, or water, so that the whole apparatus forms what may be termed a steam pneumatic or hydraulic cylinder engine press for shaping forms from sheet metal.—Patent completed.

229 J. Carr, Manchester. *Venetian blind tapes.* Dated January 25, 1869

The inventor uses a jacquard loom and furnishes it with four sets of warps, or warps which may be divided, as is well known, so as to form sheds for more than one web of cloth, and to supply these warps with weft he employs a rising box loom and prefers that it shall be furnished with four shuttles, one for each of the two tapes and one for each of the short strips, although a smaller or larger number may be used, and the arrangement of loom he now employs is that which is known as the marionette. The machinery, however, may be of any arrangement used for similar purposes and the order of making the sheds varied.—Patent completed.

230 A. V. Newton, Patent Office, Chancery-lane. *Grain germinators.* (A communication.) Dated January 25, 1869.

The introduced air rising upwards through a fluid substance gently agitates the same, thereby exposing every part of it to the oxidising action of the air more perfectly and uniformly than in a quiescent state. Where yeast is used, which is more or less uniformly distributed, the mixing will take place more thoroughly by the introduction of air, which also stirs up and revives the yeast; therefore the formation of alcohol will be assisted and otherwise the product materially improved.—Patent completed.

231 E. Hartley, Oldham. *Weaving looms.* Dated January 25, 1869.

The inventor proposes to employ a stop which, when the lathe retreats, acts against a spring, through the medium of which the shuttle is then trapped, but when the lathe begins to move forward, the stop retires from the spring and the shuttle is relieved from pressure. He proposes to use the "stop rod finger" for the spring to act upon, and to employ the usual swell as an intermediate part or to dispense with it.—Patent abandoned

232 H. D. Bowyer, Ripley. *Manufacture of wheaten flour.* Dated January 25, 1869.

The inventor first flattens or crushes the grain without breaking it into pieces, and this he does by passing the grain between smooth metal rollers. In this way he loosens the bran from the other parts of the grain. He then grinds the flattened or crushed grain between stones, when, in consequence of the preliminary flattening or crushing as soon as the stones touch the grain the bran separates in large flakes, and hence little or none of the bran is ground, whereas when the unflattened or uncrushed grain is exposed to the stones in the usual way of grinding a notable quantity of the bran is reduced to powder by the stones, and remaining in the flour discolours it.—Patent completed.

233 R. J. Green, Birmingham. *Collar studs, buttons, &c.* Dated January 25, 1869.

This consists, first, in appending to the front of collar studs or buttons a tongue or depending piece, which when the stud or button is in use lies in front of and holds down the scarf or neck-tie and prevents it from rising above the stud or button. The tongue or depending piece is made capable of being connected to and detached from the stud or button at pleasure, the connection being made by means of a spring snap or depending piece taking into and engaging with a recess or hole in the stud or button, or by other fastening.—Patent completed.

234 J. and S. Roberts, West Bromwich. *Moulds for casting.* Dated January 25, 1869.

The pattern pipe is supported horizontally and accurately fits in an opening in a moulding bed or plate at such a height that exactly one half of the pipe stands above the upper surface of the said moulding bed or plate. Upon this half pattern a half mould is made by ramming sand in a mould box in the usual way. As soon as the half mould is made the pattern is removed therefrom by depressing the said pattern through the opening in the moulding bed or plate below the surface of the said bed or plate, when the half mould formed may be removed from the moulding bed or plate. The pattern is again raised to its original position in the moulding plate and another half mould is made upon it, from which the pattern is removed by depressing it below the moulding plate, as before described.—Patent abandoned.

235 H. W. and R. Lafferty, New Jersey. *Sugar rectifier.* Dated January 25, 1869.

This relates, first, to improvements in the mode of supporting the spindle carrying the drum or basket of a suspended centrifugal draining machine, viz., placing and securing an encircling hollow nut or flanged cap in an inverted position upon said spindle, and receiving and supporting the projecting edge or rim of this nut or cap upon one or more washers in the bottom of an annular oil cup encircling the spindle but secured to and resting upon an independent hanger, bracket, or other supporting device arranged therefor. The spindle thus supported and suspended revolves upon bearings submerged in oil, so that the friction thereof is consequently reduced to the lowest degree.—Patent completed.

236 C. L. Wood, Bishop Auckland, and J. Stockley, Newcastle-on-Tyne. *Plate glass apparatus.* Dated January 26, 1869.

The rods which carry and drive the grinding runners are arranged in the direction of the width of the benches or tables (and as usual in pairs) instead of in the direction of their length as usual, thereby admitting of the use of shorter rods, and consequently of increased speed for the runners.—Patent completed.

237 E. D. Rushton and W. W. Mills, Birmingham. *Window sashes.* Dated January 26, 1869.

In connection with an ordinary sash and on either of its sides, and projecting slightly from the edge thereof, the inventors place a toothed wheel turning in a frame fixed to the said sash. The teeth of these toothed wheels are inclined to their axes, the said wheels somewhat resembling ordinary worm wheels. The teeth of the wheels may, however, be parallel with their axes. Working in slots in the sash are spring clicks or catches which engage with the toothed wheels and prevent their rotation. On either side the sash frame and in the line of the motion of the sash, strips or ribs of vulcanized india-rubber or other similar elastic material are fixed; they make these elastic strips or ribs by preference of a nearly semicircular figure in cross section, the convex side of the strip or rib being situated outwards, and being presented to the projecting parts of the toothed wheels fixed on either side the sash. When the sash provided with the toothed wheels described is in its place in the window frame the toothed wheels compress and flatten the india-rubber strips or ribs By the elasticity of the strips or ribs such an amount of resistance is offered to the toothed wheels as to support the said sash in any position in which it is placed. In order to raise or lower the sash the spring catches described are lifted from the toothed wheels so as to permit them to rotate. They prefer to arrange the handles of the catches so that the disengaging of the catches and the lifting or depressing of the sash are effected at one operation. Or the catches may be geared together in any convenient way so that pressure at one part of the sash may simultaneously release both catches.—Patent completed.

238 J. D. Ellis, Sheffield. *Rolling armour plates.* Dated January 26, 1869.

The inventor builds and heats the pile in the ordinary manner, and having set in motion rolls of a length exceeding the greatest breadth to be given to the armour plate, he introduces the pile and rolls it to and fro until he has obtained the full width of plate required. He then, by means of a turntable, overhead crane, or other suitable apparatus, turns this plate and rolls it in the direction of its length until it has attained the length and thickness originally determined upon.—Patent completed.

239 J. and J. Wilson, York. *Fibre machinery.* Dated January 26, 1869.

On a hollow bar or casing nearly the length of the frame and parallel with the rollers, are a number of lever catches, one opposite each set of rollers. The lever catches work on a pin or stud about midway their length, and the bar or rod carrying them has an internal rod traversing "to and fro," motion being imparted by means of a cam or an eccentric and wheel and a weight; the sliver or roving in its passage from the rollers to the bobbin bears on one end of the catch levers, the weight or tensional strain keeping the catch levers down on their bar or rod.—Patent completed.

240 J. Millar, Cambridge-road. *Envelopes.* Dated January 26, 1869.

The inventor proposes to form the fastening flap of the envelope intended to enclose letters or documents with a series of serrated or corrugated edges, presenting a number of pointed edges or curvilinear projections, which being gummed down, will afford a more secure attachment than can be effected by the ordinary flaps. In some cases, a perforated ornamental device or a perforated monogram may be formed on the extremity of the flap, the edges being made with a series of notches and teeth, whereby, when the flap is secured, any attempt to open the same clandestinely will be exposed by the tearing away of some portions of the flap.—Patent abandoned.

241 J. Wilson, Poppleton. *Straw making.* Dated January 26, 1869.

The machine consists of a series of leather bands (with spaces between each) and cross bands attached to bars at each of its ends, and extending from the feeding hopper and drum to the delivering board. It is actuated by two hangers or rods suspended vertically by means of pivots. The hangers are attached to shoes formed of iron and containing grooves, in which a shaft works provided with an eccentric at each end. The shoes being attached to the delivering board, it is evident that the revolution of the eccentrics will give an oscillating motion to the shoes, hangers, and board, and also to the leather shaker, alternately slackening and tightening each end, the shaker being supported midway from the board by uprights leaving two divisions of the shaker in a position while the machine is at rest.—Patent completed.

242 J. Pickering, Glasgow. *Treating timber.* Dated January 26, 1869.

This consists in applying to the surfaces of the timber to be finished rapidly moving surfaces of grinding or polishing material, such as sandstone, grindstone, emery, in combination with other substances or other suitable abrading materials. The finishing surfaces of the abrading and polishing substances are circular and made to revolve at a high velocity against or upon the surfaces of the timber requiring to be treated by them, the effect of the treatment being that heat is generated by the friction of the abrading surfaces upon the wood, so that the surface of the wood becomes coloured to the required extent, besides being rendered very smooth and polished in a rapid manner.—Patent completed.

243 W. R. Lake, Southampton-buildings. *Ventilators.* (A communication.) Dated January 26, 1869.

The body of the ventilator consists of a wedge-shaped box attached to a supporting frame or diaphragm intended to secure the body to the window. There is an adjustable funnel for adapting the ventilator to double windows, and a perforated shelf for holding a sponge or other porous absorbent. A perforated box for holding charcoal fits closely into the top of the body, but is capable of being removed at pleasure. A sliding valve regulates or cuts off the supply of air, and a foul air escape pipe is used in connection with stoves. When double windows are not used, the adjustable funnel will not be required, and in such cases that part of the invention may be dispensed with.—Patent completed.

244 A. V. Newton, Chancery-lane. *Veneer cutters.* (A communication.) Dated January 26, 1869.

This relates to a novel construction of what is called the "stay log" of a veneer-cutting machine, and which, carrying a log or section of a log, is made to revolve and present as it rotates the log or section to the action of a knife or cutter, so as to cut in curvatures corresponding to the rings of the tree or thereabouts. In this novel construction, the portion of the stay log to which the timber is bolted is rendered adjustable relatively to its journals, so that an eccentric adjustment may be given it to suit logs or log sections of different peripherical or perimetrical curvatures, and to adapt it to avoid cutting from or through defective portions of the log or section, which in having a complete revolution given at each cut affords ample time and opportunity to set or feed up the cutter without stopping or checking the motion of the machinery.—Patent completed.

245 H. Law, Strand. *Metal pipe connectors.* Dated January 26, 1869.

Soft metal pipes have sometimes been connected by expanding the mouths of the two pipes to be brought together by driving a cone into them, and then inserting between the mouths a double cone of metal, consisting of two cones united at their bases, and with a hole passing through them from apex to apex of the size of the waterway of the pipes. Afterwards the mouths of the pipes were drawn together by means of two rings which were placed on the pipes before coning them, and which rings were so formed as to fit the ends of the pipes when coned. The present method is up to this point similar to that described, but formerly the exterior cone rings which draw the parts together have been made each with two lugs, one on either side, and screw bolts passed through the lugs have been used to draw the parts together.—Patent completed.

246 C. Gil, Paris. *Sugar.* Dated January 26, 1869.

The inventor has observed that when limiting the acid to small quantities instead of its being prejudicial it produces great advantages in the colour, taste, and easy draining of the syrup and even by changing it into crystallizable sugar. This observation has led him to employ an acid process, a method of proceeding entirely different from those used in the manufacture of sugar, and permitting him to obtain new and very advantageous results, viz., to produce directly from the beet root juice white manufactured masses having an excellent flavour, and above all giving loaves which drain easily and are perfect, as well as regular results, which cannot be obtained by an alkaline or neutral process.—Patent completed.

247 C. French, Blandford-square. *Communicating in trains.* Dated January 27, 1869.

The inventor employs a length of chain, cord, rope, or wire for each carriage, provided with a spring hook at each end for connecting one length with another, and in order to prevent the slackening or straining of the rope or other communicator upon the carriages approaching or receding from each other, he passes it around pulleys at each end of each carriage. One of such pulleys is carried by an arm, the other being fixed to a plate to which the arm is connected. The arms are each provided with a coupling or pin joint so as to facilitate their connection with each other, and they are connected to the carriages by double pin joints, one being in the contrary direction to the other (or a universal joint may be used) so as to facilitate the passage of the carriages around curves without injuring the connections.—Patent abandoned.

248 C. Mather, Salford. *Singeing apparatus.* Dated January 27, 1869.

This relates to those singeing frames in which the fabric is brought against both sides of the flame, and in which the combustion of the gas is promoted by causing a current of cold air to be drawn towards or through the flame. This current of air is produced by a fan or other equivalent, which exhausts the air out of a slotted tube, and this invention consists in the application of certain parts to the above machines, whereby the results produced by the process of singeing are greatly improved. In carrying out this improvement the inventor applies a doctor or thin blade of metal or a roller with blades against the surface of the fabric that has been singed, and this doctor is adjustable, so as to act with more or less force on the fabric as it passes one guide roller or rail to the other. The effect of the fabric passing over the doctor is to detach the carbonised particles, and when the doctor is placed in a slot in the air tube these particles are carried away by the fan.—Patent completed.

249 T. Reeder, Preston. *Sheet metal rollers.* Dated January 27, 1869.

In carrying out this invention the edges of a plate of sheet metal are first bent over, and then the sheet is formed into a tube or cylinder with the bent edges locking into each other as usual. This tube is then put on a mandrel having a longitudinal groove for the joint; a die of the exact diameter of the finished roller is then drawn over the tube on the mandrel, and the action of this die equalises the irregularities in the thickness of the sheet metal, thereby producing a roller of uniform diameter throughout its length. In some cases more than one die may be drawn over the tube on the mandrel, or the same die may be drawn over more than once, and as the die is of the exact diameter of the finished roller it is evident that the thicker parts of the sheet metal are drawn out and elongated until the metal is of uniform thickness.—Patent completed.

250 J. Gough, Kirby-street, Hatton Garden. *Application of colour to printing surfaces.* Dated January 27, 1869.

This consists in maintaining the necessary supply of ink or colour in the interior of a cylinder, which is suitably mounted on a spindle and free to revolve thereon. It is furnished with openings in its circumference, through which ink or colour from the interior can find its way to the outer surface, which is grooved to allow of the ink or colour spreading. Enough of the outer surface, however, is left between the grooves to give adequate support to a covering of wire gauze or other permeable material or materials, through which the ink or colour can escape or be withdrawn.—Patent abandoned.

251 J. Taylor, Birkenhead. *Ships' propelling apparatus.* Dated January 27, 1869.

The inventor hinges to the sides of the vessel arms or levers, to the ends of which are attached screw propellers worked by means of air or hydraulic engines applied direct thereto, to which the air or water under pressure is conveyed through flexible or jointed pipes, passing from a suitable pumping engine on board over the side of the vessel and down to the engines, or the propellers may be worked by endless chains, ropes, or bands passing over a pitch wheel on the shaft of the propeller and worked from a steam winch, crane, or other engine on deck, arranged to turn on a turntable, so that by lowering the arms or levers with the screw propeller into the water against the side of the ship, and driving the screws by the air or hydraulic engines, or by endless chains, the ship

may be propelled when becalmed. When the screw propellers are not required the arms or levers are raised up out of the water into an upright position and serve as davits or shear legs for raising, lowering, and suspending the ship's boats.—Patent abandoned.

252 T. VAUGHAN, Middlesborough. *Smoke and soot machine.* Dated January 27, 1869.

The inventor collects the smoke or soot found in all chimneys, funnels, or flues, as also in gas and other retort flues, or in any other place where carbonaceous matter is burnt, which smoke (when condensed) or which soot is then subjected to the process of calcining in order to separate therefrom the volatile constituents and sulphurous particles, after which it is ground under edge runners or other suitable apparatus. Or the condensed smoke or soot may previously be sifted, by preference by the action of an air blast, by which the finer particles are carried away into a chamber, leaving the coarser particles behind, which may then be ground.—Patent abandoned.

253 H. BARCROFT, Glen, near Newry, Ireland. *Damask machines.* Dated January 27, 1869.

This consists in the use of a horizontal bar or tumbler stretching across the machine between the rows of hooks and below the grife, and moving on a longitudinal pin or axle bearing at each end in the framework or in a bracket attached to the framework of the machine. The office of the bar or tumbler is to press one row of hooks towards and so as to catch a knife of the grife, and to press the adjoining row of hooks from and so as to avoid a knife of the grife at each pick or throw of the shuttle, thereby producing the twills. The bars or tumblers meet the rows of hooks at an inclination, and are set in motion by a horizontal shaft revolving at right angles to the bars or tumblers in sockets or bushes in the framework of the machine, and furnished with tappets, each of which strikes a snugor or lever attached to the axle or pin of a bar or tumbler, so as to raise the lower side or edge and to depress the higher side or edge of the bar or tumbler. A spring restores the bar or tumbler to its out-of-action inclination as soon as the action of the tappet ceases. The revolving shaft, which carries the tappet, is furnished with a ratchet wheel, such as is hereinafter described, through which it receives the required motion. In order to press only part or parts of a row or rows of the hooks as hereinbefore described the blade of the bar or tumbler between the rows of hooks must be limited in length to the part of the row of hooks desired to be made use of, and the number of bars must be increased to equal the number of such parts. One bar or tumbler may be used alone, or several bars or tumblers may be used simultaneously according to the twill required to be produced. —Patent completed.

254 J. PORTEOUS, Edinburgh, and H GIBSON, Musselborough. *Tobacco machinery.* Dated January 27, 1869.

This consists of a shaft or spindle on which circular flanges, by preference with openings formed in them, are placed, the distances between these flanges being equal to the length of the rolls, which are to be coiled. On the end of the above-mentioned spindle a worm or screw is fitted, and this gears into a worm wheel carried on a stud or cross shaft. To the body of the worm wheel a heart or other shaped cam is fixed, which acts against an antifriction roller carried on a horizontal guide rod, this guide rod being jointed to a lever to which the vibrating action due to the cam is communicated.—Patent abandoned.

256 J. H. JOHNSON, Lincoln's Inn-fields. *Railway keys* (A communication). Dated January 27, 1869.

This relates to an improved construction of the keys or wedges employed in securing or holding the rails of the permanent way of railways, or used in other engineering constructions exposed to the action of the weather, whereby not only are the wedges rendered more durable, but a better and more permanent or tightening is obtained of the rail or other part to which the wedge is applied. According to this invention it is proposed, in lieu of making the keys or wedges entirely of wood as heretofore, which are sure to be destroyed by the blows of the hammer under the constant tightening necessitated by the alternate shrinking and swelling of the wood with the changes of the weather, to construct such keys or wedges partly of metal, say cast iron, and partly of wood, preferring such wood as has been previously treated with a view to its preservation in any well known manner, as, for example, by injection and compression. The main partition of the key or wedge is made of metal, which, receives the blows of the hammer when being driven, and this piece of metal is recessed on one or both sides, or has an opening made through it, into which recesses or opening is inserted a facing or a block of wood, the friction or holding surface or surfaces being of wood, whilst the core or body is of metal. The wooden partitions should, by preference, be rather shorter than the metal portion, in order that the hammer may not come in contact with and destroy the wood in the operation of driving.—Patent completed.

257 J. GIRDWOOD, Edinburgh. *Envelopes and bags.* Dated January 27, 1869.

This consists in making blanks for envelopes or sample bags of various forms impossible to describe unless with reference to drawings.—Patent completed.

258 E. H. PRENTICE, Stowmarket. *Phosphatic manures.* Dated January 27, 1869.

The inventor has found that by the addition of a certain proportion of chloride of ammonium to the phosphatic materials during the action of the sulphuric or other acid thereon, a larger proportion of the phosphate is rendered soluble, and that there is less if any tendency for the soluble phosphate to revert to the insoluble form. Before treating the phosphatic materials the inventor determines by analysis the quantity of sulphuric or other acid required to render the phosphates soluble, as is usually done. The mixing of the acid and the phosphatic materials is then effected by any of the processes commonly employed, and the chloride of ammonium is added either during or after such mixing, or the chloride of ammonium may be incorporated with the phosphatic material before this is mixed with the acid.—Patent abandoned.

259 J. SILMAN, Birmingham. *Shoemakers' sole knives.* Dated January 27, 1869.

This consists in manufacturing the knives as follows:—The inventor forms, by the process of rolling bars of steel having a taper or wedge shape in cross section, a smaller or supplementary wedge being formed near the thin edge of the bar. The bar is plain on one face, but slightly convex near the thin edge, while the other face has near the thin edge of the bar a step or shoulder formed by the supplementary wedge-shaped part described. The bars are cut into pieces of such length that each piece, when bent into the proper shape and its ends welded together, will form one of the said knives. In making the knives from the bars of steel the bars are bent so that the shoulder described shall be in the inside of the knife. In using the knives, the soles as they are cut out rise above the said shoulder, and thus entering a larger part of the knife offers no resistance to the soles afterwards cut.—Patent completed.

260 G. TANGYE, Birmingham. *Copying presses.* Dated January 27, 1869.

The lower platter or surface on which the copying book is placed while a letter is being copied, is supported on two hollow uprights fixed to the base plate of the press, these uprights being connected to the base by joints which permit the uprights and platten to have motion through a small angle in a vertical plane. The said lower platten is connected to the top of the uprights by joints. The upper platten is supported by a screw working in a crosshead, the crosshead being fixed to the tops of two upright rods passing through the hollow uprights carrying the lower platten.—Patent completed.

261 C. LUNGLEY, Greenwich. *Iron work structures.* Dated January 27, 1869.

The objects of this invention are to build in wood and iron and other metal caissons pontoons and other such structures, such as ships and other vessels, and to fit the same with divisions, tanks, and decks, so that the floating capacity of a caisson and pontoon may lift all or nearly all its own weight, and thus save the lifting of the weight of the caisson or pontoon which now has to be lifted in addition to the ship upon it when lifted by hydraulic or other pressure.—Patent completed.

262 A. C. PASS, Bedminster. *Condensing vapour.* Dated January 27, 1869.

The smoke fumes, vapours, or gases to be condensed or purified are drawn, forced, or driven by motive, ductive, or propelling power, through the meshes, interstices, or apertures of a series or arrangement of latticework, sievework, bars, perforated or reticulated material, or other like appliance or contrivance whereby the smoke, fumes, vapours, and gases are divided, and which offer the largest possible wetted, damped, or moistened surface in the smallest possible space for the accomplishment of this object. On or over this lattice work or other above described arrangement, the inventor projects or applies a continuous flow of water, so that the smoke, fumes, vapours, or gases are brought for a sufficiently protracted period into intimate contact with water, which absorbs a large portion of the noxious gases, and also cools the vapours, smoke, gas, or fumes, and charges them with moisture. The cooled and damped smoke, fumes, vapours, or gases are led or pass into a chamber or receptacle in which they deposit the metal, particles, and soot, and the now invisible gases are allowed to escape.—Patent completed.

263 C. W. PETERSEN, Norton Folgate. *Lifeboats, &c.* Dated January 27, 1869.

The inventor constructs lifeboats with a watertight chamber of oval or other form rising from the centre of a deck for the purpose of rendering the boat self-righting in the event of its being capsized by reason of the increased buoyancy obtained at the upper part of the boat by means of the chamber. This chamber, which may be provided with an air shaft or shafts, and with glazed openings for admitting light, may also be applied to steam tugs, pilot boats, and tenders, and to ordinary ships' lifeboats when decked for the purpose above described, and may serve as a saloon cabin, or for other purpose.—Patent abandoned.

264 B. M. MARCHANT, Torrington-square, W.C. *Obtaining power.* Dated January 28, 1869.

This consists in the compression by force pumps in stages of certain gases to be used as a motive power, with or without subsequent heating, so that a pressure is obtained allowing of their most expansive application, the supply being cut off from the cylinder (where this method of applying the power so provided is used) at any desiredly small fraction of the length of the stroke of the piston therein.—Patent completed.

265 W. SPURRIER, Birmingham. *Salt spoons.* Dated January 28, 1869.

The inventor makes the bowls of the spoons of greater thickness and consequent weight of metal than usual, the weight of the bowls being equal to or greater than the weight of the handles of the spoons. When a salt spoon of this kind is placed in the salt cellar, the weight of the bowl causes it to take a safe position therein, and there is no tendency of the spoon to overbalance. He gives this increased strength and weight of metal to the bowl of the spoon by making the blank from which the spoon is to be made of the greatest thickness at that end from which the bowl is to be formed, so that when the blank is raised or fashioned into a spoon in the usual manner, and by the use of the ordinary shaping dies a spoon is produced having a bowl as heavy as or heavier than the handle of the said spoon.—Patent abandoned.

266 W. BROWN and T. H. GARBUTT, Seamur. *Fire-bars.* Dated January 28, 1869.

This consists in constructing fire or furnace bars hollow and perforated in themselves, and thereby allowing of a rapid and free circulation of air through as well as between them, this greatly improving the draught and thereby ensuring the proper and thorough consumption of fuel; also the bar by this means being kept a uniformly low temperature, its fusion, fouling, and breaking is entirely prevented, or nearly so.—Patent completed.

267 R. JONES, Botolph-lane. *Improvements in curing apparatus.* Dated January 28, 1869.

The animal substance to be cured is placed in a suitably sized tank capable of being closed airtight, and which is also supplied with brine or curing matter supplied from a suitable reservoir, and a portion of the liquid is then withdrawn from the interior of the tank, and the animal matters therein, and thereby facilitates the impregnation of the brine or curing matter.—Patent abandoned.

270 R. BLACKBEE, Norfolk-road, Dalston. *An improved pessary.* Dated January 28, 1869.

This consists in so constructing a pessary as that by being shaped in direct reference to the anatomy of the pelvis, it shall possess, from its peculiar construction, a double self-acting spring, that is to say, laterally and transversely.—Patent completed.

271 A. BROWNE, King William-street. *Rotary engines.* Dated January 28, 1869.

Within a hollow fixed cylinder, placed horizontally and formed with closed ends, another but solid cylinder is fitted, so as to be capable of revolving within the fixed cylinder, the two cylinders being formed of such diameters as to leave an annular space between them for the passage of steam across the edge of the aforesaid solid cylinder, and opposite to each other two slits are formed, each communicating with a circular hole formed across and through the said solid cylinder. Into each of the aforesaid slits a flat, side, or piston is fitted steamtight, and the said slides or pistons are kept forced outwards, each by a spring or springs placed in the before-mentioned circular holes.—Patent abandoned.

272 L. P. HEBERT and L. A. MOULIN, Neuilly on-Seine, France. *Letter stamp, &c.* Dated January 28, 1869.

This consists of an ink box of the same shape as the stamp, with a vertical tube at the centre and top thereof. The ink box is formed in two parts or chambers. The upper one contains the ink, and in the lower one a sheet of cork is placed, and a piece of felt in contact therewith. The division plate of the ink box, as also the piece of cork, are pierced with small holes, for the passage of the ink on to the felt.—Patent completed.

273 J. BOX, Southsea House, E.C. *Cleaning wool.* Dated January 28, 1869.

The burr and all other vegetable and ligneous matters in wool or in hair in its raw and unmanufactured state are destroyed by passing into and through the wool or hair a current of chlorhydric acid gas, which gas is produced by the saturation of common salt by dilute sulphuric acid placed over a moderate heat. The wool of sheep and the hair of goats are frequently greatly damaged in value by the burr, which is the seed vessel of a plant common in England and most other parts of the world.—Patent completed.

274 J. EASTERBROOK, J. H. ALLCARD, and A. M. WILD, Sheffield. *Grinding and polishing.* Dated January 28, 1869.

The inventors mount a grindstone emery wheel or other grinder on a revolving axis carried by a suitable frame. The stone or grinder is placed against a face plate at the end of the axis and is there clamped or held in a suitable chuck, so that the flat of the grinder may run truly. Opposite to the grinder is a slide capable of traversing on guides on the frame in a direction parallel with the grinding face. On the face of the slide (which can be set for grinding taper if required) the article to be ground is held by suitable stud jaws or other convenient fastenings.—Patent completed.

275 N. C. SZERELMEY, Pimlico. *Making tarpauling.* Dated January 29, 1869.

The inventor boils in an iron pot 1cwt. of gas tar until the same becomes hard, and at the same time he boils in another iron pot, which is heated by steam, admitted between the pot and a jacket or casing which surrounds it, 14 gallons of Stockholm tar spirit, 10lb. of American rosin, and one gallon of rosin oil. When these ingredients are completely dissolved and mixed, they are drawn, together with the boiled tar, which should be at about the same temperature, into a mixing vat or vessel, and the whole is thoroughly stirred together. When the mixing has been continued for about ten minutes, 2oz. of commercial sulphuric acid is added, and the mixing is continued. This composition is suitable for the preparation of dark coloured tarpauling, and for preserving sail cloth and other fabrics.—Patent completed.

276 G. HAWKSLEY, Caledonian-road. *Ventilators and chimney pots.* Dated January 29, 1869.

These ventilators or pots are formed from a long metal band, say of hoop iron, which the inventor turns into a coil by extending it on one edge more than on the other. He does this by passing the hoop iron between rollers which are set so as to form a taper nip, and the roller may be so formed as simultaneously to give to the iron a curved face. Or, in place of expanding the outer edge of the hoop iron, a similar result may be obtained by corrugating its inner edge. He then takes a cylindrical mandrel of the size of the interior of the ventilator or pot which it is desired to produce, and having in it a number of longitudinal radial grooves equi-distant the one from the other. In these grooves, other flat pieces of hoop iron are placed, having inclined notches in them at equal distances apart from end to end of each piece.—Patent completed.

277 W. M'LEAN, Glasgow. *Printing apparatus.* Dated January 29, 1869.

The machine consists of an upright frame in which the zinc cylinder is carried in bearings. Above the zinc cylinder is a pressure roller. At the side or sides or other convenient part of the frame, the trough or troughs for containing the printing ink is or are placed, and a roller is situated near to it, so that the ink may be carried to the ink distributing rollers, and thence to the zinc cylinder. Damping rollers revolve in contact with the zinc cylinder, and the whole is put in motion by spur or toothed gearing. A lever and adjustable weights are situated either beneath the floor or above the framing of themac hine, and these are so arranged as to force the zinc cylinders with the necessary amount of pressure against the pressure roller, or, in lieu of a lever and weights pressure, screws may be employed.—Patent completed.

278 J. PICKERING, Glasgow. *Propelling ships.* Dated January 29, 1869.

The injectors or ejectors are placed in the lower part of the vessel or boat, one or more of such instruments being used as required. The throat or throats of the injectors or ejectors is or are securely fastened to the stern part of the skin of the vessel or boat, in which one or more openings are formed to correspond with the throat or throats of the injectors or ejectors. Steam is admitted through the instrument as in the injectors or ejectors at present in use, and water is drawn in through the suction pipe, which also has an opening through the side or skin of the vessel or boat, and the jet of water issuing from the apparatus at the stern acting against the water in which the vessel or boat floats, causes the propulsion of the ship, vessel, or boat forward.—Patent completed.

279 T. W. CARTER, Gray's Inn-road. *Propelling and steering.* Dated January 29, 1869.

The inventor proposes to form one or more longitudinal and transverse channels or water courses through the bottom portion of the ship or vessel. These channels form tubes running completely through the submerged portion of the ship or vessel, but being equally as watertight as the hull, make no difference, except in the space they occupy, with regard to the soundness of the general struc-

ture, unless it be to afford increased strength to the vessel. These channels may be of a circular, or square, or other section, as the case may require, not only on account of facility of construction, but of strength, and the suitability of any such particular form for the revolution of the propeller or paddle wheels, and for the position of the same and the rudders, either at the stem or stern of the vessel, or at both ends and within such channels or water courses. —Patent abandoned.

280 J. M'DONALD, Hackney. *Stoppers for bottles.* Dated January 29, 1869.

This consists in fitting in a socket formed with a screw thread, for screwing into a bottle or other vessel a hollow plug. This plug is closed at the bottom, but has a hole in the side near the bottom through which the fluid or air is free to pass. The upper portion of the plug is fitted with lugs to enable it to be turned, a pin or stud being on the outside to limit the movement, so as to ensure the openings corresponding. An aperture for the admission of air into the bottle is formed on the outside of the plug; this aperture coincides with a small hole in the socket, so that when the plug is turned and the vessel tilted, air enters through the aperture, and the fluid is free to run out.—Patent completed.

281 L. SMITH, Nottingham. *Taps.* Dated January 29, 1869.

The body of the tap or valve which is adapted to be screwed or otherwise connected with the supply pipe or passage and usually also to a delivery pipe is formed with a water or fluid way through it. A conical hole is formed in the body from one side and into it a corresponding plug fits which when in its place closes the water or fluid way through the body. On the side of the body, and over the conical recess for the plug, a chamber is formed, and when the plug is drawn back to open the water or fluid way it is received into this chamber and leaves the passage way clear of all obstructions with an undiminished area for the direct inlet and outlet of the volume of steam, water, or other fluids which may be conveyed to the passage; the plug is raised and lowered by a screw, the stem of which passes through the cover of the chamber and receives a handle or hand wheel on the exterior.—Patent completed.

282 G. HAWKESLEY, Caledonian-road. *Pumps.* Dated January 29, 1869.

The inventor casts the barrel with a foot at its lower end by which it is fixed, and at its upper end a head and spout suitable to receive and deliver the water from the barrel and to support the fulcrum of the lever handle. Below the portion of the barrel to which the pump bucket is fitted is a cavity of larger diameter closed at the bottom with the exception of the suction passage which passes through it, and beneath which is a socket receiving the suction pipe. Into the cavity at the lower end of the barrel is a side opening closed air-tight by a cover. The cover has lugs upon it on the inner side, and a piece of sheet india-rubber or leather, which forms both the hinge and the packing of the valve over the suction passage, is held by these lugs, which are simply passed through holes formed for them in the india-rubber. The metal valve is connected with the india-rubber by means of a central boss on the valve, over which the india-rubber is sprung, a corresponding hole being formed in the india-rubber and a groove being cut around the bottom of the boss into which the india-rubber nips.—Patent completed.

283 G. PRICE, Birmingham. *Window fastenings.* Dated January 29, 1869.

Upon the one part of the fastening is formed the circular catch plate in the ordinary way as a fixture thereupon, and a movable catch is provided secured to the circular catch plate as a hinge by a vertical rivet pin passing through the parts. The movable catch has a spring action by means of the spring secured to the side of the circular catch plate, the spring always bearing and pressing inwards. The movable catch is curved or rounded at its free end and is suitably cut or recessed to engage with and fit around a raised stud piece. The raised stud piece is formed upon the lever arm or catch bar upon the other part of the fastening, which is made in the ordinary manner with the exception of the knob or handle end, upon which a movable friction or cam plate is attached, by means of the stud piece which acts as a centre or pin for the friction or cam plate, a suitable handle or thumb piece being formed to project from and as part of the friction or cam plate.—Patent completed.

234 J. H. JOHNSON, Lincoln's-inn-fields. *Steel piles.* (A communication.) Dated January 29, 1869.

This consists in the forming of iron or steel into piles, faggots, or billets preparatory to rolling by pressing the metal into forms of the required shape; also in forming iron or steel into hollow piles or billets preparatory to rolling into hollow articles such as pipes or columns. Various combinations or arrangements of machinery may be employed in manufacturing pressed and moulded piles or faggots, as above described, but that which the inventor has found to give the best results consists of a hydraulic or other powerful press, the ram of which carries a plunger which accurately fits inside a strong metal case or mould of any desired size and transverse section, the sides of such mould being capable of opening on hinges in order to release the compressed and finished pile; the blooms having been placed in the mould and the sides closed down and secured, the plunger is caused to enter through one end of the mould which is left open for that purpose, and to forcibly compress by the action of the hydraulic press the metal contained inside the mould, thereby not only expelling the impurities which may be in the bloom and which escape through the joints in the mould, but causing the metal to be thoroughly consolidated and to take the exact form of the mould.—Patent completed.

285 A. M. CLARKE, Chancery-lane. *Hulling grain.* (A communication.) Dated January 29, 1869.

This consists in removing the husks from the grain by means of friction. The ears pass between two rollers grooved either in straight or curved lines.—Patent completed.

287 F. JAY, South Lambeth-road. *Paint.* Dated January 29, 1869.

The inventor proposes to use any or all the ingredients now used in the manufacture of paints, but the peculiarity of his invention consists in utilizing or using together with such ingredients the common resin of commerce in combination with oxide of zinc. This combination has not heretofore been employed in the manufacture of paint applicable to the various purposes for which ordinary paint is used.—Patent completed.

289 T. WHIMSTER, Perth. *Forcing gases.* Dated January 30, 1869.

The apparatus is rotary and comprises a drum fixed on and turned by means of a horizontal shaft being placed in a casing partly filled with water or other suitable liquid. The space above the water is divided into three compartments by two hanging partitions, which dip down below the surface of the water, and the drum is in the middle compartment between the two partitions, whilst it is with the same middle compartment that the pipe for admitting the gas communicates. The drum may be varied in form, but it is preferred to construct it with two plain discs formed with eyes at the centres and connected by spirally bent partitions.—Patent completed.

292 T. PIMBLEY, Bayham-street, Camden Town. *Communicating in trains.* Dated January 30, 1869.

The compartment of each carriage is to contain a handle which when pulled will communicate by wire with boxes fitted on to under carriage. These boxes contain alarm signals, one of which will be dropped from each box on to the metals (or rails) in front of wheels which in passing over will cause an explosive alarm which can be heard by every passenger in the train, as well as by the guard and driver (immediately on the handle being pulled), and as only one signal will drop out of each box the alarm may be repeated if necessary. Patent abandoned.

293 S. TAYLOR, Sheffield, and G. W. DYSON, Tinsley. *Spade and shovel moulds.* Dated January 30, 1869.

The inventors take a bar of iron or steel, or of steel and iron combined, and forge, cut, or stamp it to the shape of an ordinary mould, leaving the strap end solid. They then form the straps by splitting this solid end with a circular saw or with cutters, and having cut down the goffer and weld or otherwise treated the strap ends, they proceed to roll or plate out the moulds in the ordinary manner.—Patent abandoned.

294 H. N. NISSEN, Mark-lane. *Printing bankers' cheques.* Dated January 30, 1869.

The inventor employs paper either white or coloured with a highly-glazed surface, on which he prints in the ordinary manner, but with specially prepared ink or colour. In this preparation, having ground his colour with glycerine, starch, flake white, or a saccharine matter, preferably pure syrup without colour, or with a mixture of any of the above ingredients, and in such proportions as shall not detract from the brilliancy of the colour employed, by which he is enabled to produce a perfectly soluble surface printing colour.—Patent abandoned.

295 K. C. WATSON, Glasgow. *Boats.* Dated January 30, 1869.

One or more lines of chains, ropes, straps, or bands are attached to and stretched from the bow to the stern on each side of the boat. The first line is situated a distance below the gunwale of the boat equal to the depth which it would sink beneath the surface of the water when the boat is upset, so that persons who have been thrown out of the boat and are floating in the water may easily grasp a chain or band. The other lines are situated a short distance apart from each other nearer to the keel of the boat, so that by means of these persons in the water may lift themselves on to the bottom of the boat, and in so doing the bottom of the boat will be upturned and "righted" by the unequally distributed weight on each side of its longitudinal axis.—Patent completed.

296 E. T. HUGHES, Chancery-lane. *File planing machine.* (A communication). Dated January 30, 1869.

This file-planing machine is principally intended for planing arm and smooth files worn out by long use in lieu of the present expensive whetting process they were hitherto subjected to previous to their being cut. A file of 4lb. weight requires upwards of 20 minutes' whetting, whilst its planing is completed in one minute.—Patent abandoned.

297 E. T. HUGHES, Chancery-lane. *File-cutting machine.* (A communication.) Dated January 30, 1869.

The chief driving axle is set in motion by straps from any suitable motor, and drives by two tappets the tilt hammer, which is fixed to its axle. This hammer actuates the chisel, which strikes its blows upon the file. The said file rests on a lead cushion on an anvil, which is moved by cog and bevel wheel gear by a screwed axle. To withdraw the anvil the driving strap is pushed upon a disc, whereby the motion is transferred to other axles by a toothed wheel and toothed shaft which are fixed to the said anvil. The vice jaws for holding the file must be previously separated from the screw mandrel, which is brought about by raising a weight and a chase in connection therewith.—Patent abandoned.

299 J. TOLSON, Dalton. *Cleaning cards.* Dated January 30, 1869.

This consists in the employment or use of self-cleaning revolving combs, or a series of combs of suitable length according to the length of the card cylinders or rollers to be cleaned, working in eccentric grooves within a rotary cylinder, so as to move in and out through slits in the rim thereof as the cylinder rotates, and so that at one part or position of the cylinder in its rotation the comb teeth will protrude through the slits, and at the opposite part the said teeth will be withdrawn within the surface of the cylinder.—Patent completed.

300 G. H. ADAM, Birmingham. *Engine reflector.* Dated January 30, 1869.

This consists in attaching to the locomotive engine a plane mirror on one side or on each side of the locomotive, the mirror or mirrors being fixed at or about the height of an ordinary man, and so inclined that in looking into the mirror or mirrors the enginedriver may be able to see by reflection from the said mirror or mirrors the several carriages of the railway train.—Patent abandoned.

301 T. H. KILNER, Lepton. *Feed apparatus.* Dated January 30, 1869.

The inventor uses an endless travelling feed sheet, which passes round a supporting roller (having its bearings in a travelling carriage on the frame at either side of the apparatus) over pulleys at the end of the frame and around a travelling roller working in "races" at the bottom part of the frame. To the travelling carriage he connects a chain at either side, which is caused to pass over a toothed disc on a revolving shaft, over a second similar one near the bottom of the frame, and thence to the travelling roller (working in the race at the bottom of the framework), to the axis of which it is connected.—Patent abandoned.

302 A. L. ANDREWS, James-street, Old-street. *Horse collars.* Dated January 30, 1868.

It is proposed to make the pad of the collar of india-rubber or other airproof or suitable material covered on the one side with soft fabric, such as moleskin cloth, and on the other with linen, drill, or other like fabric for the purpose of strengthening the india-rubber, to which the covering and lining are cemented with india-rubber solution or otherwise secured. This pad is to be either inflated or filled with air or fluid, or with any soft and elastic material, such, for example, as the material known as "moo main," horse hair, wool, and stuffing fibre.—Patent completed.

303 J. T. BINTLEY, Kendal. *Billiard and bagatelle tables.* Dated January 30, 1869.

The inventor fixes at the sides of such tables a trough fixed and inclined in such manner that the balls dropping into any of the pockets will fall into such trough and travel along the same into the aforesaid tray or receptacle. —Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated August 17, 1869.

2450 T. J. Leigh, Mostyn-road, Brixton, Surrey. Improvements in furnaces.

2451 R. H. Charsley, Beaconsfield, Buckinghamshire. A new or improved carriage for locomotion by manual labour.

2452 H. B. Barlow, Manchester. Improvements in apparatus for dressing or preparing hides and for other purposes.

2453 J. Eastwood, Blackburn, Lancashire. Improvements in apparatus for churning milk and mixing liquid compounds, which improvements are also applicable to other purposes.

2454 B. Hunt, Serle-street, Lincoln's Inn. Improved apparatus for spinning yarns of flax, hemp, tow, and other textile materials.

2455 J. Williams, Wigginton Rectory, Oxon. Improvements in maps, and in scientific and educational diagrams to facilitate references and ascertain distances.

2456 M. H. Jacobi, Chancery-lane. An improved galvanoplastic process for depositing iron, applicable for the reproduction of engraved surfaces, stereotyping, and other useful and ornamental purposes.

2457 R. F. Fairlie, Victoria Chambers, Westminster. Improvements in locomotive engines and carriages, and in the mode of coupling the same together.

2458 J. H. Johnson, Lincoln's Inn-fields. Improvements in the manufacture of iron, and in the apparatus employed therein.

2459 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in penholders.

2460 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for making sewing needles.

Dated August 18, 1869.

2461 J. Checketts, Raglan-street, Wolverhampton. An improved window blind.

2462 J. Jenkins, St. George's Wharf, Grand Surrey Canal, Camberwell, Surrey. Improvements in treating and in lining the interior of casks to preserve their contents from the effects of must or other smells arising from the wood.

2463 J. Prato and F. Polacco, Great Winchester-street, Middlesex. Improvements in charcoal filters for purifying water or other liquids, likewise in the mode of applying the same.

2464 J. Mackenzie, Camden Quay, Cork. Improvements in the construction of machinery for sowing seeds and for distributing artificial manure.

2465 E. T. Hughes, Chancery-lane. Improvements in the manufacture of boots and shoes, and in machinery or apparatus employed therein.

2466 A. Brown, Isle of Wight. Improvements in ground or earth screws.

2467 T. Parkinson, Liverpool. Improvements in or connected with doors for regulating the admission of air to furnaces.

2468 E. T. Hughes, Chancery-lane. Improvements in looms for weaving.

2469 R. F. Fairlie, Victoria Chambers, Westminster. Improvements in injectors for feeding steam boilers with water.

2470 J. Lewis, Birmingham. Certain improvements in spring sackings for bedsteads, which said improvements are also applicable to other articles for sitting or reclining on, as also in the joints for connecting and expanding the sides of metallic bedsteads with the head and foot parts.

2471 G. Metcalf, Pertusola Foundry, near Spezia, Italy. Improvements in furnaces for obtaining lead from its ores.

2472 J. Watson, Southampton-buildings, Chancery-lane. Improvements in presses for compressing cotton, jute, and other materials.

2473 J. Mitchell, Sheffield. Improvements in machinery for forging, stamping, tilting, swaging, hammering or planishing metals.

2474 H. W. Cook, Ovington-square, Middlesex. Improvements in turret and other large clocks.

Dated August 19, 1869.

2475 M. Wilson, Wellington-street, Southwark, Surrey. Improvements in bird cages.

2476 J. J. E. Mayall, Brighton, Sussex. Improvements in obtaining motive power, and in the machinery or apparatus employed therein, parts of which improvements are applicable to the forcing and exhausting of air.

2477 W. Campion, Nottingham. Improvements in sewing machines.

2478 A. Gilchrist, Glasgow. Improvements in slide valves.

2479 H. N. Moyon and J. E. Lemercier, Rue Ste. Appoline, Paris. Improvements in machinery for the manufacture of coverings for the feet, together with apparatus and instruments connected therewith.

2480 W. N. Hutchinson, Wellesbourne, Bideford, Devonshire. Improvements in locomotive engines and all descriptions of railway carriages, also for improvements in the form of rail on which the carriages run.

2481 J. Blakey, Leeds. Improved means and apparatus for utilising waste leather, or the small pieces of leather resulting from the cutting out of the several parts for boots and shoes.

2482 F. Braby, Fitzroy Works, Euston-road, Middlesex. Improvements in the means and apparatus for the manufacture of caustic ammonia and ammoniacal salts.
2483 W. Jones, Guide Bridge, Lancashire. Improvements in or applicable to sewing machines.
2484 S. Robinson, Westland-row, Dublin. Improvements in the construction of glass houses for horticultural and other purposes.
2485 J. Jones, Walton-terrace, South Lambeth-road, Surrey. Improvements in apparatus for applying electro-magnetism as a motive power to carriages, boats, and machinery in general.
2486 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in screw propellers.

Dated August 20, 1869.

2487 W. S. Sutherland, Clayton-square, Liverpool. Improvements in welding or uniting plates, tubes, and other forms of iron or steel, and in means or apparatus employed therein.
2488 A. Wigzell, Sowerby, near Halifax. Certain improvements in steam boilers.
2489 W. Longbottom, Barnsley, and A. Willan, Harrogate, Yorkshire. Improvements in velocipedes and other vehicles propelled by manual power.
2493 W. Byrne, Belfast. Improvements in the process of distilling alcoholic liquors, and in apparatus for that purpose.
2491 H. J. H. King, Glasgow. Improvements in apparatus for measuring, indicating, and regulating the flow or passage of liquids.
2492 L. B. Fortin, Paris, and J. Ferrabee, Brimscombe, near Stroud, Gloucestershire. Improvements in machinery for the manufacture of bats for felting and other purposes.
2493 A. V. Newton, Chancery-lane. An improvement in the process of manufacturing paint.

Dated August 21, 1869.

2494 W. Allan, W. Payne, and A. B. Fraser, Liverpool. Improvements in, and apparatus for, extinguishing fires in the holds or below decks of navigable vessels, whether arising from spontaneous combustion or other cause.
2495 A. Neill, Bradford, Yorkshire. Improved machinery or apparatus for cutting and dressing or producing an even surface on stone, marble, slate, or other substances, also for moulding or shaping and polishing such substances.
2496 G. W. Morgan, George-yard, Great Dover-street, Southwark. Improvements in life buoys.
2497 J. Barlow, Bolton, Lancashire. Improvements in the manufacture of toilet quilts, table covers, and other similar fabrics.
2498 F. Coote, Charlotte-street, Fitzroy-square, Middlesex, and F. W. Cranch, Drummond-street, Euston-square, Middlesex. Improvements in velocipedes.
2499 A. M. Clark, Chancery-lane. Improvements in springs for wheeled vehicles.
2500 P. A. Blake, Highbury, Middlesex. A new or improved safety explosive compound or compounds to be used for blasting and other purposes, together with means connected with its use.
2501 J. Baur, New York, U.S.A. Improvements in the manufacture of steel.

Dated August 23, 1869.

2502 H. Henchman, Bromley, Kent. The improvement of windmills.
2503 T. Gibb and C. Gelstharp, Jarrow-on-Tyne, Durham. Improvements in the extraction of copper from its ores.
2504 N. Delandtsheer, Malines, Belgium. Improvements in combing machines.
2505 H. A. Bonneville, Sackville-street, Piccadilly. A new and useful improvement in machinery for carding and combing wool and other fibrous materials.
2506 L. D. Girard, Faubourg Poissonniere, Paris. Improvements in railways and in railway rolling stock, parts of which improvements are also applicable to other purposes.
2507 T. Whitehead, Holbeck, Leeds. An improved shackle and roller end for hardening machines for felting.
2508 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus for raising and forcing water and for obtaining motive power.
2509 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in posts or standards for gas lamps.
2510 J. H. Johnson, Lincoln's Inn-fields. Producing imitations of, and substitutes for, wood, ivory, stone, and other hard substances applicable to the manufacture of billiard balls and other articles.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," August 24, 1869.

1100 J. B. Spence
1111 J. Wadsworth
1112 D. Johnson
1131 B. J. B. Mills
1132 R. E. and C. Marshall
1139 M. Samuelson and C. Eskrett
1141 E. Dowling
1144 A. H. Renton
1145 W. H. and T. Hacking and J. Chambers
1150 B. W. Farey
1155 W. Gradwell
1158 C. E. Brooman
1160 H. J. Worssam
1163 E. Cooper
1166 F. J. Bramwell
1170 W. J. Cowlman and A. Doe
1171 A. K. Rider
1172 F. Mulliner
1177 S. Harrison
1188 T. Amies
1190 T. Page
1198 J. E. Ward
1210 K. S. Mackenzie
1220 E. O. Catrin
1228 C. M. Barker
1230 C. E. Brooman
1242 G. G. Tandy
1272 A. Jack
1296 Hon. R. Flower and M. M. Crowly
1275 O. Engholm
1314 T. Bostock
1326 E. Crowe
1415 E. S. Copeman
1417 W. N. Nicholson
1455 T. Bullivant
1483 G. F. Henry, I. A. F. Bang, F. R. C. Monestier, and J. P. A. Figuier
1536 W. R. Lake
1566 J. P. Nolan
1618 J. D. Brunton
1626 F. H. Lloyd
1665 J. F. Nicholls
1668 P. Kirk
1708 C. Francis
1816 E. G. Brewer
1857 W. E. Newton
1906 T. and R. Nuttall
1946 A. Clark
2010 N. Mole
2078 T. Kendrick
2136 J. J. Cousins
2195 S. Hall
2304 J. M. Clements
2317 F. A. Yeo and H. Hanna
2356 W. Tongue
2416 W. R. Lake
2438 T. Ward and W. S. Black

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 20, 1869.

543 J. W. Reid
544 W. R. Lake
549 J. E. Liller
560 J. Johnson and W. Gill
567 W. E. Gedge
571 W. Williams
574 J. I. Vaughan
577 J. T. Griffin
596 J. Cheetham
612 T. S. Blair
615 R. S. Norris
616 G. J. Snelus
666 J. Gough
846 S. R. Wybrants
692 C. Mather and W. Rossetter
929 H. Haschke
963 B. Dobson and J. Eastham
1054 J. Robbins and J. Allbutt
1284 H. Hall
1466 H. Luke
1516 C. Moseley
1546 D. Roberge
1929 J. Taylor, R. and J. Ingham, and J. Sharples

Sealed August 24, 1869.

592 H. J. Ledger
610 J. H. Johnson
617 L. G. Lysons
704 A. Mitchell
711 J. J. Shedlock
712 J. J. Shedlock
732 W. Weldon
750 W. E. Newton
774 W. H. Harfield
778 E. W. and M. Slade
780 C. Vero
804 J. L. Norton
969 G. Wells
994 W. Allan
1335 J. R. Jefferies
1358 B. Hunt
1443 B. J. B. Mills
1557 Z. E. Coffin
1790 G. Fry
1804 W. E. Newton
1899 W. R. Lake
1948 W. H. Perkin
2004 W. A. Biddell and J. Redgrave
2009 P. G. Gardiner
2048 F. Trappes
2103 C. F. Dunderdale

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2069 E. A. Cowper
2127 J. Varley
2136 W. Taylor
2139 R. A. E. Scott
2149 J. Longbottom
2151 J. M. Hyde
2155 W. Tongue
2160 J. Livesey and J. Edwards
2168 W. Welch
2174 J. B. Fell
2192 G. Hunter and W. F. Cooke
2244 C. D. Abel

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2331 J. Standish and J. Gooden
2398 J. Davis

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following uumbers:—

1400	2350	2358	2366	2376	2384	2392	2400
1661	2352	2360	2370	2378	2388	2396	2406
2095	2354	2362	2372	2380	2390	2398	2408
2348	2356	2364	2374	2382			

LIST OF SPECIFICATIONS PUBLISHED

For the week ending August 21, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
123	0 6	3915	0 8	3955	0 6	96	0 4	127	0 4	148	0 4
3829	2 6	3921	0 8	3957	0 6	98	0 4	129	0 4	149	0 4
3854	1 10	3922	0 8	3988	0 10	101	0 4	130	0 4	151	0 4
3855	2 10	3925	1 6	7	0 8	102	0 4	133	0 4	152	0 4
3871	0 10	3926	1 6	15	0 8	108	0 4	134	0 4	153	0 4
3879	1 10	3929	0 10	25	0 8	115	0 4	135	0 4	155	0 4
3895	1 4	3934	0 8	28	0 4	119	0 4	136	0 4	156	0 4
3906	1 6	3935	0 10	89	0 4	120	0 4	138	0 4	158	0 4
3908	1 0	3936	0 10	92	0 4	123	0 4	139	0 4	161	0 4
3913	0 10	3937	0 8	93	0 4	124	0 4	143	0 4	439	0 4
3914	1 2	3939	1 0	94	0 4	125	0 4	145	0 4		

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Departmen , 166, Fleet-street, London, E.C. ,to whom all communicat tions upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, SEPTEMBER 3, 1869.

BRIDGES AND ROOFS.

THE introduction of the railway system, conjointly with the employment of iron on a large and increasing scale, compelled engineers to pay that regard to theory and science which they had never previously done. In all probability but for these circumstances the rule of thumb would have still held chief sway amongst us. As it is, it is by no means so extinct as we would wish to see it. The failure of some of the early iron bridges, and the gigantic structures contemplated in which that material was to play a prominent part, necessitated a careful inquiry into the nature and capabilities of both cast and wrought iron. It is well known that twenty years ago a Royal commission was appointed to enquire into the whole matter. The results of its labours were published in a blue book, which will well repay perusal. Since that time treatises have appeared at intervals dealing more or less lucidly and fully with the subject of iron structures, but even at present our scientific resources on this point are very scanty. Another volume* has been recently added to our *repertoire* by Mr. Unwin, which consists of a reprint of lectures delivered to the members of the Ordnance Corps at Chatham. In the first lecture the subject of shearing strain is investigated, and some very happy graphic methods given for delineating it for any particular case that may occur. It will assist the student if he bear in mind that a shearing strain is always in a vertical direction, and may be said to be the more immediate consequence of placing a weight upon a beam, than the other descriptions of strain. With a load uniformly distributed over a girder, the shearing strain is equal to zero at the centre and is a maximum at the ends over the points of support. With a movable load, its amount and position will vary with the lengths of the loaded and unloaded segments respectively.

There is a point in connection with estimating the correct margin of load upon a bridge that is worthy of notice. Our author justly observes that, whereas some years ago one ton and a half was assumed as the load for a double line of way, now a couple of tons and occasionally so much as two tons and a half are taken by engineers. This is due to the increased weight of the engines and rolling stock of the present day. The point, however, to which we would draw attention is, that there must now be a large number of railway bridges designed upon the former assumption of their load, which are strained a great deal in excess of what was originally intended. Possibly some of them may have been strengthened, but we fancy that is rather the exception than the rule. It is, in fact, not sufficient, as Mr. Unwin points out, to consider the load only when designing a bridge. Attention should be directed to the span and general dimensions of the structure and all the possible positions in which the load may be placed. The position of the load will frequently have quite as much to do with the resulting strain as its absolute amount. It is generally admitted now that tubular bridges are the most expensive type of construction that can be adopted for crossing any intervening space. But although events and the progress of science since the erection of the Menai Bridge may have demonstrated this fact, yet it does not lessen our admiration of the structures themselves, or our esteem for those engineers who designed and executed them in the face of difficulties, obstacles, and prejudices of every description. Considering how imperfect, comparatively speaking, their knowledge of the capabilities of iron was, and how, literally, every step had to be taken in the dark, it is a wonder that so much success was achieved. The cellular flanges have gradually given way to the trough shape, as seen in Charing Cross, Blackfriars, and numerous other railway bridges. Lecture III. concludes with some valuable practical remarks relating to the designing and arrangement of the cross girders of a bridge, a point very rarely paid sufficient attention to. There is quite as much room for design in the cross as in the main girders of a bridge, and a great deal more play for economical planning and adjustment than is usually imagined. Lecture IV. will be found to contain an excellent investigation of the usual forms of braced girders, or those constructed upon the open web principle. The shape of the booms, which include the sectional area of the flanges, and whatever extraneous material it may be found necessary to add to them, is a matter of some importance, more especially as it affects the position of its points of attachment with the web. Theoretically, in order that the strains may be uniformly distributed over the whole flange area, the points of attachment should be so arranged as to pass through the centre of gravity of the section. Practically, a deviation, within certain limits, from this result is of no importance. Moreover, in girders of large span there are other considerations, which would define the shape of the upper flange at least to be such that exact accuracy on this score would not be practicable. So far as the relative economy of the various descriptions of girders is concerned, whatever may be the doubt respecting the different forms of the open-web system, there is none between that system itself and the solid-sided or plate principle. The advocates of the former estimate the saving in weight at fifty per cent., but this probably is a little too high. For small bridges, that is, having a span of about forty feet, it is immaterial which principle is used, as the superior economy of the open web does not appreciably indicate itself in girders of less span than seventy or eighty feet.

It was not very long after the application of iron to girders and bridges that its employment was extended to the construction of roofs, and the gigantic structures at many of our railway stations demonstrate the success that has attended the experiment. Mr. Unwin, in determining the strains upon the principals, commences with the simplest example, namely, that of a pair of rafters, connected at the feet with a tie, and thence proceeds to more complicated cases, including the bowstring and other types of construction. There appears to be some little confusion attending the diagram of stress for the bowstring girder, and there is no doubt the strains could be determined in a simpler manner. We endorse the views of our author respecting the necessity of providing for accidental pressures upon roofs, which do not theoretically act in a vertical direction, but we consider that after including them in the absolute load or weight upon the roof, their further influence is best provided against by properly securing the whole structure with adequate bracing and wind ties. These are points which cannot be regulated by theory. Practice and experience are the only guides to their solution. The best provision against wind pressure lies in the *vis inertiæ* or actual weight of the whole structure. The wind pressure is to some extent a moving load, and its counteraction depends upon the same principles as guide us in the designs of bridges intended for that description of load. In the treatise we have just reviewed numerous plates and woodcuts are added to a clear and well printed text, and the volume is alike a credit to the author and the publisher.

* "Wrought-Iron Bridges and Roofs." Lectures delivered at the Royal Engineer Establishment, Chatham. With examples of the calculation of stress in girders and roof trusses by graphic and algebraic methods. By W. CAWTHORNE UNWIN, B. Sc. Assoc. Inst. C.E. London: E. and F. N. SPON, 48, Charing Cross. 1869.

LIGHT AND OPTICS AT THE BRITISH ASSOCIATION.

REFLEXION OF THE LONG WAVES OF THE SPECTRUM BY FLUOR SPAR—ROCKSALT PRISMS—THE LIGHT OF METEORS—PHOTOGRAPHS OF FOSSIL CORALS—THE ACTION OF LIGHT ON VAPOURS—THE DARK DISCHARGE IN VACUUM TUBES—A NEW HELIOSTAT.

DURING the visit of the British Association to Exeter, several novelties of interest relating to light and optics were brought under the notice of the members. One of the principal of the discoveries was made known by Professor Gustav Magnus, who found out by experiment that fluor spar reflects the waves of ether thrown off by hot rocksalt more than any other polished surface out of the very large list of substances which he tried. Hence if these long waves were visible to the eye, fluor spar would sparkle more brilliantly in such rays than would the polished surfaces of metals. Dr. Balfour Stewart, who was on the platform of Section A during the reading of the paper, called attention to some experiments of his own made a few years ago, tending to prove that the heat rays emitted by rocksalt are very long ones, belonging almost to the extremity of the spectrum. He also found out that, despite the general transparency of rocksalt to obscure heat, it shows great opacity to the heat rays emitted by a second piece of its own substance.

Mr. C. Brooke, F.R.S., narrated to Section A how he and Mr. Browning, the optician, had tried to make rocksalt prisms for use in a heat spectroscope. Supposing the base of the prism to be parallel to the line of cleavage of the crystal, it was found that in nearly every instance the apex of prism split off, and that, as a rule, long before the apex had been ground down to anything like a sharp edge. They therefore thought they would try the influence of annealing upon the crystal, so put one of them in a tin box full enough of sand to well cover the piece of rocksalt, and with a slow and gradual increase of heat, brought it in the course of a few hours to a very high temperature. It was then allowed to cool very slowly indeed. The result of this treatment was to produce pieces of rocksalt which could be ground into prisms without much danger of the splitting of the crystal.

Professor Newton, a distinguished American astronomer, in the course of a speech made at the British Association, said that observations of meteors made in the United States tended to prove that the November meteors burnt up at a much higher altitude in the air than the August meteors. He, therefore, raised the question whether the resisting medium in space which transmits waves of light may not have retarded the lighter fragments forming the meteoric showers more than it retarded the heavy substances. If so, it might be possible that the lighter fragments were formed of different chemical substances to the heavier ones, so burnt up at a higher altitude in consequence. He broached this question, he said, merely as a passing idea, and not as possessing any great weight. Perhaps the spectroscope may hereafter give some information upon the point.

A year ago we called attention in these columns to the method adopted by Mr. James Thomson, of Glasgow, to photograph the bodily organs of fossil corals. Each of these fossil corals is nearly as large as a hen's egg, and Mr. Thomson, it will be remembered, cut a thin slice out of the centre of each coral,

and then ground down and polished the stone slice till it became thin and translucent enough to be used as a negative from which to take photographic prints on paper. When he exhibited these valuable photographs at the British Association at Norwich, last year, Mr. W. H. Harrison recommended him to have them copied in future by the permanent carbon process. Mr. Thomson in consequence went to Newcastle-on-Tyne, saw Mr. Joseph W. Swan, the patentee of the chief carbon process, and made arrangements for a large supply of permanent photographs from the stone negatives. Some of these carbon prints were exhibited at Exeter, and met with much approval. Mr. Thomson says that he and Mr. Swan are now trying experiments upon a new process, which they hope will result in the production of blocks from the coral sections which can be used in the common printing press, to print from in printing ink.

A paper by M. Morren was read by Mr. R. B. Hayward, M.A., detailing some experiments on the action of light upon vapours and gases confined in tubes. The experiments were of the same nature as those performed by Professor Tyndall, wherein the action of a conical beam of intense light from the electric lamp was seen to set up cloudy chemical decomposition in certain transparent vapours from organic volatile liquids. M. Morren, who lives in the south of France, was able to do away with the electric light, and to use sunlight in its place. His experiments were tried with inorganic substances, so as to render easier the task of deciding upon the actual nature of the chemical decomposition set up by light, and in the course of his researches he discovered a source of error in the method of working adopted by Professor Tyndall. The glass experimental tube was of the same description as that used by Professor Tyndall; it had flat ends of glass, fixed to the tube itself by brass ferrules and cement, the ferrules being fitted with stopcocks for the exhaustion of the air. M. Morren introduced a mixture of perfectly pure and dry hydrogen and nitrogen gases into his exhausted tube, and on sending a beam of sunlight through the long axis thereof, he was surprised to see signs of chemical action in the shape of the formation of a cloud. This phenomenon led him to suspect that the resinous cement used to fix on the ends of the tube had perhaps liberated some volatile hydrocarbon to mix with his pure permanent gases. He accordingly made another tube, and used cement free from this objection, but the cloud was formed as before. Lastly, he suspected the arrangement for drying the gases, which consisted of powdered glass wetted with sulphuric acid, and on substituting chloride of calcium as the drying agent, no cloud was formed on the repetition of the experiment. In the end, he found out that even the purest sulphuric acid, quite free from arsenic and other foreign substances, liberates traces of sulphurous acid gas, and thereby causes the formation of a cloud. This fact shows that in some cases, this method of experimenting is a very delicate test for the presence of certain chemical substances. Moreover, the discovery made by M. Morren affects a large number of the experiments on the action of gases upon radiant heat made by Professor Tyndall, and published by him in his celebrated work "Heat Considered as a Mode of Motion." In all those experiments Dr. Tyndall dried his gases by means of powdered glass and sulphuric acid, so that, as shown by M. Morren, traces of sulphurous acid gas must always have been present in his experimental tube, and influencing the result to a certain extent.

Mr. J. P. Gassiot, F.R.S., called attention to a curious deposit of metal in a vacuum tube which he purchased upon the continent. Gradually, as is often the case, a metallic deposit was formed upon the glass round the negative electrode, which was a brass wire, but in addition a number of dark metallic rings were deposited at regular intervals, all along the tube itself. He did not know what gas had been used by the makers to leave its traces in this particular tube. Being one day in the shop of Mr. Cetti, a well-known maker of vacuum tubes, he saw a tube which had been thrown aside as worthless because of the formation of a similar dark deposit. In this latter tube there was an arseniuretted hydrogen vacuum. In both cases he found upon examination that the dark deposit took place exactly in the position of the dark discharge. In Mr. Cetti's tube, wherever the bore was narrowed so as to make the discharge intensely luminous, there was a bright instead of dark deposit of the metallic aluminium of the electrodes. Mr. Gassiot could offer no explanation in either case as to the cause of the phenomenon; he only pointed out the fact.

Mr. G. J. Stoney, F.R.S., exhibited a new heliostat, which he had tested for many months. Without sectional drawings its construction cannot be explained, but it is remarkable for its cheapness and simplicity, and is sure to prove a formidable rival to others in the market.

ON THE REPORT OF THE METEOROLOGICAL COMMITTEE.

THE progress of science suffers no impediment from diversity of opinion, nor from candid criticism. Truth, whether of facts, principles, or laws, however entangled it may be by doubts and discussion while yet only foreshadowed to the scrutiny and intellect of the human mind, will at length become manifest and unassailable for evermore. Thus we shall not be encumbering, but rather assisting, the advance of meteorology by freely commenting upon what is being done in its cause both officially and privately. Few sciences enjoy so large assistance from the State, so greatly do the public desire its development. Hence, as the majority of our readers cannot devote attention to official publications, we endeavour to interest them in the progress and practical application of meteorology by reviewing from time to time the method and results of the work of the Meteorological Office. The Report of the Meteorological Committee for the year 1868 has just been made to Parliament; and from it we learn that the work of the office is distributed under three branches—marine meteorology, telegraphic weather intelligence, and land meteorology.

The office undertakes the duty of supplying the Royal Navy with all the meteorological instruments used in the service, and at the end of the year there were afloat 188 barometers, 416 aneroids, 806 thermometers, 161 hydrometers, &c. The recording of observations with these excellent standard instruments is, however, entirely voluntary on the part of naval officers. It seems that a little reform is required here. The splendid opportunities which her Majesty's ships afford for contributing to meteorological research should be taken advantage of without fail. It is certainly not necessary that every ship in a fleet, nor that ships in home ports, should be constituted observatories for the Meteorological Office; but the flag ship of each squadron and all isolated ships afloat should be. Only about 70 months' observations were sent in during the year by the Navy, while the merchant service returned 259. As it is absolutely necessary that only reliable instruments should be used for the observations desired, captains of merchant ships who volunteer their services are supplied with the requisite instruments; and, at the end of the year, there were so lent, 62 barometers, 12 compasses, 393 thermometers, 254 hydrometers; constituting about 62 floating observatories. We cannot imagine how the committee hope to work up the meteorology of the oceans in anything like a reasonable time with such limited co-operation. They state that the documents already collected are numerous enough for the beaten tracks of the seas; but surely more effort must be made to collect observations where they are said to be urgently required, and we are glad to say the committee "contemplate a more extensive issue of instruments."

"The registers which are in the office are in process of being systematically examined, previous to their being used for the purpose of discussion of their contents. If any register affords internal evidence of inaccuracy, such as a record of barometrical readings which does not exhibit the diurnal range between the tropics, or a series of readings of the dry and wet thermometers which do not differ, or other proofs that it is not trustworthy, it is rejected. By the application of tests such as these, about half of the early registers bearing on the district now under investigation which have been hitherto examined had to be set aside." We cannot understand the grounds of this wholesale rejection for partial faults, and, remembering what Maury accomplished with ordinary ship's logs merely, we feel regret to have had to read this. The work of the office must be mainly of a routine character, such as the reduction of observations, preparation of numerical tables, deduction of averages, &c. Consequently there is little interest in report of progress to the general reader who looks for results. The committee have brought forward and published an atlas of charts showing the monthly mean surface temperature of the South Atlantic, undoubtedly the best work that has yet emanated from the office.* When a public office is allowed to get its affairs muddled, a large expenditure of time and trouble is required to reduce them to order. This has been the case with the Meteorological Office, and the committee very fairly enter at some length into an explanation of the steps taken to rectify account and disposition of instruments. Under the head of telegraphic weather intelligence we have to notice, in the first place, that the committee have recast Admiral Fitzroy's "Instructions for Meteorological Telegraphy," and anyone so disposed can now readily learn the entire plan upon which the observations are made daily at the seaports and transmitted to London, together with directions for using the instruments. The London office is also in communication with the prominent stations on the open seaboard between Cape Finisterre and Bergen. It is, however, found by experience that owing to the geographical position of these islands, weather intelligence of more value can be sent to the continent than can be received therefrom. Heart's Content, Newfoundland, has been a reporting station during the year. The directors of the Anglo-American Telegraph Company very liberally transmit the messages free of cost through their own line, so that the committee have only to defray the cost from Valentia to London. We shall return to this subject in our next.

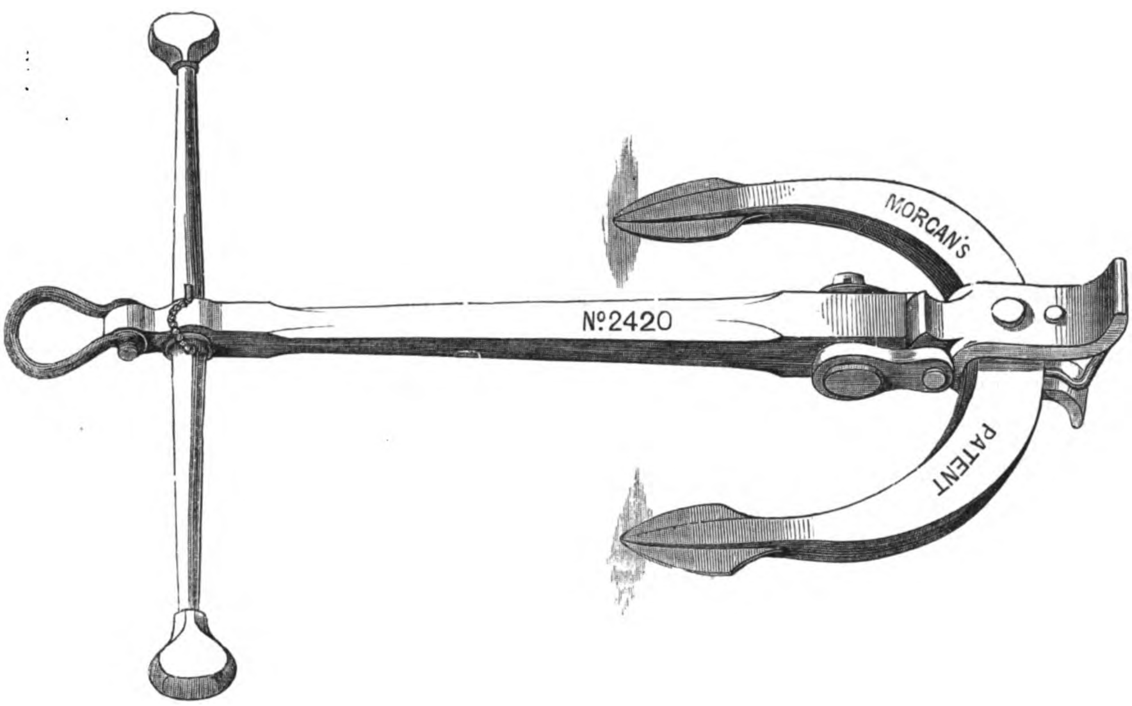
NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

A PAINLESS KNIFE—GAS IN LIGHTHOUSES—THE METRICAL STANDARDS AND A METRICAL CALENDAR.

AT a recent meeting of medical men, Dr. B. W. Richardson exhibited what he claimed to be a "painless knife." Unfortunately, it fell into clumsy hands, and the mechanism became disordered, so that it could not be seen in practical operation. The invention, however, deserves the attention of mechanicians, who may be able to assist Dr. Richardson in perfecting his instrument. A circular blade, sufficiently sharp and revolving

* See MECHANICS' MAGAZINE for August 14, 1869.

MORGAN'S ANCHOR.



with sufficient rapidity, it seems, gives no pain when it inflicts a wound. The problem is to devise an instrument including the necessary mechanism which a surgeon can hold in his hand and use without difficulty. The production of such an instrument will confer incalculable benefits.

Among recent applications of science we may mention the use of gas in the lighthouse of Howth, Ireland, which has proved so successful that it will probably lead to the employment of gas in all lighthouses to which it can be furnished. Some small works established close to the tower at Howth supply the lamps with cannel gas, and a far superior light is obtained at very much less cost than when oil is used. The burner, which is the invention of Mr. Wigham, of Dublin, consists primarily of three concentric rings, which carry twenty-eight fish-tail jets. These alone give a light two and a half times more powerful than the four-wicked oil lamps previously in use at Howth, and generally employed, we believe, in our lighthouses. Supposing, however, the two lights to be only equal, the saving in cost is over 25 per cent. But, in addition to what we have called the primary burner of 28 jets, Mr. Wigham's apparatus can bring into action several more rings carrying 20 burners each until the light of 108 is furnished. Thus the light can be graduated according as the weather is clear or thick, which was impossible with the old oil lamp. The testimony of all who navigate Dublin Bay, and of the captains of the Irish mail boats, is conclusive as to the superiority of the gas light.

All our readers probably will know that the measurements on which the French metrical system are formed are not rigidly accurate. The error is indeed but trifling, but it was thought sufficient to make it a question whether or not it would be advisable to amend the standard metre and kilogramme kept by the Government. A commission of the French Academy has accordingly considered the subject, and has come to the conclusion that the standard measure and weight now in existence should be retained, and that steps should be taken to present foreign governments with authentic copies of them. The general movement towards the adoption of the metrical system made this a question of interest to the whole world. It is curiously illustrative of the present rage for decimal systems that a Frenchman has just proposed a decimal calendar. We have not yet seen any account of his system, so for the present take no further notice of it.

MORGAN'S PATENT ANCHOR.

THE novelty of this anchor is that it takes the ground with both flukes instead of with one, as in the ordinary anchor. The arms are made to move swivel-like on the shank, so that the palms are always certain to take hold of the ground in whatever direction the anchor may fall on the bottom, or in whatever direction the strain may be on the cable. The stock and the flukes lying both in the same line it is impossible for the pea of the anchor to penetrate the ship's side when entering dock or coming in contact with the pier-heads, as was lately the case with the "Clydesdale" and the "John Bull" at Liverpool. It can be used as well without the stock as with, so that if the stock be broken (an occurrence not infrequent) the biting or holding qualities would not be impaired, and both flukes being down the anchor in shallow water could not damage the ship's bottom in the case of overriding the anchor or grounding. All the parts are made in separate pieces, can be conveniently stowed away, and readily put together when required.

Another important advantage in this anchor is that the several parts are put together without a "weld." The shank is in one piece, having an oval cotter hole punched through it at one end, to which are fastened the two straps, between which "swivels" the "gab strap," and between which again swivel the arms and flukes at right angles, each piece being made without "welds," the whole being riveted or attached by the cotters and bolts, as shown in the drawing.

The extraordinary strength of this anchor has been proved at the Mersey Docks and Harbour Board's Testing Works, Birkenhead, where it withstood the strain of 345 per cent. above Admiralty proof without breaking.

The following is a report of the trial of Morgan's patent anchor, which took place on board the "Scotia," 150-horse power, on Wednesday, August 18, 1869:—

First trial. Off Erith.—Soil, hard coarse gravel. Let go the anchor athwart the tide with a 2½-knot current, boat going through the water at 2 knots. Brought the boat's head to tide immediately; steamed astern full speed without starting the anchor in the least, then steamed ahead with full power over the anchor, and after straightening the chain suddenly brought her up, giving her a great list and pinning her head down about 18in., thus clearly proving the impossibility of fouling the anchor; then steamed again hard astern with the same satisfactory result as before. It was quite evident that in this trial the anchor must have broken ground twice and immediately held again. All on board expressed their surprise and satisfaction at the result of this trial.

Second trial. Off Northfleet.—Soil, hard chalk and flint. Let go the anchor, tide running down very strong, quite three knots. The same experiments were tried as at the first trial with the same results. Everyone on board the vessel expressed their astonishment at the immediate manner in which the boat was brought up over such a bottom. The ordinary anchor could never have got hold in such ground.

Third trial. Off the Mucking Light, Sea Reach.—Soil, soft light mud, and oozey bottom; tide run out. Dropped the anchor and steamed astern full power, the anchor holding immediately; then steamed ahead over the anchor, then astern again, but the anchor held firmly, which was proved by the deep sea lead. It was here determined to try the anchor without the stock, and when it was removed the anchor was again let go; the same form was then gone through by steaming ahead and astern, and, to the astonishment of all on board, the anchor held as firmly without the stock as with.

Everyone being satisfied, and no further proof being required as to the anchor's capabilities, the boat's head was turned for London. In coming up the river a meeting was held by all the practical men on board on the quarter deck; Captain Laing, surveyor to Lloyd's underwriters, took the chair. He said he was deeply gratified with the result of the trials with Morgan's patent anchor. It was impossible that more severe or impartial trials could have taken place. He was perfectly satisfied that the stock was a useless encumbrance to this anchor, and that the holding power, as exhibited, was not in the least degree diminished without it. He also remarked that in his opinion the anchor used at these trials, weighing 7cwt. 2qr. 11lb., was sufficient to have held a vessel of 1,000 tons in any ordinary weather.

These remarks and opinions were endorsed by Captain Champion, surveyor to Lloyd's underwriters; Captain Peters, shipowner and surveyor; Captain Thompson, marine surveyor; Captain Moore, of the "Shipping and Mercantile Gazette"; Captain Newholm, surveyor to Austrian Veritas; Captain E. Little, of the Columbian Navy; Captain Watson, of the Caledonian Steam Towing Company; Captain Newman, of the "Scotia"; and about thirty or forty other gentlemen, representing shipowners, shipbuilders, and others interested in shipping matters. The company were much indebted to Mr. R. R. Edward, the London agent to the Morgan's Patent Anchor Co. (Limited), who, with Mr. Morgan, the patentee, was in attendance to afford every information and explanation required, and personally superintended the arrangements.

PROCEEDINGS OF THE BRITISH ASSOCIATION.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

Report of the Committee on Underground Temperatures.

Mr. G. J. Symons read the report of the committee on underground temperatures. He stated that he was only one of the members of the committee, but the duty of the reading of the report

fell on him in consequence of the absence of the Chairman, Professor Sir William Thompson, and of the Secretary, Professor Everett, of Glasgow University. The report set forth that the committee had tried experiments on underground temperatures at Glasgow, Dundee, and wherever they could get access to very deep wells or borings in the earth. But the chief experiment had been tried in a well made many years ago at Kentish Town by a company formed for the purpose of supplying the district with water. The total depth in this instance was 1,032ft., 540ft. of which consisted of a bricked well, and the remainder of a boring lined with thin sheet iron. The well was made first, but as the people in the neighbourhood complained of the hardness of the water, the boring was done, the result being that the supply of water fell off, and the company ruined itself after spending £100,000 on the works. The committee had obtained the use of the old well, and fitted up winding apparatus above it in a hut, to let specially constructed thermometers up and down in the boring. The general result of the experiments was to prove an increase of temperature of one degree for every 52·4ft. increase in depth.

Mr. S. J. Mackie, F.G.S., said that he thought the theory of the internal fluidity of the globe to be untenable. Yet if the increase in temperature mentioned by Mr. Symons continued the same at all depths, at about 450 miles below the surface of the earth, the temperature must be equal to that of the surface of the sun. From diagrams on the wall he noticed that the increase of temperature only became regular after the bricked portion of the wall was passed and the boring reached. He thought that perhaps the conduction of the iron tube would tend to equalise the temperature, and that if the sides of the boring had been rock, irregularities in temperature would have been recorded.

Mr. Symons said that the iron tube was thin—only about one-tenth of an inch in thickness, and 8in. in diameter. It would be a good plan to sink a short length of such a tube in the ground, and to find out whether its conduction of heat influenced the results.

On Secular Variations of Lunar Tints.

BY MR. W. R. BIRT, F.R.A.S.

The author of this paper, in alluding to the importance of an examination of the tints of the lunar surface, remarked that to carry it out in its entirety would entail a most enormous labour, but he recommended that a few of the most prominent objects should be selected for the purpose. He called attention to the fact that changes of tint and brilliancy were common on the moon, as every observer who paid but a slight attention to the subject knew. These changes, he said, were generally referred to variations in the angle at which the sun's light fell upon the object; but he remarked that, although the presumptive evidence is strong this is really the case, it does not come out inductively, because as yet the observations have not been discussed with reference to the sun's altitude and azimuth, as seen from the moon. The author then proceeded to notice certain differences which have been observed between the tints of objects as recently determined and those of the same objects as recorded by previous selenographers, and remarked that we are unable, inductively, to characterise them as resulting from physical change, because the earlier observations are too few on which to found a legitimate conclusion. We have, however, as stated in the paper, the means of obtaining presumptive evidence at least of change of tint, independent of illumination, in the fact that if any two spots be taken, one being brighter than the other according to any particular scale of brightness at a given epoch of illumination or phase, should the order of brightness be reversed at any subsequent epoch, the illumination being the same, the legitimate conclusion would be that a change had occurred in the meantime; and as being unconnected with any theoretical considerations of change, the author suggested the term "secular variation of tint," to designate such phenomena. In the concluding part of the paper the author referred to the number of spots which have been observed during the last forty-nine years on the lunar crater Plato. From records in his possession, it appears that no less than twenty-four spots have, at various times, been seen on the smooth dark floor. Previous to February, 1869, fifteen had been recorded, of which six have been observed recently. In and since February, 1869, nine additional spots have been observed, of which five have been more or less constantly seen by two observers. The remaining thirteen have either become invisible or are but rarely seen.

On the Lunar Crater Plato.

BY MR. W. R. BIRT, F.R.A.S.

In this communication the author stated that certain peaks on the western wall of the crater had been measured by Beer and Madler, the heights varying from 5,000 to 7,000 English feet. These peaks at sunrise cast well-defined long shadows on the floor, and these shadows have been measured by Professor Challis, of Cambridge. The fact of the shadows having been measured left no doubt of the existence of certain irregularities in the shadow corresponding to the irregularities on the summit of the wall. Mr. Birt's collection of drawings of Plato having increased of late, he is able to compare delineations of the shadows by Professor Challis, the late Lord Rosse, the late Rev. W. R. Dawes, and J. Birmingham, Esq., of Millbrook Tuam, and finds some interesting results, among which may be named the proximity of the shadows of the three principal peaks to three very minute craters on the floor of Plato, thus furnishing a means of readily identifying these craters at any future time. In the concluding part of the paper Mr. Birt urged the importance of multiplying such drawings, as a discussion of them in reference to the moon's year may make us better acquainted with the wall itself.

Fall of an Aerolite.

BY DR. NEUMAYER.

Dr. Neumayer read an abstract of a paper recently presented by himself to the Imperial Academy at Berlin, detailing the facts relating to the fall of a meteor a short time ago, at Krähenburg. The fall took place in the day time, and so great was the velocity of the mass that it buried itself 2ft. deep in the sandstone rock. It was dug out while still warm, and found to weigh 31½lb. So great was the noise caused by the rushing of the aerolite at planetary velocity through the air, that it unnerved those people who stood near the spot where it fell, and the sound was heard over a radius of thirteen miles.

Dr. Mann spoke of an aerolite which passed over the colony of Natal, quickly followed by a noise resembling the discharge of a heavy gun; the same aerolite, when seen at another place 120 miles from the first, was also and as quickly heard to produce the same noise; the two reports, therefore, he thought, were not explosions, but sounds quickly produced and lost in consequence of the velocity of the mass.

Professor Newton thought the probability was that it gave two separate explosions.

The Rainfall of Natal.

BY DR. R. J. MANN.

Dr. Mann, in a communication on this subject, said that Natal is, practically speaking, a great inclined plain, with low marshes near the coast, and more and more mountainous as the inland parts are reached. The result of this is that, when the warm steady winds of the summer months roach Natal, laden with vapours of water from the Indian Ocean, the inclined plain forces the moisture-laden air up into colder regions, where it is condensed, and falls again in heavy rains. Floods often occur near the coast, but not in the interior. On the hills the climate of temperate regions is experienced, and lower down the rich vegetation of sub-tropical climates is found. In consequence of its rich vegetation and its fertility, it is a good place for settlers.

SECTION B.—CHEMICAL SCIENCE.

Chemical Nature of Cast Iron.

The committee appointed to investigate the above subject, and which consists of Messrs. F. A. Abel, D. Forbes, and A. Matthiessen, reported that they entrusted the preparation of pure iron to Mr. Matthiessen, who carried out this part of the investigation in conjunction with M. Szizepanowski very satisfactorily. These gentlemen expressed a hope that next year a great deal of very useful information will be obtained on the chemical nature and physical properties of pure iron and its alloys. According to an analysis made by Professor Abel the iron contained in a hundred parts only 0·00025 parts of sulphur. To another analysis the amount of sulphur found by M. Prus. Szizepanowski was 0·0007 per cent. The amount of substance taken for each analysis was about 30 grammes. Phosphorus and silicon were carefully tested by both the above analysts, and found to be entirely absent. Professor Matthiessen then detailed very elaborately the nature and properties of pure iron, and the best and most approved methods of fusion and filtration.

Electrolytic Iron.

BY DR. JACOBI.

Dr. Jacobi read a paper on the electro-deposit of iron. The learned Professor illustrated his remarks by a series of plates of extreme beauty. The solution from which the metallic iron was deposited consisted of a double salt, the sulphate of iron, and magnesia. It was found desirable to coat the recipient of the deposit with a thin film of nickel or copper. Specimens illustrating the application of the electro-deposit of iron to purposes of engraving (aided by photography) were also exhibited.

On the Phosphorescence of Sea and Ozone, in Connection with Atmospheric Conditions.

BY DR. MOFFAT.

Dr. Moffat detailed the results of observations taken at sea to show that ozone is in maximum quantity with decreasing readings of barometer, and the conditions of the south or equatorial circuits of the atmosphere. It is supposed that there might be some connection between ozone and the phosphorescence of the sea.

On the Oxidation of Phosphorus, and the Quantity of Phosphoric Acid Excreted by the Kidneys in connection with Atmospheric Conditions.

BY DR. MOFFAT.

Dr. Moffat stated that from results of observations on the luminosity of phosphorus in connection with atmospheric conditions for a period of six years, it appears that periods of phosphorescence and ozone periods commence, continue, and terminate under the same atmospheric conditions. While the barometer is increasing, and the wind is veering towards the north, phosphorescence diminishes in brilliancy, and ozone increases in quantity, and so on in various quantities, according to the change of wind and barometrical influence. Liquid and gaseous bodies when in contact with phosphorus in a non-luminous state become under certain conditions ozonised. As venous blood contains phosphorus, which in coming in contact with the oxygen of the air is converted into phosphoric acid, and combines with certain alkalies and earths in the liquor *sanguinis*, and forms phosphates of soda, magnesia, and lime, it is not unreasonable to suppose that the quantity of phosphorus oxidated and the phosphates formed in the system and eliminated from it through the kidneys is in some degree determined by the pressure and temperature of the atmosphere, and the state of the weather generally with a view to ascertain the quantity of phosphoric acid excreted by the kidneys. Dr. Moffat tested urine, under certain conditions, viz., that of a healthy man, and by the results it appears that the amount of phosphorus oxidised in the air and the amount oxidised within us depends upon similar atmospheric conditions.

On a Remarkable Structural Appearance in Phosphorus.

BY PROFESSOR TOMLINSON.

Professor Tomlinson said that a very remarkable appearance in phosphorus was seen some months ago by Mr. James John Field, F.C.S., who requested the learned Professor to account for it. Mr. Field placed about half-a-dozen sticks of phosphorus in a cylindrical jar containing water, which rose about half an inch above the ends of the sticks, and the jar was closed with a bung. This jar was placed in a cellar, where it remained undisturbed about three years. The cellar is flagged with stone, surrounded by damp walls, and almost entirely protected from light and currents of air. The maximum temperature probably did not exceed 50deg. or 55deg. Fahr. After this long repose the jar was taken into the laboratory, when it was found that the level of the water had sunk to about one-third of its original height, and the liquid left in the jar had become as dense as the strongest syrup. The portions of phosphorus that rose some inches above the liquid, instead of being cylindrical as before, were conical, from a sharp point to the full diameter, and each cone had a double spiral running down from left to right, as if two flat tapered bands of the substance had been made to cohere at right angles lengthwise, and then twisted into pointed rods, just as if the sticks had been mounted in a

screw-cutting lathe geared to cut a coarse tapering double spiral. The sticks had also changed from the creamy opaque surface to a translucent appearance from the surface of the liquid up to the points. The learned Professor then explained the appearances above described. First, the wasting away of the sticks and their conical form are clearly effects of slow combustion, diminishing in intensity downwards. The continued combustion diminishing, the evaporation of the water must have been due to a badly fitting cork, which during a falling barometer allowed a portion of the moist air to escape from the jar, and, during a rising barometer, allowed a portion of comparatively dry air to stream in. After giving the most conclusive reasons for the spiral markings he concluded by stating that when the particles approach the orifice they converge to a point beyond it; and as this point in the phosphorus to which the relating lines converge, though fixed in or near the tube, is being constantly shifted in the phosphorus by being drawn out and moulded in the tube, the converging lines also are drawn out, and thus give the appearance of a double spiral. Professor Calvert, Dr. Nevins, Mr. Braby, Mr. Wm. Huggon, and Professor Tomlinson took part in the discussion in this Section.

RUST.

BY PROFESSOR CALVERT.

PROFESSOR CALVERT, at the request of the President, gave some interesting results of his experiments into the nature and condition of rust. Oxidation of the bottom of iron ships he thinks may be prevented by an external coating of a preparation of an alloy of lead and antimony, while an alkali is placed in the bilge water within the vessel.

ON THE PRODUCTION OF HIGHER TEMPERATURES BY STEAM OF 212DEG. FAHR.

BY MR. P. SPENCE.

HAVING had occasion to raise large masses of liquor to 228deg. Fahr., for experiment, and as time was of importance, the object of Mr. Spence was to heat the liquors as rapidly as possible. This was accomplished by injecting steam into the mass of liquor, and, as soon as that was obtained, to stop off the steam and to allow the external fire to operate alone so as to raise the additional 16deg., and to maintain the temperature at 228deg. Fahr. The modes adopted, and which the paper detailed, were successful, and it was found that if both steam and fire were left acting after the higher temperature was obtained, the temperature continued, notwithstanding some theories obtained in the experiments as to cooling. After testing the apparatus used with certain solutions the use of fire was discarded, using only steam as a vehicle of heat. Many other operations of this kind were referred to, and it was found that steam sent into large masses of liquor heated them rapidly, and was capable also of dissolving certain salts in a much more rapid and economical manner than by fire.

SECTION C.—GEOLOGY.

DISCOVERY OF FOSSIL PLANTS IN THE CAMBRIAN ROCKS NEAR ST. DAVID'S.

BY DR. HICKS.

IN this communication, the author stated that the strata in which the fossil plants had been found were the Upper Longmynds. Their ripple-marked character showed they had been deposited in shallow water. Last year, Professor Torrell reported his having found land plants in the Cambrian strata, and this encouraged Dr. Hicks to seek for them. He had been successful.

Professor Harkness said that there was a difference in the nature of the supposed plant remains. He mentioned the various theories afloat as to the nature of these plants, and said they might be fucoidal. Some of Dr. Hicks's specimens were, he thought, the tracks of marine worms. Dr. Hicks had sent fossils which were found 1,500ft. below the horizons where they have hitherto been met with in the British islands. They were, therefore, the earliest types of life which had hitherto been found in this country.

Professor Phillips thought that many of the so-called fossil plants in strata of this age might be referred to annelides. He thought the finding of the trilobites and other remains 1,500ft. below the stage they had been found in before ought to teach geologists a valuable lesson. The learned Professor went into an elaborate review of the order of life, succession, and of the natural history classification of the early geological epochs. He thought it the duty of the Association to encourage and support such able workers as Dr. Hicks.

Professor Etheridge said that the plants exhibited were quite of a different character to those shown by Professor Torrell last year. He thought they were nothing beyond furrows or tracks of annelides and crustacea. The number of generic species of trilobites, &c., showed that life was enjoyed in great abundance during these early epochs.

ORGANIC REMAINS IN THE MENDIPS.

BY MR. C. MOORE.

THIS was the report of the committee for the purpose of investigating the veins containing organic remains which occur in the mountain limestone of the Mendips and elsewhere. Mr. Moore has for a long time made the organic remains frequently found in mineral veins his particular study. In his report, he referred to the various theories extant as to the origin of veins. They could not have been formed by sublimation, or the fossils would not be found in them. Mr. Moore was equally against the doctrine of segregation. Referring to Mr. Wallace's theory that many of the veins had been filled up by superficial action since the glacial period, he pointed to the age of the fossils as decidedly against it. Mr. Moore's idea was that open fissures communicated with submarine floors and dwindled down below. The mollusca, &c., of these seas were deposited in the fissures. Three or four things were necessary to the formation of mineral veins—open crevices, the presence of certain minerals in the water of the seas, and electrical action. The Mendip hills are intersected with veins, and on their tops some of these are worked. One of them extends for 270ft. downwards, and contains abundant lias fossils, although no liassic rocks are nearer than several miles away. This proves how great must have been the denuding force. Mr. Moore has also discovered both land and fresh water shells in these veins, as well as entomostraca, as well as seeds of old carboniferous plants. In the mines of North Wales he had found molluscan and fish remains, the latter belonging to no fewer than ten genera. Intermixed with the contents of some of the mineral veins, the author had found innumerable teeth of fishes, *conodonts*, nearly all of which were so small that they required optical power to see them. In the lead veins he had met with great quantities of foraminifera, all of secondary age. These veins also developed the existence of a fresh water fauna, of coal measure age, having no fewer than nine genera, and 127 species.

Mr. H. Brady said three well-known genera of foraminifera had been mentioned by Mr. Moore, all of which still existed. One of the most abundant foraminifera, *Involutina*, was remarkable for its variety of form. Mr. Brady's remarks on the rest of these minute shells were of a purely technical character.

Professor Phillips said Mr. Moore had produced so many new facts that he was entitled to speculate. When he first heard of the discoveries, he was perfectly astonished. What had to be considered in the origin of mineral veins was the altered power of heated water as a solvent to take up and precipitate mineral matter. Mr. Brady's remarks on the alterations in the type of a certain foraminifer were valuable, for, if wide differences could occur in them, why not in animals of a higher organization, such as lions and tigers? He referred to similar changes in the cephalopoda, and expressed his opinion that the understanding of lower types would make us better acquainted with higher forms.

THE WATER-BEARING STRATA IN THE NEIGHBOURHOOD OF NORWICH.

BY MR. J. E. TAYLOR.

THIS paper dealt with the origin of sandpipes in chalk, showing them to be natural drains, and advocating their origin from a chemical point of view. These sandpipes were most abundant in the disturbed chalk, and less so in the solid strata. The latter allowed the water to get away by means of joints and flint bands. The age of some of the sandpipes could be told by the material filling them, and by the unchanged contour of the country. In the excavations attending the sewage works at Norwich, much trouble was given by their having to work through strata thoroughly saturated with water. The same sort of strata standing above the water-level gave no trouble whatever. The deduction was drawn that if so much trouble ensued whilst working only 20ft. below the water-level, the excavation of the proposed Channel tunnel, under so much more pressure, must necessarily be attended with great difficulties. Mr. Taylor gave an interesting statement of the manner in which the wells were drained by the pumping in the neighbourhood of Norwich, and showed they were affected according to the different nature of the strata in which they were sunk.

Mr. Godwin-Austen mentioned several localities in Devonshire where sandpipes occurred in the sandstone rocks, and thought that the chemical theory could not hold in cases like these, although they might do so in chalk districts.

Sir Willoughby Jones expressed his gratification at the papers which had been read, and, as a Norfolk man, said he could thoroughly bear out the correctness of Mr. Taylor's views. It was a very common thing for holes to be suddenly formed by the caving in of gravel and sand into the sandpipes.

Mr. Taylor, in reply to Professor Harkness, said that the upper and lower boulder clays in Norfolk were very distinct. The former were derived principally from the wreck of the lias beds, and the latter from the lower chalk and oolite. One was of a dark blue colour, and the other of an ochreous white.

SECTION D.—BIOLOGY.

ON THE PHYSIOLOGICAL ACTION OF THE METHYL SERIES.

BY DR. B. W. RICHARDSON, F.R.S.

THE author stated that the use of some of these agents had greatly increased during the last twelve months, especially in France; the bichloride had been very safely used, having been administered 2,500 times without any fatal result. With ordinary skill and ability on the part of the operator, insensibility could be produced with about six minims, and in forty seconds of time, which was long enough for all simple operations, and the patient recovered in from three to five minutes. Dr. Richardson alluded to the new substance chloral, discovered by Liebig, the physiological effects of which were about the same as those in the methyl series, but he had not yet examined it himself. The investigation of the alcohols was most elaborately described, and as an anæsthesia the use of alcohol was condemned as being too slow and too prolonged. He could not place the alcohols in any other position than other chemical bodies—they were certainly not foods, nor could they either give strength or supply material for strengthening the tissues, or throw force into the tissue which had been supplied by other matter. It was time that the learned in the profession should recognise the true position of these agents, for seeking force in alcohol was like seeking for sunlight in a subterranean cavern. The report referred to the means of restoring suspended respiration, during which Mr. Richardson exhibited the bellows which he had constructed to aid in restoring respiration artificially. He had, by the aid of the apparatus, restored respiration from two to four minutes after all appearance of it had ceased in dealing with rabbits and other animals, but he could not always succeed, and why he did not he was totally unable to say. A brief discussion followed the report, and in reply Dr. Richardson, speaking of the means used to restore respiration, said that the operator should always have the power to raise the temperature of the room in which he worked, and, as this remark applied to the recovery of the apparently drowned, all receiving houses should contain a room in which the temperature could be raised to 140deg. or even to 160deg. at the will of the operator. There was always in the case of suspended respiration a lowering of the temperature, and the air used in producing artificial respiration should be warmed artificially before being passed into the lungs.

THE LAW OF DEVELOPMENT OF CEREALS.

BY MR. F. F. HALLETT.

MR. HALLETT'S experience showed him several years ago that corn, and especially wheat, was injured by being planted too closely. He found a wheat plant would increase above the ground in proportion as its roots had room to develope, and that the roots might be hindered by being in contact with the roots of another plant. Mr. Hallett continued a series of experiments, planting one kernel of wheat only, and succeeded so well in improving the method of cultivation as to raise wheat whose ears contained 123 grains, or more than 60 on each side. In the course of his investi-

gations Mr. Hallett made other discoveries with regard to the growth of cereals, which he sums up as follows:—"1. Every fully developed plant, whether of wheat, oats, or barley, presents an ear superior in productive power to any of the rest on that plant. 2. Every such plant contains one grain which, upon trial, proves more productive than any other. 3. The best grain in a given plant is found in its best ear. 4. The superior vigour of this grain is transmissible in different degrees to its progeny. 5. By repeated careful selection the superiority is accumulated. 6. The improvement which is first raised gradually, after a long series of years is diminished in amount, and eventually so far arrested that, practically speaking, a limit to improvement in the desired quality is reached. 7. By still continuing to select the improvement is maintained, and practically a fixed type is the result." In the discussion which ensued Mr. Hallett was warmly complimented upon the results he had attained, and the gigantic ears of wheat which he exhibited were examined with the greatest interest by those in the room.

On the Moral Imbecility of Habitual Criminals, Exemplified by Cranial Measurements.

BY DR. WILSON.

The author's theory was that habitual criminals did not possess such an amount of intellect as to enable them to discriminate between right and wrong, and that the majority of them were devoid of moral sense. The habitual criminal was of a low type of intellectual development, and some of them were so backward as to be unable to surmount the rudimentary difficulties of education. The measurements submitted by Dr. Wilson were from 464 separate measurements, and all showed a cranial deficiency, especially in the anterior lobes of the cerebral portions of the brain. Dr. Wilson recommended the adoption of a system of treatment of criminals similar to that in practice in Ireland—a system of punishment more reformatory than punitive, He also suggested that means should be taken to test a criminal, after he had been confined for a certain period, and that if he did not withstand the test he should be for his own sake and also for the sake of society kept in confinement. The discussion which ensued was of a very lively character, and became rather phrenological, till the President announced that there was a paper on that subject to be read on the following day. The President, the Rev. Mr. Caine (chaplain of the County Gaol, Manchester), Professor M'Clellan, Mr. Prideaux, and others, took part in the discussion.

SECTION E.—GEOGRAPHY.

Distribution of Heat on the Sea Surface of the Globe.

BY ADMIRAL SIR E. BELCHER.

The gallant Admiral pointed out that the temperatures which prevail in the Atlantic equatorial currents do not vary much from those in the other or Pacific portion of the ocean; and that north or south, in the Pacific, Arctic, or Antarctic, we find the warmer temperatures prevail more than they do in those regions on our European course into the seas washing Norway and towards Novazembla. That taking certain squares of similarly situated patches in various parts of the world, he thought geographers in general had given too much importance to a supposed warm current, deduced, too, from the equatorial one running to the north-east into the Arctic seas; and having urged that, he sunk the probability of a similar action such as that known to exist in the Antarctic seas. Thus, for instance, south of the Capes Horn and Good Hope, we know that stronger currents prevail in an easterly direction than have been traced in any other part of the world. Assuming a similar law to prevail in high northern latitudes, we can readily account for the flow of a portion of the Atlantic drawn into the vortex without drawing upon the resources of this so-named Gulf Stream.

The Peruvian Expedition.

BY MR. F. F. SEARLE.

This was a narrative of the Peruvian expedition, which was undertaken with a view to the establishment of steam navigation, by Mr. Searle, who was surgeon in charge of the expedition. He gave an account of the expedition from 1862 up to the present time, on the Upper Amazons. He described the expeditions against the Cachibos, who had murdered some officers while on an exploring expedition, and proved that the statements current on the main view of cannibalism prevailing in the interior were well founded. He gave an account of the labours of the Hydrographic Commission, which ascended the Ucayali, to its formation by the Tambo and Wrubamba, and attempted to proceed up the former, but were prevented by the force of the current, but the "Morora," a steamer of 500 tons burden, ascended the Pachitea, within forty miles of Mairo. The settlement of Yquitos now contains over 1,000 inhabitants, of whom 72 are English. The factory is in full work, employing 150 hands, where machinery is produced for private use in the neighbourhood, a floating dock launched, a regular monthly steam communication carried on from Taiatinga, on the frontier of Brazil, to Hurunaguar or the Huallaga River. The climate was favourable for Europeans, labour was plentiful, and the soil fertile. The Peruvian Government will give to emigrants every sort of countenance and protection, grants of land will be given to all who would go out on the sole condition of clearing them within two years, and to skill d labour further advantages will be offered. Much credit was due to Peru for the perseverance displayed in carrying out its object.

Recent Surveys in the Straits of Magellan.

BY CAPTAIN R. C. MAYNE, R.N.

The author gave an interesting account of the recent Government survey in the Straits of Magellan. He glanced at the history of the discovery of the Straits by the first circumnavigator, Magellan, and to the geographical position of the Straits. The Straits are 300 miles in length, and the width varied from two miles at the narrowest to fifteen or twenty miles at the wider parts. In that distance, a complete change of scenery and climate took place. At the entrance, they came upon low prairie land, bare of trees, with a bright sky and fresh wind; but, further on, they came upon mountains rising almost perpendicular from the sea, covered with antarctic evergreen leaves, torrents of rain, varied with snow and hail in their seasons. In some parts, the rain never ceased for twenty-four hours together, and he and his crew had gone for three months without being able to dry their clothes, except at the engine fires. He referred to the great use that was now made of the Straits to avoid the troublesome passage around the Horn. He gave the results of the recent survey, in which he was engaged from December, 1866, to the end of May last. He gave a description of the Patagonians and Fuegans, their manners and customs. The Patagonians were not such giants as represented; he had measured one who was 6ft. 10½in. high, but the average height of the men was 5ft. 10in. to 5ft. 11in., and the women were nearly as large. The Fuegans were small, badly-shaped, and ugly. The Patagonians drank very hard, but the Fuegans would not touch wine or spirit of any kind; on the other hand, the Patagonians would not smoke, but the Fuegans would smoke until they were insensible. The information obtained by Fitzroy as to the Patagonians killing their old people was true; he never saw anybody above a working age. He thought the inhabitants of the region might be very easily educated.

The Gulf Stream.

BY MR. A. G. FINDLAY.

In his paper on the supposed influence of the Gulf Stream on the climate of North-West Europe, Mr. Findlay submitted that the actual bulk of water which passes through the Florida Channel is from 294 to 330 cubic miles per day, and it receives no accession from the tropics. Fully one-half of this passes eastward and southward from the banks of Newfoundland, and the northern half, cooled down and neutralised by the Arctic current, has, according to this theory, to cover this area to raise its temperature. The known bulk of the Stream will only give six inches per diem over this area. And he would ask, how is it possible that such a minute film could have any influence, and this, too, at from one to two years after it has left the Gulf of Florida as the true Gulf Stream? He would not advert to the further progress of this warmer water, which might be traced to and beyond Spitzbergen, and its effects throughout the North Polar Basin, and these effects, he contended, were totally and absolutely incompatible with the now well-known particular of the Gulf Stream proper. He could not go into the isothermal lines, which show most markedly the higher temperature in the winter and much less so in the summer. The equable temperature of the waters causes this change—the relation of the warm and cold water. It had been propounded by Mr. Crott that the modern method of determining the amount of heat would account for all the phenomena popularly attributed to the Gulf Stream. But he (Mr. Findlay) would deferentially demur to his calculations. Mr. Crott took no account of the time it takes for the water to circulate. He doubled, as he (Mr. Findlay) thought, the volume of the Stream, and he took no account of the interferences it encountered. However valuable his suggestions might be, they must be applied in a different way. How, then, can the phenomena of our warm winter climate be accounted for? The reason seemed to him to be simple and obvious. The great belt of south-west winds called the Anti-trade, or Passage winds, passes over the North Atlantic throughout its breadth, and drives slowly the whole surface of the water to the northward of an easterly course or towards the shore of North-West Europe. From the particular configuration of the land, this north-west drift is allowed to pass into the Polar area. This south-west wind infuses into high latitudes the temperature and moisture of much lower parallels, and by its greater rate of travelling passes over the warmer water to the southward, and this brings to Exeter in one day the warmth of the centre of France. By its variation from westward or eastward of a southerly direction, we find all the variations or moisture which is induced by this wind passing over land or sea. The excellent observations made in the expedition from the Royal Society, under Dr. Carpenter and Dr. Wyvell Thompson, would, he had no doubt, throw great light on this obscure north-east current, which should not be called the Gulf Stream, but possess a specific term.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

Education of the Agricultural Labourer.

BY THE REV. CANON GIRDLESTONE.

Canon Girdlestone, in his paper on the Maintenance of Schools in Rural Districts, said another twelve months had confirmed him more strongly than ever in the opinions he had expressed at Norwich last year, on the condition of the agricultural labourer. He had advocated and promoted emigration as a mere palliative, and with great success; but he looked to education as the only permanent means of improvement. After referring to the general expectations that something would be done in Parliament next session, in the direction of the compulsory education of children of the agricultural labourer, he urged that such a measure would be unjust and useless until the establishment of really efficient schools within easy reach of every cottager's door, which was far from being the case now in more than half the rural parishes. In 14,877 parishes in England and Wales, there were only 7,406 aided schools; of the remainder, 2,779 were schools built with State aid, but not fulfilling the conditions of annual State aid. With regard to 4,692 parishes nothing whatever was officially known, but there were, no doubt, good schools in some of them. The Rev. Canon proceeded to explain the cause of the deficiency. The difficulty did not consist in the first effort to build a school, but in the continued effort required in its maintenance. This was not owing to poverty in the parishes themselves. The rate-books showed that there was sufficient property in each to maintain an efficient school by a tax so small as to be almost inappreciable. The clergy did their part, not only in the schools themselves, but in the disagreeable task of collecting subscriptions from parties many of whom altogether refused to do their duty, while not a few treated the clergymen with rudeness. Then, while some landlords were very generous, especially if the school were near their own residence, yet as a class, especially if non-resident, the landlords almost entirely ignored the claim which the cause of education had upon property, and the occupiers of land contributed hardly anything at all. Those were facts, proved by official documents. There could never be any guarantee for the existence of an efficient school within easy access of every labourer until the land was made to do its duty. He recommended that the children should continue to pay a penny a week; that the State grant should be contributed as now; that where there were not efficient schools such schools should be built with money borrowed wholly on the parochial rates; that Denison's Act should be made compulsory, and so throw upon occupiers of land the charge of educating the children of out-door paupers; and that the money now raised by voluntary contributions should be collected in the form of a tax or rate upon land. If

this cost a million, a rate of 2½d. in the £ would raise the money, and a 1d. in the £ would probably be sufficient. Thus, the landowners would be made to pay a fair share, the occupiers, under the operation of Denison's Act, would pay a small share (being already heavily burdened), and professional men and others would contribute their share through the general taxes towards the State aid. There would still be enough for voluntary beneficence to do in supporting Sunday schools, and extra books, maps, libraries, presents, and superannuation allowances to deserving teachers, and helping poor children to clothes to go to school in, &c. Towards the conclusion the Rev. Canon quoted the words of Mr. Howard, Her Majesty's Inspector of Schools in North Devon:—"At present the chief burden of the support of schools is borne by the clergy; the farmers, as a class, give nothing; the contributions of the country gentlemen are shamefully small."

Mr. J. Bayley Denton immediately followed with a short paper on Technical Education of the Agricultural Labourer. He advocated a system by which, along with primary education, information might be imparted to the children of agricultural labourers on such matters as the animals, insects, and crops on the farm, and the teachers should be qualified to teach children matters connected with the business of their future life.

THE SUTHERLAND GOLD DIGGINGS AS A SCIENTIFIC AND SOCIAL EXPERIMENT.

BY DR. L. LINDSAY.

DR. L. LINDSAY'S paper on this subject was taken as read. He had laid it down as a fact at the Dundee Meeting that a great portion of the area of Scotland, including Sutherland, is auriferous. Lately Mr. Robert Gilchrist had made successful experiments in raising gold in Sutherland. The object of the present communication was to show the extent to which these diggings had already proved successful and beneficial, the character of the difficulties that have been overcome, and the obstacles that still stood in the way. In conclusion, he said there was every reason to believe that many other parts of Scotland were quite as auriferous as Sutherland, and to those the attention of the gold diggers should be turned if the existing obstacles at Sutherland were not speedily removed.

THE DECLINE OF SHIP-BUILDING ON THE THAMES.

A PAPER by Mr. John Glover was read on this subject. He attributes the great decline in this branch of business in the metropolis to the fact that the cost of one day's work of a ship-carpenter, a joiner, plater, caulker, riveter, sail maker, boiler maker, engineer, turner, and pattern worker, is on the Thames, 72s.; on the Clyde, 58s. 8d.; and on the Wear, 55s. 8d. The extra cost of labour on the Thames was, he contended, alone sufficient to account for the decline of the trade. The establishment charges on the Thames were reported to be double those on the Northern rivers. There were some minor causes tending in the same direction. The comparative disuse of wood, for example, in the building of ships was disadvantageous to the Thames ship-builder. Then why did not the wages on the Thames fall to the Northern level? Because the trades unions fixed an artificial standard, and they destroyed the trade.

SECTION G.—MECHANICAL SCIENCE.

ON ROADS AND RAILWAYS IN NORTHERN INDIA AS AFFECTED BY THE ABRADING AND TRANSPORTING POWER OF WATER.

BY MR. LOGIN.

THE author commenced by stating general conclusions he had arrived at to the effect that the abrading and transporting power of water was increased directly as the velocity and inversely as the depth; also, that when flowing water had once got its proper load of solid matter in suspension all erosive action ceased. In short, that it was like a balance, the load being always equal to the power, which power, somehow or other, increased as the velocity became greater, and decreased as the depth of a stream increased, Nature always adjusting the load to the various circumstances. He then gave a short description of the plains and rivers of Northern India, and, by the aid of diagrams, went on to argue that rivers flowing through alluvial plains were raising rather than lowering their beds, and, though this silting up process may be very slow, yet it was satisfactory to the engineer to know that the foundations of his bridges would be as safe, if not safer, a hundred years hence, as they are now. In speaking of the changes of the courses of rivers, he said that there was more or less a constant cutting going on on the concave banks of a river, with a silting up process on the opposite side.

The next subject referred to was the denudation of the high-level plains of Northern India called "Doabs" (two waters), and locally known by the name of "Bhangar" land, in contradistinction to the term "Khadir," or low valley lands, through which the large rivers, fed by the melting snows, now meander. Mr. Logan said that the higher ridges or "back bones" of these Doabs were not caused by any upheavals, but were formed by the denudation of these high-level plains; and, as the rainfall was three or four times as great in the valley of the Ganges as that of the Indus, these back bones in the plains of the Punjab disappeared, as well as all defined drainage lines some fifty miles below the hills, for the simple reason that the water spread over these plains and was absorbed. To this peculiarity in the Punjab, particular attention was drawn; for Mr. Login argued that, if standing crops and grass could permit without receiving injury the rain which fell higher up to flow through rather than over those standing crops, surely the same water could flow over an iron rail at very slow velocities, seldom, if ever rising to such a height as to interfere with a locomotive passing over the line; however, if it did, the obstruction could only last for not more than one day in a whole year. By acting on this principle, Mr. Login believed that hundreds of thousands of pounds can be saved in the construction of railways in Upper India, as no embankments or masonry culverts and bridges would be required in crossing such high-level plains as the Bechna Doabs, which he had surveyed; while pounding back these flood waters by embankments, and forcing it to find an escape through culverts, was most costly and dangerous, for it increased the abrading and transporting power of the water at the very point where alone it could do injury, namely, where it crossed the rails.

In support of his argument he quoted actual occurrences. He urged that deep foundations for bridges was the proper mode for spanning the large rivers of India, and that only one opening for both the main stream and the inundation water should be provided, while any little water that might be left behind in the swamps or low ground which is below the level of the main river, should be drained off by spoon-mouthed syphons. Speaking of the minor torrents, he briefly referred to another description of bridge, resting on inverts, with deep massive curtain walls, which may, with economy, be introduced in some instances; and concluded by stating that once the abrading and transporting power of water was more fully investigated the engineer could proceed with all descriptions of works affected by flowing water with greater confidence and economy, instancing harbours on the Madras coast, which province, from being at present a financial loss to the state, would soon become profitable, both to India and England, by increased commerce.

UTILISATION OF TOWN SEWAGE.

BY MR. T. D. BARRY.

AFTER expressing an opinion adverse to the application of Mr. Moule's dry system to large towns, the author proceeded to criticise the irrigation system, especially as developed at Edinburgh, Worthing, and Croydon, and contended that fields subjected to constant irrigation can produce nothing but rank coarse grass, and that if any other crop is to be grown in those fields, the flow of sewage must be discontinued. Indeed, unless this was occasionally done, he did not think irrigation would benefit land. The effects of irrigation were most beneficial on clay and sandy soils, and really good land did not give evidence of so much improvement. He could see but little difference between the effects of sewage irrigation and the pure water irrigation in Lombardy and Piedmont. The advocates of irrigation claimed that their system possessed two advantages, viz., freedom from offensive smell, nuisance, or injurious influence on the health of a district, and a remunerative return for money laid out. He proceeded to dispute both these propositions. With respect to the latter, he argued that the apparent success was due to accidental circumstances, and had no permanent reality, and brought forward several illustrations in support of his views. He also argued that the system was not so free from nuisance, &c., as was claimed for it, and quoted authorities on the matter, and then proceeded to contend that the land was deteriorated by repeated and successive applications of liquid sewage. He expressed his adherence to the system of filtration as more suited to certain localities and large towns. He explained that, at Leamington, the town ashes, road scrapings, &c., were mixed with the sewage, and a dry manure formed which found a ready sale among the farmers, produced good crops of all kinds of vegetables, and was prepared without any offensive or unhealthy odour.

Dr. Paul said the works at Leamington were satisfactory, as far as the eye went, but it was illusory. Only about one-fourth of the manure was taken from the water, though it seemed perfectly clear. Four per cent. of ammonia was the only component in the manure produced at Leamington which was of any value, and at places where much manure was produced, it was sold at from 6d. to 2s. per ton. With regard to the question of profit and loss, he held that the towns must be expected to pay for getting rid of their refuse, and the real profit was the improvement of the land. He did not see the greater danger to health of spreading the sewage on the land than of pouring it into the water we drink.

Mr. Rumney said it had been stated that either irrigation or filtration must be adopted. This he denied, and explained a plan which is being adopted under the Artisans' Dwellinghouse Act at Manchester which he thought preferable to either.

Mr. Hope, of the Barking Sewage Farm, joined issue with Mr. Barry, and defended the judicious use of liquid sewage, and said that where it had parted it was due to mismanagement.

Mr. Stanford compared a company looking for profit from the deposit of sewage to a ferret watching one hole of a rabbit burrow while the rabbit ran out of the other. Irrigation was not adapted to all towns, and he thought it better to make sewage solid by mixing it with something else, and carrying it away, as in Manchester.

Admiral Belcher said that in China and Malay the excreta is allowed to be in proximity to the houses, but no malaria resulted; but if water was allowed to flow over it, fermentation would ensue, and bush fever would follow. The drainage system which we have adopted robbed the land of the fertilising salts, and conveyed them to the rivers. He was the originator of the Thames Sewage scheme, and he had suggested that the outlet should be extended through Essex, and be delivered by the River Crouch into the German Ocean.

Mr. Barry said he was afraid the dry system mentioned as in operation at Manchester would not answer, because of the difficulty of administration, and the annoyance and danger of carrying the excreta through the houses.

SEA-GOING SHIPS.

BY MR. C. W. MERRIFIELD.

MR. MERRIFIELD read extracts from the report of the committee on the state of knowledge of stability and sea-going qualities of ships. The report treated at considerable length on the rolling of ships in still water, followed by an account of the mechanism of waves and an abridgement of what is known on the subject of the rolling of ships in wave water. The report itself being, in reality, a very condensed abstract of our existing knowledge, it would be difficult to make a useful selection for reading. Meanwhile, it may be stated in general terms that the rolling of a ship in still water, and her behaviour in a seaway, although interdependent, involve very divergent conditions. It seems that the chief point to attend to to secure easy rolling is that the natural period of the ship's oscillation should not coincide, or nearly coincide, with the period of the waves, and there seems reason to suppose that we already know how, in a rough way, to influence the natural periodic time of the ship, so as to be able to predict nearly in what waves she will and in what waves she will not roll through excessive angles and with excessive quickness. But our knowledge is exceedingly crude and deficient in detail, and even our known means of observation of the height and form of waves are very unsatisfactory. He also read several reasons by Mr. Froude for not agreeing with the committee.

THE Duke of Cambridge has conferred the new appointment of military controller in the Chatham district on Assistant-Commissary-General W. Fulford Adams, who has entered on the duties of the office. Assistant-Commissary-General Thomas E. M'Clintock, who had previously been named as having received the appointment, has been ordered by the Field-Marshal Commanding-in-Chief to assume the duties of paymaster only for the Chatham district.

IMPROVED HARVESTING MACHINE.

BY MR. J. T. GRIFFIN.

FIG.1.

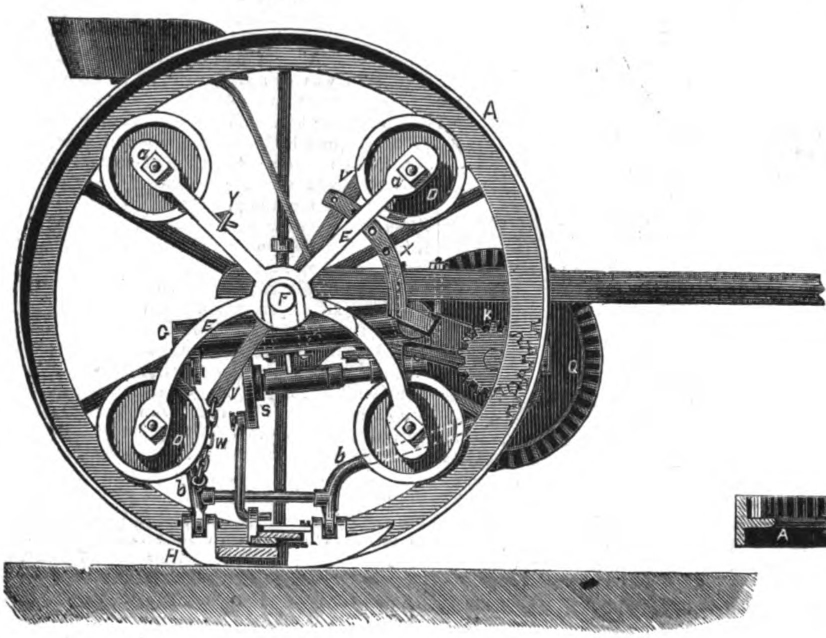
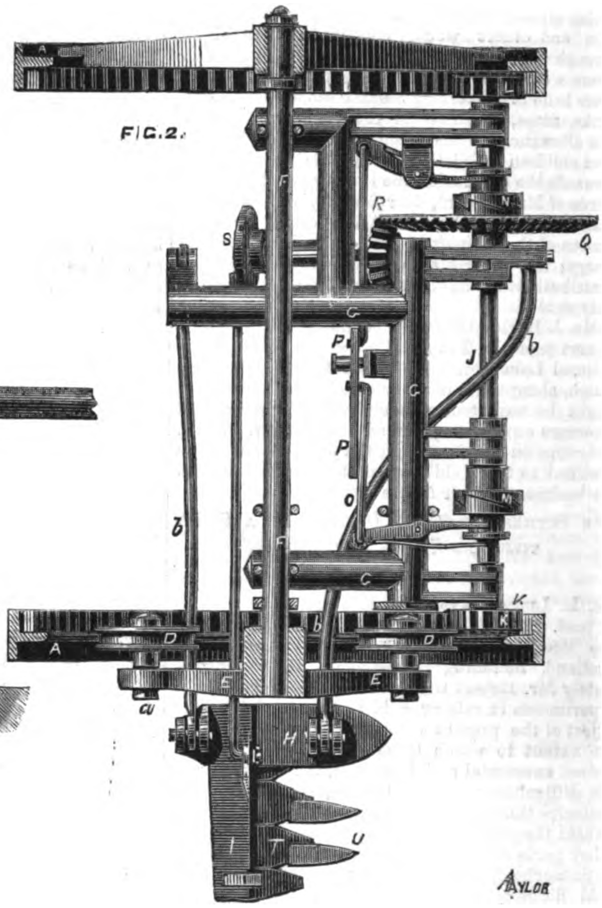


FIG.2.



IMPROVED HARVESTING MACHINE.

THE principal feature of the invention we are about to describe is an improved arrangement of the frame and parts connected with it in machines in which the finger beam is fitted in a line with the axle of the main driving wheel. The finger beam and cutters are connected to bars or supports which pass through one of the main driving wheels, which is supported upon rollers attached by bars to the main axle. The main axle is rigidly fixed to the frame. The driving wheels are each made with an internal rib or feather; the rollers bear upon or against the rib of one of the wheels; the insides of the rim of the wheels are formed with teeth for pinions to work in, which drive or operate the cutters.

The bars or supports for the finger beam are jointed to the main frame, so that they can be raised and lowered by means of a chain and lever placed within reach of the driver, in order to regulate the height of cut, the lever being held in place by a bolt passed into holes in a quadrant. The axle on which the pinions are mounted is furnished with two clutches, the forks of which are connected to one hand lever, so that both can be thrown into and out of gear simultaneously. The shoe of the finger beam is jointed to the supporting bars, in order that it, with the beam and cutters, can be turned on end when the machine has to be moved from place to place. The pitman and cutters are driven in the usual manner.

The invention has been patented by Mr. J. T. Griffin, of 77, Upper Thames-street, London. In our engravings, fig. 1 is a side elevation of a harvesting machine constructed upon this principle; and fig. 2 is a plan view of the working parts, with the main bearing wheels in section. A A are the wheels, upon which the whole weight of the machine is borne, and by which the mechanism is caused to act as the machine travels. The inside of one of the wheels has a rib or feather C for running upon rollers D D, which are pinned upon axles *a a* of a frame E fixed on one end of the main axle F; this axle carries bars or connections G G, to which the rods *b b* for supporting the shoe H and finger beam I are fastened, and which are in a line with the main axle. There are projecting pieces on the front of the bars G G for carrying a shaft J, upon which are mounted the two pinions K L, which receive their motion from the teeth of the wheels A A; each end of the shaft J is provided with a clutch arrangement M N and levers O P, so that one movement of the lever P throws both of the clutches into or out of gear as required. The upper end of the lever P is brought within reach of the driver, so that he has perfect command over the working of the machine. The shaft J has a bevel wheel Q mounted loosely upon it, and when the clutches are in gear this wheel Q acts upon the bevel pinion R and causes the pitman S to revolve, whereby the cutters T T are drawn to and fro in the beam I in a rapid manner, and by their working in slots formed in the fingers U the grass or other crop is operated upon and severed from the roots.

The height at which it is determined to cut the crop above the ground is regulated by the lever V, which is connected to the shoe H by a chain W. The upper end of the lever works in a quadrant or rack X, and on a bolt being passed into one or other of the holes in the quadrant the lever is held secure. The rods *b b* are pinned or jointed to the shoe H, so that the shoe and finger beam may be turned up in a vertical position to enable the machine to pass through gates or narrow passages into the field in which it is desired to work it. When the finger beam is in a vertical position it is held secure by a spring catch Y, fitted to one of the arms of the rollers D D, and by the clutches being out of gear the main wheels and their pinions rotate without communicating the motion to the cutting mechanism.

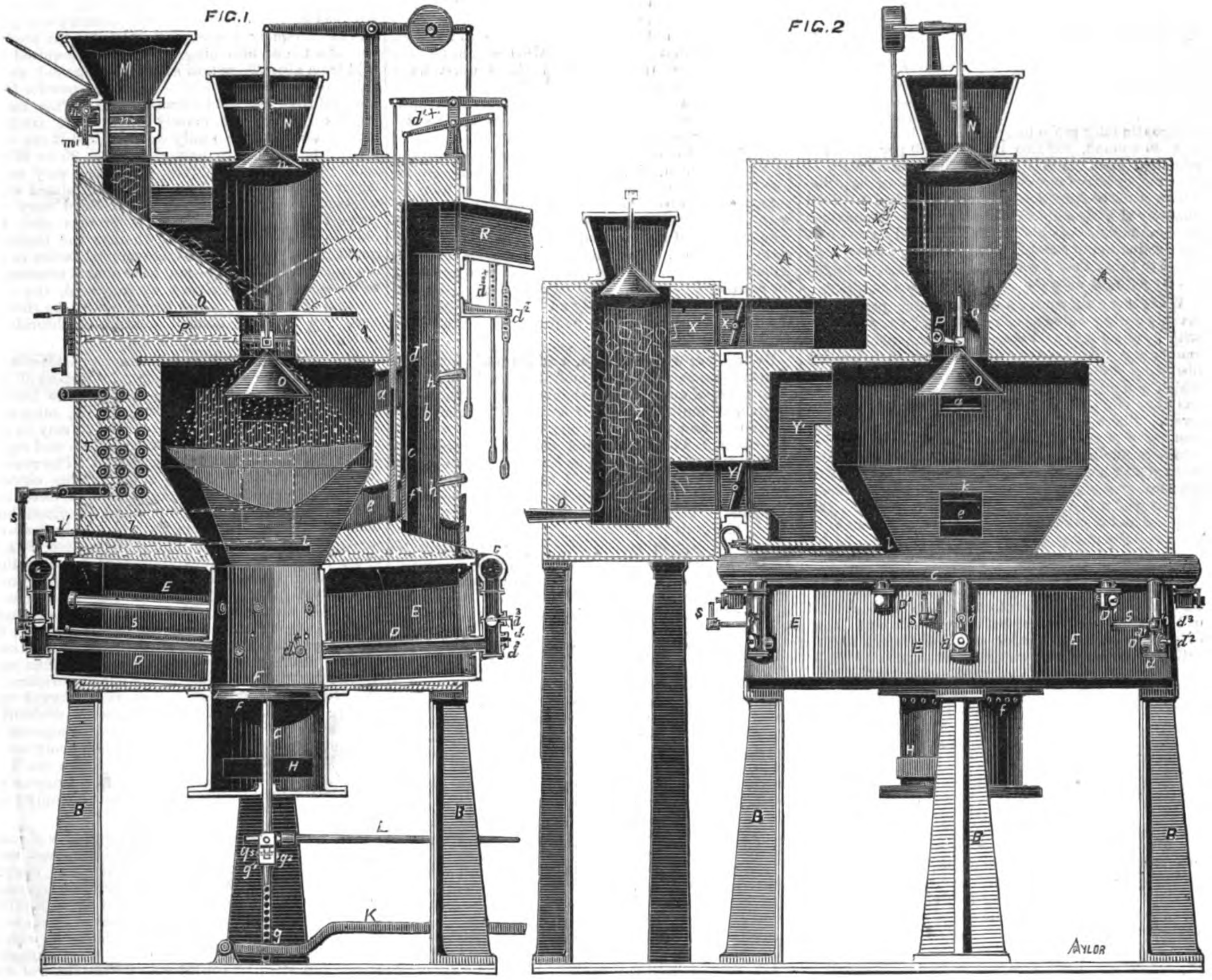
APPARATUS FOR PRODUCING COMBUSTIBLE GASES.

MR. G. H. BENSON, of Staleybridge, and Mr. W. G. Valentin, of the Royal College of Chemistry, have patented some improvements in generators for producing combustible gases. These generators are applicable to various kinds of fuel, but our engraving shows at fig. 1 a transverse vertical section of a generator for free-burning non-caking coals, fig. 2 being a longitudinal vertical section of the same with the purifier attached. It is a close apparatus A A, consisting of a casing of wrought-iron plates supported on cast-iron standards B B about 6ft. from the ground, and lined with firebrick, a bed of sand being placed next the plates to keep all gastight. The air to support combustion is supplied in the form of blast produced by a blast engine, and is brought from the engine by a pipe to the air main C C. This air is heated by the waste heat of the furnace. From the air main C are separate connections to each of the tuyeres D D [1], which are placed at equal distances round the generator. These tuyeres are strong wrought-iron pipes fitted into cast or wrought-iron boxes E filled with water. These boxes may be either open or close vessels, and are in connection with a reservoir, which will supply the water evaporated from them. These boxes form the lower portion of the generator in which the carbonic oxide is produced. The lower tuyeres D or "soder" tuyeres act on the partly burnt coke and ash, and reduce it into a semi-pasty-like mass, called "solder," which will run away into the lower portion of the cylindrical chamber and allow fresh fuel to fall to the tuyeres. The top row or gas tuyeres I [1] convert the coke into carbonic oxide and act freely, as solder will not have time to form and obstruct them, but should any form, it will be rapidly pressed down by the fuel above aided by the action of the tuyeres below. A portion of the gas made below is ignited by the air from these gas tuyeres, but is converted again into carbonic oxide by passing through the layer of hot coke above the gas tuyeres.

In the generator there are six top tuyeres and six bottom tuyeres placed at equal distances round the generator, but not in a line above each other. The tuyeres pipes at the outside of the water boxes turn up, and at the angle are placed boxes *d d* for holding any solder that may stick to the poking bar on withdrawing it after poking the fire. This requires to be done about once every fifteen minutes. These boxes *d* can be emptied through the sliding door below. The top tuyeres do not require these boxes, as any solder that may be formed may be pushed inside. The poking bars are introduced through a sliding door d^1 at the end, or by withdrawing a plug d^2 in the door d^1. Each tuyere is provided with a separate tap or valve d^3, so that the volume of air can be changed and regulated as may be required. Where the tuyere pipes touch the fuel they may be contracted by a nozzle d^4, which can be easily removed from the outside through the tuyere pipe when not required. The refuse ash, clinker, or "solder" made by the melting of the dirt in the fuel falls from the tuyere mouths on to the movable plate F, and when the space is filled with a fused mass which impedes the working of the solder tuyeres, the plate F is lowered 2in. by altering the position of the peg *g* in the rod G a hole higher so as to let the plate down.

APPARATUS FOR PRODUCING COMBUSTIBLE GASES.

BY MESSRS. G. H. BENSON AND W. G. VALENTIN.



In about twenty-four hours, the whole space in which the plate F works will be filled up with "solder." The air must then be shut off, and horizontal bars are introduced through the holes *f f* so as to hold up the fuel. The solder can then be withdrawn through the door H, as it will be cold and brittle and will not stick to the smooth iron as it would to brick. The plate F will then be placed in its original position and the bars withdrawn from the holes *f* and all made tight by means of a closely fitting door, and the generator will again be in working order.

In the usual generators the operation of clearing away the solder causes considerable interruption several times a day, but in this generator it is effected in a few minutes, leaving the generator quite free from solder, except a thin layer to protect the movable plate F. This plate is provided with a scraper I to keep the plate in position and to scrape off any pieces of solder which might otherwise fasten the plate for a time against the tuyere boxes and thus impede its free working. The plate F can be easily moved up and down by means of the lever K, so as to break up any holes in the hot fuel and prevent the air from passing through the coke without forming gas. It will also prevent any solder from sticking to the boxes E, which would cause the fuel to remain up and not fall gradually to the blast. The movement of the plate F will thus save poking the fuel above, which is an evil, inasmuch as it disturbs the action of the slow distillation. Just above the pin *g* the central rod G of the plate F is divided into two parts, and is fitted together by a socket joint [1], so that by withdrawing the connecting pin *g* [2] it can be turned round by a lever L fitted into a projecting pin *g* [3] on the socket *g* [1] so as to bring a different surface of fuel to the action of the blast. The bottom plate F can be made to revolve once every hour, and when it is wished to stir the fuel the pin *g* [2] can be inserted and the plate F can be raised once or twice; but in practice, with the right sort of fuel (and if the tuyeres are kept open) this is very seldom required.

The fuel is fed into the generator either by a hopper and plug arrangement, as at N, or by a feeding apparatus M, which consists of a rotating wheel *m* fitted with wings, and made to rotate in a box or cylinder at the bottom part of a hopper, so that at every sixth part of a turn of the feeding wheel *m*, a portion of the fuel will be dropped into the generator. The wings of the rotating wheel fit at the bottom gastight, and are fixed on a shaft which carries on its end a worm wheel *m* [1], which is driven by a worm *m* [2] fixed on a shaft driven by the engine. By this means a regulated and continual stream of coal is always dropping into the generator. The hopper and plug arrangement seen at N is not used, except when first starting the generator or for letting in large quantities of fuel at a time. It is provided with a close top to prevent the gas from escaping when the plug *n* is lowered. The fuel from the feeder falls on to a conical plug O, which will spread it equally all round the generator on the surface and to the outside of the previously filled fuel. This plug is moved up and down by means of a rod P provided with a lever which acts on the stem of the plug O. The outer end of the rod P is provided with handles for turning it, and is fitted with a ratchet and catch to hold it in position. The plug O is moved backwards and forwards laterally by means of a rod Q.

The fuel inside the generator forms a sort of circular inclined plane or hollow inverted cone, the lower portion of which is being slowly distilled off and gradually sinks to the hot fuel in the centre, the fresh added fuel taking its place at the top of the plane. The raw fuel by falling to the outside prevents the air from stripping up the sides and so lighting the gas at the surface; it also prevents the brickwork from being eaten away. The hydrocarbon and carbonic oxide gases are passed direct to the main pipe R or through a purifier, which we shall presently explain. When sent direct to the main R, the gases escape by the opening *a* into a vertical flue *b*, which opening *a* may be closed by a valve *c* worked by the rod *d*[a] and lever *d* [1a], and may be held in position by a pin *d* [2a] in the pendent rods *d* [3a]. Below the surface of the fuel there is another exit aperture *e* provided with a valve *f*[a] which is worked by the same rod and lever as the valve *c* above. This lower aperture *e* is called the carbonic oxide flue, and it is used when the top fuel is becoming too much burnt through, or to stop a sudden flush of gas. Should a sudden evolution of gas occur, these evils are prevented without stopping the volume of gas or arresting the blast or stopping the action of the feeder. This is effected by simply raising the rod *d*[a] and shutting the top fuel *a*, at the same time opening the bottom flue *e*, and thus forcing the gases to descend through the hot fuel, whereby the tarry matters being obliged by pressure to descend will be converted into gas, and the flame will be clear and the volume of gas the same in the furnace as if nothing abnormal had occurred. When the sudden flush of gas is over, the valves are replaced as before and all goes through the opening *a*.

In addition to the valves *c* and *f*[a], there are stop valves *j k*, worked by a lever and rod for regulating the amount of gas to the furnaces. The two flues *a e* being exactly of the same size, each can be partly closed without interfering with the action of the carbonic oxide valve arrangement. The upper part of the generator forms a reservoir for gas, and thus prevents intermittent supplies of gas to the furnaces, if from any cause the generator should cease temporarily to produce the regular supply. It also keeps the tarry matters in the generator, and prevents it from filling the pipes and choking them. Poking holes *l l* are made in the form of long slits, and are placed at various heights in the generator. These holes or apertures are provided with air pipes *l* [1], the blast from which will prevent the escape of gas through the holes and will protect the hand of the workman from the flame that would otherwise issue. Steam can also be introduced by the pipe S, and this steam may be superheated by passing it through pipes built into the brickwork as at T.

THE attempts to employ naphtha as fuel have at length proved successful. On July 31 a train arrived safely in Kutschujan, 81 versts from Charkoff, whose engine was heated with raw naphtha instead of coals. The honour of the invention is ascribed to the mining engineer Portzki.

ON THE MANUFACTURE OF CHLORINE BY MEANS OF PERPETUALLY REGENERATED MANGANITE OF CALCIUM.*

BY MR. WALTER WELDON.

SINCE the last meeting of the British Association chlorine has begun to be manufactured extensively by a process which depends on the production and perpetual regeneration of a compound no mention of which, so far as I can find, as yet exists in chemical literature. As this process, besides thus producing and continually reproducing what I believe to be a new compound, reduces by fully 80 per cent. the principal item in the cost of the manufacture of chlorine, greatly increases the quantity of chlorine which can be practically obtained from a given quantity of hydrochloric acid, and, moreover, enables the manufacture of chlorine to be carried on without the production of any offensive residue, I have ventured to think that a very brief account of it might not be without interest to this Section.

What has hitherto been the ordinary process of manufacturing chlorine consists simply in digesting with hydrochloric acid ores containing peroxide of manganese. The reaction which takes place, besides liberating chlorine, produces chloride of manganese, which remains behind in solution after the chlorine has gone off, and has hitherto been usually thrown away. There have been proposed and tried a great number of processes for transforming this chloride into peroxide for use over again, but the only one of them which has met with the slightest measure of practical success, prior to that which is the subject of this paper, is the one which is known, from the name of its inventor, as Dunlop's process. Dunlop's process decomposes the chloride of manganese by heating its solution, under a pressure of from two to four atmospheres, with milk of carbonate of lime, and then, in the dry way, transforms the resulting carbonate of manganese into a mixture or compound of two equivalents of peroxide with one equivalent of protoxide, by subjecting it for 48 hours to the action of air at a temperature of about 600deg. Fah. The product of Dunlop's process is a sufficiently satisfactory one, containing about 72 per cent. of MnO^2; but the process requires a very formidable amount of apparatus, and in this and other ways is so costly that its use has never extended beyond a single firm of manufacturers.

Three years ago I began to endeavour to work out the idea of decomposing by either lime or magnesia the chloride of manganese in the residual liquors of the chlorine manufacture, and then blowing air through the resulting mixture of hydrated protoxide of manganese with solution of chloride of calcium or of chloride of magnesium, as the case might be. I took for granted that one-half of the protoxide of manganese so treated was the largest proportion of it that could thereby be converted into MnO^2—in other words, that one could obtain only sesquioxide by this method; but it was soon found that, when using lime to decompose the chloride of manganese, considerably more than half the protoxide operated upon was frequently converted into MnO^2. It was found eventually that more than half the protoxide was thus peroxidised only when more lime was used than simply the quantity necessary to decompose the chloride of manganese, and when what was treated with air was thus a mixture of protoxide of manganese and lime; and it was also found that in all such cases there was a definite relation between the quantity of lime associated with the protoxide of manganese and the quantity of the protoxide, in excess of half, which became peroxidised. This led to the discovery that whereas when protoxide of manganese by itself is treated with air in the wet way one-half is the maximum proportion of it which can thereby be converted into MnO^2, the association of a certain proportion of lime with the protoxide so treated will enable the whole of it to become converted into MnO^2. It is to this fact, together with that of the much greater rapidity with which protoxide of manganese can be peroxidised by treatment with air in the wet way when lime is present than when lime is not present, that the practical success of the new method of manufacturing chlorine is mainly due.

The action of lime in increasing the proportion of protoxide of manganese which can be peroxidised by treatment with air in the wet way evidently consists in the lime substituting itself for that part of the protoxide which, when protoxide of manganese not having any other basic substance associated with it is treated with air in the wet way, does not undergo peroxidation. It would seem that the production of MnO^2 in the wet way, by direct combination between hydrated MnO and atmospheric oxygen, absolutely requires the presence of a base with which the MnO^2 can combine as it forms. When protoxide of manganese, not having any other basic substance associated with it, is treated with air in the wet way, a part of the protoxide itself has to act as the required base; and this is the reason why, in that case, not more than half of the protoxide can become peroxidised, the other half being required to combine, as MnO, with the half which becomes converted into MnO^2. When, however, the protoxide of manganese which is treated with air in the wet way has lime associated with it, the MnO^2 which forms (or a part of it, according to the proportion of lime present) combines with CaO instead of with MnO, thus leaving free to undergo peroxidation that part of the MnO which, but for the presence of the CaO, this MnO^2 must have combined with, and which would thus have got locked up in a state in which it would have been incapable of being peroxidised, at least in the wet way and by air alone. Hence, the presence of enough lime to take the place of that half of the protoxide which, if no lime were present, would have to go into combination as base, and also to supply enough base for that half itself to combine with after undergoing peroxidation, will enable the whole of the MnO operated upon to be raised to the state of MnO^2. The minimum quantity of lime which is enough for this purpose is an equivalent for each equivalent of MnO operated upon, or the quantity necessary to supply an equivalent of lime to all the MnO^2 which can be produced by the peroxidation of all the MnO.

By treating with air, then, a mixture of protoxide of manganese and lime suspended either in water or in solution of chloride of calcium there is formed a compound containing MnO^2 and CaO in the proportion of an equivalent of one to an equivalent of the other. This compound may be regarded as sesquioxide of manganese, or Mn^2O^3, the MnO in which is replaced by CaO. I call it manganite of calcium, and believe it to be a new compound. Gorgeu, in 1862, described a compound which he called manganite of calcium; but his compound contained five equivalents of MnO^2 per equivalent of CaO, and the CaO in it was so feebly combined that it readily decomposed chloride of manganese. My compound contains only one equivalent of MnO^2 per equivalent of CaO, and has no action upon salts of manganese.

This compound has now been produced and reproduced to the extent of some hundreds of tons. The process of producing it and applying it to the manufacture of chlorine is conducted as follows:—The residual liquor which remains after a charge of manganite has reacted upon hydrochloric acid in any suitable still is run from the still into a well or other receptacle in which it is treated with carbonate of lime, to neutralize any free acid, and to decompose any sesquichloride of iron or sesquichloride of aluminium, which may be contained in it. The neutralized liquor is then pumped up into an elevated cistern, in which it is left at rest for a few hours in order that it may deposit certain solid matters which it now holds in suspension. The most abundant of these is usually sulphate of calcium, due to the somewhat considerable quantity of sulphuric acid which is nearly always contained in the hydrochloric acid produced in alkali works; but there are also small quantities of sesquioxide of iron, derived from the sesquichloride of iron in the hydrochloric acid, and sometimes partly from the lime used in the process, and larger or smaller quantities of alumina and silica, due to the lime. These impurities having deposited, the supernatant liquor, which is a mixed solution of chloride of manganese and chloride of calcium and is now quite clear and of a beautiful rose colour, is run off into another vessel, where there is added to it the quantity of lime necessary to decompose the chloride of manganese in it and nearly an equivalent more. A blast of air is then injected into the resulting mixture, and what was at first a perfectly white mud, all the manganese in which was in the state of MnO, soon becomes a very black mud, nearly all the manganese in which is in the state of MnO^2. This is then allowed to settle for about twelve hours, at the end of which time it has separated into a denser black mud and a supernatant clear solution of chloride of calcium. This solution of chloride of calcium having been drawn off, what remains is ready for use in the still. It is used as mud, without drying, being conveyed to the still by pipes and entering by a hydraulic lute. In the still it meets with hydrochloric acid, from which it liberates chlorine, at the same time reproducing exactly such a residual solution as was commenced with. With this solution the round of operations is recommenced; and so on, over and over again, continually. The samples I exhibit are portions of a charge of manganese which, at the works of Messrs. J. C. Gamble and Sons, of St. Helens—where this process has been worked out, by the liberal cooperation of Lieut.-Colonel Gamble, the proprietor of those works, and the invaluable assistance of Mr. Bramwell, the very able manager of them—has actually generated chlorine, from which bleaching-powder has been made, something like fifty successive times.

Hitherto, the principal item in the cost of chlorine has been that for native peroxide of manganese. Last year, in Great Britain, France, Belgium, and Germany together, there were produced about 120,000 tons of bleaching-powder, which cost, on an average, for native oxide of manganese, not much, if any, less than £5 per ton. My process substitutes for this cost for native oxide of manganese a cost for the regeneration of manganite of calcium not exceeding fifteen shillings per ton of bleaching-powder, being about ten shillings for lime, one shilling for steam, one shilling for wages, and two shillings for interest and wear and tear. Moreover, whereas hitherto, at least in this country and in all but an extremely few exceptional cases, the production of a ton of bleaching powder has required the acid from about 75cwt. of salt, my compound yields chlorine enough for a ton of bleaching-powder from the acid from less than 45cwt. of salt. This larger yield of chlorine is mainly due to the artificial manganite being so easily soluble that it can very readily be caused to neutralize from 95 to 99 per cent. of the acid employed, which is a very much larger proportion of it than can be neutralized when working with manganese ores. A third very important advantage of the new process over the old one consists in this, that whereas the immense quantities of acid which escape neutralization in the old process are usually—and have almost necessarily to be—sent into the rivers, as free acid, the only product of the new process which has to be thrown away is a perfectly neutral solution of chloride of calcium.

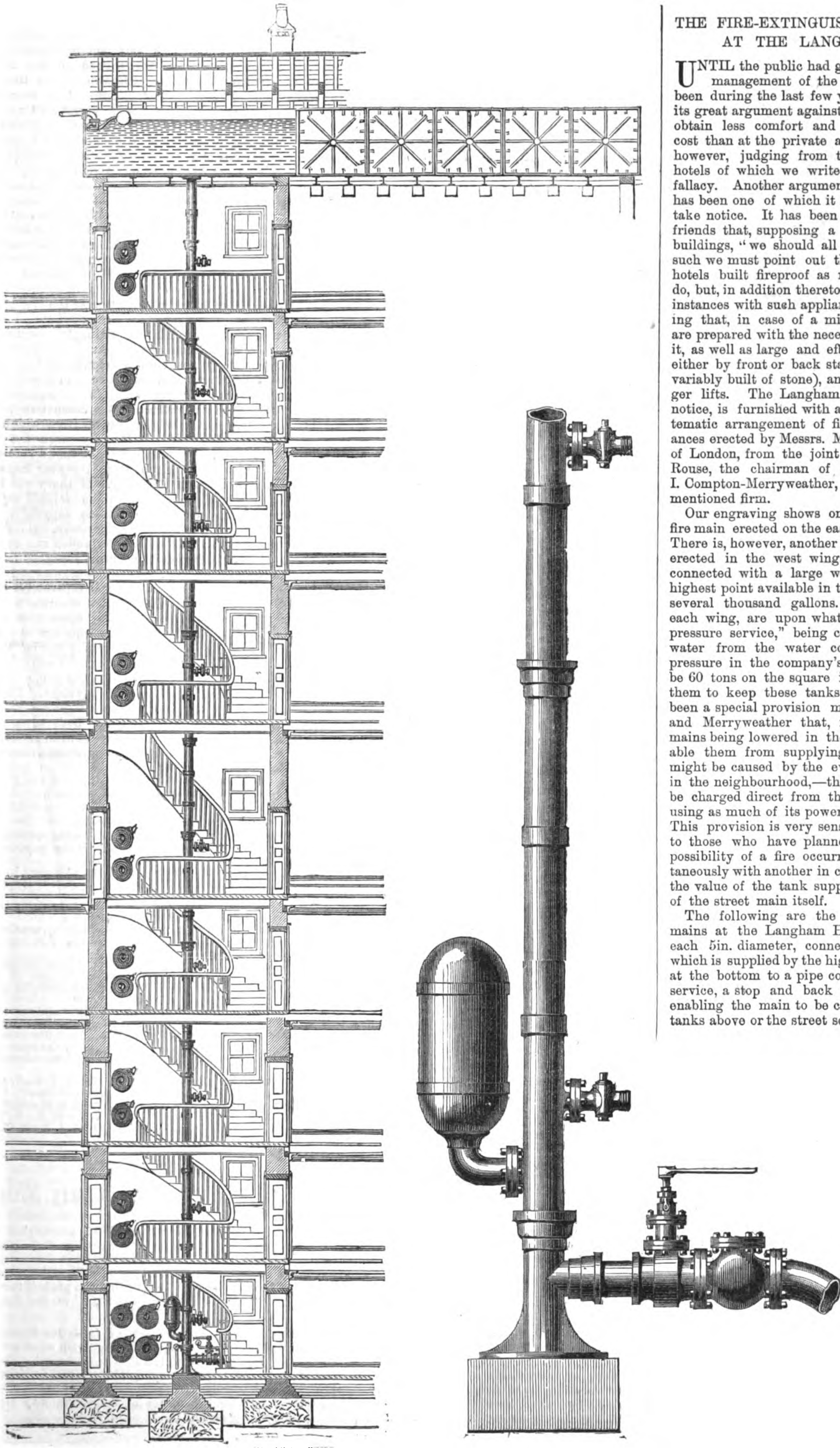
Seeing that manganite of calcium, or $CaMnO^3$, is only of the same value, precisely, in respect of the quantity of chlorine which it can liberate from a given quantity of acid, as sesquioxide, otherwise manganite of manganese, or $MnMnO^3$, it may be well to explain why it is preferable to produce and reproduce the former rather than the latter. The reasons for this are two. There is, firstly, the obvious reason that, when all the manganese is converted into MnO^2, twice as much work is done, per given bulk of material operated upon, as when only half the manganese is converted into MnO^2; and this, of course, would be a very important consideration, even if the transformation of chloride of manganese into manganite of calcium occupied the same time as its transformation into manganite of manganese. Really, however (and this is the second reason), the former operation, in which all the manganese is converted into MnO^2, does not occupy more than one-fifth of the time required for the latter operation, in which only half the manganese is converted into MnO^2; and hence, while the manufacture of chlorine by means of perpetually regenerated manganite of calcium effects the very considerable economy above stated, it is questionable whether chlorine could be manufactured by means of manganite of manganese, regenerated by the same method, more cheaply than by means of manganese ores.

The length of time which, when protoxide of manganese, by itself, is treated with air in the wet way, is required for its complete conversion into sesquioxide, is very remarkable, and the fact that hydrated protoxide of manganese is somewhat freely soluble, alike in water and in neutral solution of chloride of calcium, would seem to have something to do with it. It is a curious fact that the peroxidation of protoxide of manganese by treatment with air in the wet way is greatly retarded by the presence in the medium in which the protoxide is suspended of any proto-compound of manganese in the state of solution. Thus, in a solution of either chloride or any other protosalt of manganese, peroxidation will go on only extremely slowly; and solution of the protoxide itself, which will be present until the very end of the operation when protoxide alone is treated with air in the wet way, has the same retarding influence. On the other hand, when treating with air a mixture of protoxide of manganese and lime suspended in solution of chloride of calcium, there are formed solutions containing peroxide of manganese, in the presence of which peroxidation goes on with extreme rapidity. All these solutions are more or less deeply coloured, solution of the protoxide being without colour. I exhibit a sample of one of the coloured solutions, called by the workmen "the port-wine solution." The nature of these coloured solutions has not yet been fully investigated, but I believe them to consist of manganite of calcium dissolved in solution of oxychloride of calcium.

I may be permitted to mention, in conclusion, that while there is every prospect, from the rapidity with which the new process of manufacturing chlorine has been and is being adopted both in this country and on the continent, that within a period to be measured only by months nearly all the chlorine made in the world will be made by it, there is every likelihood that in nearly all cases a portion of the hydrochloric acid saved by it will be applied to the recovery of sulphur from alkali-waste. The chief reason why the recovery of sulphur from alkali-waste has been so little practised hitherto is that the manufacturers have considered it more profitable to use all their acid for the manufacture of bleaching-powder than to use any part of it for the recovery of sulphur; but the process which I have had the honour to describe will enable them to make even more bleaching-powder than they have made hitherto, and yet have enough acid left to permit of their applying to all their alkali-waste the only process for the recovery of sulphur therefrom which as yet has been found practically successful, and I am able to state that this application of a portion of the acid saved by my process will be extensively adopted.

* Read before the British Association—Section B.

FIRE-EXTINGUISHING APPLIANCES AT THE LANGHAM HOTEL.



THE FIRE-EXTINGUISHING APPLIANCES AT THE LANGHAM HOTEL.

UNTIL the public had gained confidence in the management of the large hotels that have been during the last few years opened in London, its great argument against them was that it would obtain less comfort and attention at a greater cost than at the private and smaller hotels; this, however, judging from the patronage that the hotels of which we write receive, has proved a fallacy. Another argument, none the less pointed, has been one of which it is now our pleasure to take notice. It has been urged by many of our friends that, supposing a fire to occur in such buildings, "we should all be roasted alive." To such we must point out that not only are these hotels built fireproof as much as it is possible to do, but, in addition thereto, they are fitted in most instances with such appliances for fire extinguishing that, in case of a mishap of any kind, they are prepared with the necessary apparatus to meet it, as well as large and efficient means of egress either by front or back staircases (the latter invariably built of stone), and the hydraulic passenger lifts. The Langham Hotel, which we now notice, is furnished with a most efficient and systematic arrangement of fire-extinguishing appliances erected by Messrs. Merryweather and Sons, of London, from the joint designs of Mr. J. L. Rouse, the chairman of the directors, and Mr. I. Compton-Merryweather, a member of the abovementioned firm.

Our engraving shows only an elevation of the fire main erected on the east wing of the building. There is, however, another fire main similar to this erected in the west wing. Each fire main is connected with a large water tank placed at the highest point available in the hotel, and containing several thousand gallons. These tanks, one to each wing, are upon what is termed the "high-pressure service," being constantly supplied with water from the water company's mains. The pressure in the company's mains must, however, be 60 tons on the square inch in order to enable them to keep these tanks supplied. There has been a special provision made by Messrs. Rouse and Merryweather that, in the event of these mains being lowered in their pressure so as to disable them from supplying the tanks—such as might be caused by the event of a fire occurring in the neighbourhood,—the hotel fire main shall be charged direct from the street main, thereby using as much of its power as may be available. This provision is very sensible, and praise is due to those who have planned it, for there is that possibility of a fire occurring in the hotel simultaneously with another in close proximity. Hence the value of the tank supply, and eventually that of the street main itself.

The following are the particulars of the fire mains at the Langham Hotel:—Two fire mains, each 5in. diameter, connected at top to a tank which is supplied by the high-pressure service, and at the bottom to a pipe connected with the same service, a stop and back valve intervening, thus enabling the main to be charged either from the tanks above or the street service direct, as occasion

may require. There being nine floors to the hotel, each has two firecocks, one in each wing. These firecocks have sufficient hose, which, when uncoiled, would reach and meet in the centre of the building, so that into any room upon any floor the hose could be carried to attack the fire in a few seconds. In addition to the fire mains in the east and west wings, Messrs. Merryweather and Sons have erected a fire main with the necessary cocks in the courtyard. These are connected both with the water company's high-pressure main and the fire tanks belonging to the hotel. A fire occurring in the basement would have but little success in materially damaging the building, owing to such a vast deluge of water as would be immediately and judiciously brought to bear upon it.

There are a few other appliances in this hotel which are worthy of notice as instantaneous applicants in the occurrence of a fire, and these are the portable fire pumps. Upon each floor of the hotel are placed three of these pumps charged with water. Hanging by them are two dozen leather buckets, in order to keep up the supply from taps which are connected with the various water supplies of the building. Each pump is placed in a conspicuous position and marked "fire pump," and we congratulate the management of so large a building on placing such useful machines at their patrons' hands. Every person in the building, from the conspicuousness of the fire pump, is aware of its presence, and, in the event of a fire, we feel assured that, from its simplicity, few would fail to fly to it whilst the attendant in charge of the more powerful extinguishing apparatus would be sent for to call it into requisition. In order to prove the simplicity of the fire-extinguishing arrangements at the Langham Hotel, we may mention that the whole is under the control of the engineer who has the charge of the general machinery; and, moreover, its simplicity is such that no person is required to constantly attend it. The Charing Cross and City Terminus Hotels have arrangements somewhat similar, and no one visiting such hotels—especially the Langham—can fail to see that every precaution is taken against fire ever attaining any ascendancy over such fire-extinguishing appliances as this hotel now has. We may here incidentally mention that the portable fire pump so extensively used at the above-mentioned hotels was the design of the late Mr. Wm. Baddeley, C.E., whose name often appeared in our columns in former years, and that there is scarcely a building of any importance but adopts this useful and inexpensive fire-extinguishing appliance. It is stated that seven-tenths or nearly three-fourths of the fires in London are extinguished by this means.

MANCHESTER STEAM USERS' ASSOCIATION.

THE ordinary monthly meeting of the Executive Committee of the above Association was held on Tuesday, July 27, Mr. William Fairbairn, President, in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the past month 203 visits of inspection have been made, and 430 boilers examined, 253 externally, 8 internally, 3 in the flues, and 166 entirely, while in addition one has been tested by hydraulic pressure. In these boilers 71 defects have been discovered, 9 of them being dangerous. Furnaces out of shape, 2; fractures, 20; blistered plates, 13—3 dangerous; internal corrosion, 5; external ditto, 9—3 dangerous; internal grooving, 6; external ditto, 2; water gauges out of order, 3; pressure gauges ditto, 2; boilers without glass water gauges, 1; without safety valve, 1—dangerous; without pressure gauges, 1—dangerous; without feed back pressure valves, 4; cases of over pressure, 1; cases of deficiency of water, 1—dangerous.

On the present occasion Mr. Fletcher reports that six explosions have occurred during the past month, by which four persons have been killed and fourteen others injured. Not one of the explosions in question occurred to boilers under the inspection of this Association. The following is a statement of explosions, from June 26, 1859, to July 23, 1869, inclusive:—No. 25, July 5, plain cylindrical, egg-ended, externally fired, 3 injured; No. 26, July 6, particulars not yet fully ascertained, 1 injured; No. 27, July 9, "breeches," internally fired, 2 killed, 2 injured—total 4; No. 28, July 16, plain cylindrical, egg-ended, externally fired, 1 killed, 4 injured—total 5; No. 29, July 19, two-flue "Lancashire," internally fired, 4 injured; No. 30, July 22, plain cylindrical, egg-ended, externally fired, 1 killed. Total—4 killed, and 14 injured.

No. 25 explosion, by which three persons were injured, but fortunately no one killed, occurred at a colliery at about twelve o'clock noon on Monday, July 5. One of the Association's staff visited the scene of the catastrophe a few days after the explosion, but he was forbidden the opportunity of making an examination, although he stated he was delegated by this Association, and explained the importance of all these catastrophes being fully examined. Thus, though he had travelled upwards of 100 miles from Manchester to examine the exploded boiler, he was not allowed to see it, and was merely able to gather that the boiler was one of the plain cylindrical externally-fired class, and that it was rent in two main fragments, one of which was thrown to a considerable distance, while the roof of the engine house and another building were brought down.

WORKING MEN'S CLUBS AND THE CROSSNESS SEWER OUTFALL.

A VERY pleasant trip was afforded the members of the different clubs of London by the council of the Union on Saturday last. About 180 members met on board the "Black Prince" iron-boat at three o'clock, at the Temple and other piers down to Blackwall, for a visit to the outfall at Crossness, where they were received by Mr. F. E. Houghton, the engineer in charge, who conducted them over the works, first visiting the schoolroom and then the boiler and engine houses. The whole arrangements of machinery and apparatus employed for lifting the sewage from a very low channel into the reservoir were explained by Mr. E. Hall, F.S.A., who went with the boat and explained on the passage the nature of the works by the aid of diagrams, &c., which materially lightened his labours when they landed. The expression of surprise of some of the members at seeing from the upper floor of the engine house such ponderous masses of iron in a state of motion is something to be remembered. The workmen were distributed over the buildings, and the freedom with which they answered inquiries showed the great pleasure they felt in the visit. The cottages were also visited by some of the members, and the delight exhibited by the wives and children, all neat and trim, caused the day to be one of pleasure to them also.

On the return Mr. Hall desired to go over the Northern outfall at Barking, and preparations were made on shore for their landing, but an objection on the part of the captain, who feared the safety of the boat on the mud and a falling tide, caused a disappointment to be felt. This soon passed away on the matter being explained by Mr. Hall.

The boat then continued on her way to town, and congratulations were exchanged by the members to one another, and thanks voted to Mr. Hall for his exemplary conduct on this and former occasions. The members landed at their respective piers as the boat arrived. The next visit will be to Barking, where Mr. Hall has promised to attend.

WE are enabled to contradict in the most decided manner, says the "Army and Navy Gazette," the rumour which is afloat that Mrs. Childers and family are embarked on board the "Agincourt." The comforts of the First Lord of the Admiralty would, doubtless, not have been lessened by the presence of his "belongings" during the cruise he has undertaken with a view of increasing the efficiency of the officers and seamen of our two principal squadrons, but he is too desirous of inculcating discipline by showing that, if he forbids admirals and captains to take their wives to sea, he is himself ready to set a good example. Mr. Childers is accompanied by his son, who, we believe, will be the guest of Captain Burgoyne. We have reason to believe that the rules of the service will be thoroughly maintained by the First Lord, and there is no likelihood, while he is in power, of any relaxation occurring.

Legal Intelligence.

AN ALLEGED INFRINGEMENT OF DESIGN.

AN action, brought by Messrs. Minton and Co., of Stoke, against Messrs. Adams and Scriveners, of Longton, Staffordshire, was settled on the 27th ult., by the stipendiary magistrate, Mr. Davis. The supposed infringement consisted in placing upon cups and saucers a design corresponding in form or ornament to that registered by Messrs. Minton. In the course of an elaborate and lengthy judgment, Mr. Davis said no one would be inclined to withhold the attributes of extreme beauty and grace to the complainants' cups and saucers as works of art, or to deny the moral right of the original designer to a monopoly of production for a limited time, as a reward for the genius, skill, and labour involved in the production. There was a general close resemblance between the complainants' cups and saucers and those made by the defendants; and some of the details warranted the inference that there had been a servile imitation of the ivy leaf, for instance, the fibres, so characteristic of the ivy, represented on the complainants' manufacture, both on the cup and saucer, were found in corresponding places on the defendants' cup and saucer, emerging from the shamrock in a way certainly not seen in nature. The complainants sought to secure copyright in the distinctive pattern existing on the original saucer from which a photograph was taken, but they were not at liberty to prove by verbal evidence that a pattern existed upon it in a given form, however imperfectly represented in the copy. If there was no pattern distinctly represented in the certified copy, there could be no valid claim to copyright in respect to such pattern. He, therefore, held that the complainants had failed to establish any copyright in the pattern on the saucer, designed from the pattern on the cup. As to the argument that registration of the cup and saucer separately was not necessary, Mr. Davis held that separate registration was necessary where the same identical design was not applied to both cup and saucer, which was the case here. He was of opinion that the affixing the mark denoting a registered design to the saucer was not, as regarded the cup, a compliance with the conditions of copyright. There should have been, if not separate registration, at all events separate marking on both cups and saucers, and the saucer being defective in registration, and the cups in marks, the information could not be sustained.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166 Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—R. E.—J. R.—G. W. H.—E. T. I.—T. C.—J. B. and Co.—H. E. S.—R. S.—W. G. F.—H. H.—C. P. C.—G. L. and Co.—I. T. C.—D. T.—E. G.—J. P. M.—S. N. A.—O. C. E.—G. W. H.—F. H.—H. T. O.—H. B.—R. T.—J. R. B.—J. T. S.—G. B. W.—H. E. T.—W. J. B.—L. C. M.—J. R. K.—E. T. H.

Naval, Military, and Gunnery Items.

WE have heard through a reliable source that the challenge of Mr. Ashbury, the owner of the yacht "Cambria," has been accepted by Commodore Bennett, of the American yacht "Dauntless," and that the race is to be held during the present month of September, across the Atlantic, to the Sandy Hook Lighthouse.

THE Royal Commissioners on Irish Sea Fisheries commenced their inspection of the Irish coast on the 24th inst. at Waterford. The Admiralty have placed the Royal steam yacht "Vivid," Captain Sullivan commanding, at the service of the Commission, so that the means of inspection may be as perfect as possible.

At a banquet in the City Hall, Perth, Mr. W. E. Baxter, M.P., in replying to the toast of "The Navy," said,—We live in a period of changes, and one of the changes introduced by the present Government was the infusion of a little mercantile experience into the great spending departments of the State. They were convinced that considerable economies might be effected altogether apart from the question of reduction of force. Some of you, no doubt, are aware that the Navy Estimates for the present year were nearly a million less than they were for the year before. That saving represents about a penny sterling per pound income tax. Perhaps in February next you will find that something substantial yet remains to be done in the same direction. Don't, however, for a moment suppose that we are sacrificing efficiency. To keep scores of useless clerks, to fill warehouses with several years' supply of deteriorating stores, to retain at great cost hulks which never can be sent to sea, and which ought to be sold or distributed among the various ports as training vessels, to encumber the dockyards with old materials, and multiply offices for the sake of patronage, are not the best methods of promoting the efficiency of our fleet. The Board of Admiralty, while determined with a fearless hand to put an end to profuse expenditure and jobbery, are at the same time fully conscious that this great nation takes a pride in its navy, and is desirous that in no respect it should suffer from any fault of ours.

The return stating the wrecks, casualties, and collisions occurring to British ships abroad, reported to the Board of Trade in 1868, shows that 935 vessels, of 337,281 tons in the whole, were totally lost or partially damaged; 657 vessels belonging to the United Kingdom, and 278 belonging to British possessions. 680 vessels, of 252,484 tons, were totally lost, and 255, of 84,797 tons, partially damaged. 1,387 lives were lost, 1,187 from vessels belonging to the United Kingdom, and 200 from vessels belonging to British possessions; 12,183 lives were imperilled, but saved by remaining on board, or by assistance from shore or from other ships. Of the lives lost 159 were by wrecks, &c., on the coasts of Europe, 27 on the coasts of Asia, 18 Africa, 82 America, 80 Australia and New Zealand, 1,021 at sea. Of the 935 British vessels thus reported in 1868 as lost or damaged abroad, 229 were barks, 180 brigs, 96 brigantines, 16 cutters, 1 dandy, 9 ketches, 1 lugger, 126 ships, 84 steamships, 172 schooners, 2 sloops, 8 smacks, 9 snows, 1 yacht, 1 unknown. So far as regards casualties on the shores of India and the other British possessions abroad, a return is given which includes foreign as well as British ships, and shows that in the year 1868 237 British vessels, of 64,709 tons, were totally lost on those shores, and 22 British vessels, of 3,877 tons, were partially damaged; and 17 foreign vessels, of 5,452 tons, were totally lost, and 12, of 4,156 tons, were partially damaged. 277 lives were lost, 199 belonging to British vessels and 78 to foreign vessels. Thus the total loss of life reported in 1868 was 1,465, being 195 less than in the return for 1867, and 439 less than in the return for 1866. Of the lives lost 708 are due to vessels sailing and not heard of afterwards, 333 to vessels foundering, 309 to vessels stranding, 14 to vessels being burnt, 4 to exhaustion and exposure to cold, 22 to falling or being washed overboard, 61 to falling spars or wreck, falling from aloft, or collisions, 13 to boats or ships capsizing, 1 cause unknown; 1,301 lives lost were those of the crew, 164 of passengers. A return for the coast of New South Wales arrived too late to be included—it shows 28 casualties, and 71 lives lost. This annual return of the Board of Trade is to be regarded as still incomplete, many wrecks are not reported; but it is hoped that the return will gradually become more accurate, regular, and trustworthy.

Miscellanea.

A company has been formed for working coal mines in the communes of Bray-Maurage and Boussoit.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending August 28, was 4,414. Total number since the opening of the Museum, free daily (May 12, 1858), 1,631,397.

Among the prizes offered by the St. Ann's Industrial Society, Jamaica, at the Third Exhibition, August 4, was one "For the field labourer who can produce the best certificate and who has worked no less than 180 days in the year ending June 30, 1869, £1."

The Suez Canal Company has just issued regulations for the navigation of the Suez Canal, to be opened on November 17 next. Art. 1 states that the navigation of the Suez Maritime Canal will be open to all ships without distinction of nationality, provided their draught of water does not exceed 7½ metres, the depth of the canal being 8 metres, equal to 26 English feet.

A geological congress is this week holding meetings at Catania, in Sicily. The proceedings will continue for four days, the fourth to be devoted to the ascent of Mount Etna, and a conference at the mouth of the crater. Catania has been often desolated by the eruptions of Mount Etna; one of these, of which we have an authentic record, took place 425 years before Christ.

The number of visitors to the South Kensington Museum during the week ending August 28, 1869, was—on Monday, Tuesday, Thursday, and Saturday (free), from 10 a.m. to 10 p.m., 17,481; Meyrick and other galleries, 17,387; on Wednesday and Friday (admission 6d.), from 10 a.m. till 6 p.m., 797; Meyrick and other galleries, 90; total, 35,705. Average of corresponding week in former years, 17,127. Total from opening of Museum, 8,753,613.

Within the last week the western province annual ploughing match has come off at the Cape of Good Hope on a farm named Wolvefontein, about 25 miles from Cape Town. The Parliament suspended its sittings for the occasion. The ploughing was admirably done. The ploughs of Ransomes and Sims, and Howard, both did their work well; but the best ploughing of the day was done by the single furrow plough of Ransomes and Sims, and the best ploughman in the field—in the colony perhaps—who has always carried off prizes before with a Ransomes and Sims' implement, was an unsuccessful competitor now because he was unable to bring his old implement and trained horses into the field.

The great city gas companies are preparing to remove their works from the midst of the crowded localities in which they are now placed, and carry them into the country. The existence of these works in their present position has long been a grave nuisance. The Imperial Company has secured a location in the fields near West Ham; the Chartered on the river bank, near the northern outfall of the great main-drainage system; and the City Company, at Blackfriars, will, it is believed, migrate, in the same direction. It is to be trusted that all the metropolitan gas companies will presently find it to their interest to remove entirely without the boundaries of the thickly-inhabited districts.—"Lancet."

The Board of Trade have awarded an aneroid barometer to Mr. Wm. H. Rowe, channel pilot of Falmouth, for his prompt and gallant conduct in saving life from drowning on the occasion of a pleasure boat being run down on July 28 by the steam ship "Dandy," off Plymouth. The "Dandy" was on an excursion trip to Plymouth, and on returning, when between Drake's Island and the Breakwater, ran into a pleasure boat, which was smashed to pieces. Mr. Rowe immediately jumped overboard, and by giving pieces of the boat to the persons in the water to support themselves by until boats came to their assistance, and by himself supporting a woman and two children who were clinging to her, was the means of rescuing the lives of all the persons who had been thrown into the sea.

On Wednesday week two miners, leaving Rosedale for Cleveland, one of the most lonely parts of the moor, found a gentleman lying head downwards in a ditch, and a bicycle lying upon him. From the marks on the road it would seem that the machine had become unmanageable in a deep rut, and had run over the bank, apparently capsizing with the rider as found. The gentleman was quite unconscious, and had evidently been lying out all night. He was carried to the nearest habitation, some miles distant, and medical aid was obtained. On Thursday it was stated that he had recovered consciousness, and that his main injury was a dislocated ankle. He is a Mr. M'Henry, from Glasgow, who has been "doing" Yorkshire on a bicycle. In the part of the moors where found he might have lain for a month without being discovered in ordinary times. He was subsequently removed to a railway station.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—334, 341, 345, 362, 370, 386, 401, 402

Buildings and Building Materials—314, 320, 330, 344, 356, 399

Chemistry and Photography—318, 336, 355, 368, 373, 375, 376, 385

Cultivation of the Soil, including agricultural implements and machines—339, 342, 369, 373, 377

Electrical Apparatus—306, 340, 390, 391

Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—308, 310, 316, 363, 378, 387, 396, 404

Food and Beverages, including the apparatus for preparing food for men and animals—319, 324, 328, 329, 333, 358, 374, 381, 392

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c.—311, 313, 322, 332, 335, 338, 343, 353, 366, 382, 383, 389, 395, 398, 403

General Machinery—307, 309, 315, 357, 360, 367, 377

Lighting, Heating, and Ventilating—403

Metals, including apparatus for their manufacture—305, 326, 337

Miscellaneous—304, 310, 317, 323, 327, 349, 350, 352, 364, 371, 388, 393, 397

Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—321, 325, 351, 359, 380, 394

Ships and Boats, including their fittings—None

Steam Engines—346, 379

Warfare—348, 354, 361

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304 J. Whyte, Hoxton. *Tailor's scissors, &c.* Dated February 1, 1869.

The blades are constructed as follows:—The upper portion of the shoulder of each blade is formed with a curved projection, which is perforated for the pin or stud on which the blades work to be inserted. The lower portion of one blade has a pin or stud connected to it, the other has a slot in it for the last-named pin to work in, which slot is a segment of a circle struck from the upper pin on which the blades move. The bottom of the finger bow is of a flat form, and in a line with the back of the lower blade, thus enabling the shears to be closer to the table, and preventing, when cutting more than one thickness of cloth, any baggyness or sag in either fold.—Patent abandoned.

305 C. D. Abel, Southampton-buildings. *Casting ingots.* (A communication.) Dated February 1, 1869

A bottom for the mould to rest upon is constructed of cast iron alone, or of cast iron in combination with any suitable refractory material, the bottom being provided with runners or gates sunk below its surface. These runners are either simple grooves sunk into the metal or into the refractory material, or the grooves may be lined with prepared fireclay or firebrick, or any other suitable heat-resisting material. In the centre of this bottom a removable disc of cast iron or firebrick or any suitable material is placed to take the stream of metal as it falls into the centre or "sprue" mould as often as may be necessary. This disc may be replaced, and thus the wear of the main bottom be prevented.—Patent completed.

306 T. G. Daw, Regent-street. *Stereotype matrices.* Dated February 1, 1869.

This consists, chiefly, in the peculiar arrangement of a series of levers, each of which carries a type, and is provided with a finger key whereby it can be depressed independently of the others. These levers are arranged over the table, on which is placed the plastic bed wherein the mould or matrix is to be produced. It is necessary that the type levers should be so arranged together, in relation to a certain point in the plane of the matrix, that each type of the series when depressed will be brought to this point, and the patentee prefers to arrange them in a circle around the said point, all of the finger keys being then in a convenient position to be reached by the operator.—Patent abandoned.

307 J. A. Limbert, Gravesend. *Moving heavy bodies* Dated February 1, 1869.

The inventor forms the fixed wheel with a hole in its centre to fit a concentric portion of the axis or eccentric carrying the movable wheel so as to maintain the fixed wheel in a proper central position with respect to the other gearing, and he forms such fixed wheel with lugs, ears, or projections to fit the frame of the block, which he casts or otherwise forms in one piece. The ears, lugs, or projections on the fixed wheel may be formed so as to clip both sides of suitable parts of the frame, or so that some may clip on one side of some parts with both sides of other parts, or on one side of some parts and others on the opposite side of other parts of the frame.—Patent completed.

308 A. V. Newton, Chancery-lane. *Condensing slivers.* (A communication.) Dated February 1, 1869.

The working surface of the doffer cylinder, instead of being (as is ordinarily the case) cut up into bands to reduce the sliver into ribbons, is formed with a continuous card surface, and the sliver, as it is taken off by the doffer comb, is taken up by endless bands or other equivalents, whose office is to divide up the sliver into ribbons and deliver the ribbons to condensing rollers, which will give to the ribbons a proper amount of consistency to allow of their being wound into a roll ready for transmission to the roving frame. The width of the bands will depend on the width of the ribbons of sliver required to be formed for conversion into rovings. The bands may be brought near enough to the doffer to take up the sliver directly therefrom, or a take-up roller may be interposed between them to deliver the sliver into the bite of the bands.—Patent completed.

309 J. A. Andre Fontaine, Paris. *Hydrostatic hoist* Dated February 1, 1869.

This consists, first, of a tube almost entirely filled with water, called the "hydrostatic tube," in which is plunged (either free or otherwise) a cylinder, which, alternately filled with air or with water, produces by virtue of the hydrostatic principle above named, the ascent and descent of the load platform, with which it is connected by means of a traction rope, which passes in different directions over a system of pulleys. This cylinder is called the "ascender." Second, of a framework called the lift frame, in which the load platform rises and descends, guided by wheels on vertical rails placed on the columns forming the framework. Third, of a system of mechanical arrangements which effect the emptying of the water from the ascender in the hydrostatic tube, and at the same time the filling of the same with air.—Patent abandoned.

310 R. Caunce, Mansfield, M. G. Bradley, and B. Bradley, Nottingham. *Yarn twisting machines.* Dated February 2, 1869.

A tube of metal or other suitable substance is firmly fixed in the top spindle rail of the machine (which rail is a fixed one), and at such a length as to pass through a movable rail called the copping rail, and reaching nearly

to the top of the blade of the spindle, which passes through the tube. This tube is of sufficient strength to form a steady bearing or bolster for the spindle, and also to serve as an axle for the bobbin to revolve upon.—Patent abandoned.

311 C. HOULT, Wolverhampton. *Fireplace screens.* Dated February 2, 1869.

This consists in making, by the use of sheets of glass, transparent, semitransparent, or opaque screens, some of which are highly ornamented on the surface by cutting or being pressed or moulded or silvered at the back to serve as mirrors, or in any other convenient method. It is preferred, however, to use one or more sheets of plain glass, and to apply to the surface intended to be the back thereof any desired ornamental design in gold, silver, or colours, or imitation jewels, or any combination thereof, or to place behind such sheet or sheets of glass any painting in oil, or water, or otherwise, (or photograph plain or coloured), or otherwise glass into a frame of metal or other material, by preference stamped out of sheet metal iron or tinned iron, or they may be cast in copper, brass, or steel, or other material. Some of the metal frames are japanned, painted, or varnished, in such a way that they are themselves of an ornamental character.—Patent completed.

313 J. PROUD, Carlisle. *Basket cars.* Dated February 2 1869.

This consists, first, in fixing the uprights (which may be of iron, wood, or other material) of the basket or wicker work into a bar of wood which is fastened to the frame of the car. By this means, the wicker work is raised a little above the floor or bottom of the car, and prevented from being rotted by any water which may lodge therein.—Patent abandoned.

314 N. VOICE, Handcross, Sussex. *Water-closet machines.* Dated February 2, 1869.

The inventor takes (say) a tube of india-rubber, and encloses it at one part of its length in an outer tube of metal or other suitable material. This outer tube is provided with a boss or enlargement, in which a lever, screw, or other appliance for exerting pressure on the rubber tube is fitted. If the appliance for exerting pressure be a weighted lever, it compresses the portion of the rubber tube which is within the boss, and thereby prevents passage of water through it, but when the lever is raised by any ordinary means, the rubber tube is free to resume its natural form, and to permit the fluid to flow through it. —Patent abandoned.

315 D. JOY, Saltburn. *Oil machines.* Dated February 2, 1869.

This consists, first, in causing the faces between which the oil, seed, or other substance to be pressed lies to act as strainers, by constructing them of a number of ribs or plates, in the form of a grid or grate of any suitable figure or of cubes or polygons placed together, so that through the interstices between such ribs, cubes, or polygons, the oil or other liquid to be extracted may escape while the solid matter is reclaimed, or the inventor uses plates with holes cast, drilled, or punched therethrough, so as to permit of the drainage above named.—Patent completed.

316 S. BROOKE, Brighouse. *Condensed carding engines.* Dated February 2, 1869.

This consists in the application of a series of knives or blades fixed in front of the doffer cylinder at suitable distances apart, and so as to enter slightly into or between the card teeth, also in the employment of a series of combs or "doffing plates." Or one such plate is formed by spaces at intervals, so as to work or reciprocate in betwixt the knives or blades for stripping the film of wool or fibre from the doffer in strips or ribbons. Also a grooved roller placed in front of the knives (which enters therein) to receive and carry the strips of wool or fibre forward therefrom to a pair of grooved rollers, which conduct the same to the ordinary rubbers of the condensing machine. One of these rollers is formed with concave grooves, and the other with convex, or so as to fit in the grooves of the other roller.—Patent abandoned.

317 A. E. HARRIS, Mile End-road. *Artificial teeth.* Dated February 2, 1869.

This consists in cutting away the parts of the plates which correspond to the palate or the bottom of the lower jaw, where the tongue would naturally rest in the act of tasting, and by inserting in the space so cut away a piece of perforated platinum of exactly the same shape as the piece cut away, and consequently filling up its place entirely.—Patent completed.

318 W. I. PALMER, Reading. *Evaporating and calcining.* Dated February 2, 1869.

The inventor employs, first, a shallow pan or hearth, by preference with a concave surface and heated by furnaces or flues. To this pan or hearth he attaches an agitator so fixed and driven as to perpetually rake, stir, or agitate the surface of the thickened liquor by which the rapid evaporation of the remaining aqueous particles is greatly promoted.—Patent completed.

319 W. A. SMITH, Manchester. *Preserving meat.* Dated February 2, 1869.

The inventor uses any ordinary refrigerating apparatus such as the "compressed air," the "sulphuric acid," "the ammonia," or other machines, the construction and use of all of which are well known, but he prefers the first-mentioned, known as A. E. Kirk's machine. When using this machine the inventor takes a tank of any convenient size capable of being covered, and places therein a number of cases made of tin, tinned or galvanized iron, copper, or any such metallic substance, and having placed the meat or substance to be preserved therein, fills it up with water. After this the brine from the refrigerating apparatus is caused to circulate round the cases, by which a solid frozen mass is obtained enclosed in cases which may be packed in wooden boxes for transport, or placed one upon another in a railway van with felt, sawdust, or other non-conducting material between them if found necessary.—Patent completed.

320 J. BIRD, Kingswinford. *Brick kilns.* Dated February 2, 1869.

The inventor forms in the outer chimney stack or stacks at a suitable height, a firegrate or firegrates furnished with a damper or door for closing up the flue opening or firegrate when required, a damper or dampers being also provided in a short flue or flues upon the top of the kiln. From the firegrate in the base of the stack the ordinary air culvert or passage traverses underneath the floor of the kiln to a central open mouth or vertical flue into the drying chamber, other traversing or radiating flues being formed beneath the floor of the kiln and communicating with the main flue.—Patent completed.

321 W. E. NEWTON, Chancery-lane. *Permanent way.* (A communication). Dated February 2, 1869.

The lower portion or base of the rail is provided with a rib bevelled on the outer side of its upper edge. It has a groove running its entire length, and is perforated with round or square slots. The upper portion or head has a rib also bevelled upon one edge and a groove. Through the rib are slots elongated horizontally, with the lower surface made flat to correspond with the flat side of a key; these slots are also of greater diameter vertically than the slots in the base. The grooves in both head and base have a pitch exactly corresponding to the bevelled edges of the ribs.—Patent completed.

322 H. BATE, Hackney-road. *New top.* Dated February 2, 1869.

This consists in enclosing within the body of the top a fan wheel or flier horizontally mounted upon a tube or barrel so as to revolve upon a fixed vertical spindle or peg upon which the same is spun, in connection with which musical combs or wires secured internally to the sides of the top, are employed for sounding the notes or chords through the medium of striking pins or points formed upon the revolving barrel in like manner to the action of the musical box.—Patent abandoned.

323 Captain W. BRABAZON, Malahide, Ireland. *Oyster dredge chain.* Dated February 2, 1869.

The links of this dredge are runners like those of a snow sleigh. They are turned up at the ends and connected by an iron ring or link, which rests on them and presents a smooth under surface which carries it along the bottom of the sea, passing over the spat and brood of oysters, mussel, &c., without injury to them.—Patent abandoned.

324 V. BAKER, Aldershot. *Vessels for hot liquids.* Dated February 3, 1869.

The inventor constructs the vessels with a double casing, having a space between the inner and outer casings which may contain air, or may be filled with imperfectly conducting material such as wool, hair, feathers, or the like. When the vessels have covers or lids, he makes them also double, with a space containing air or imperfectly conducting material. When the vessels have a spout or tube he makes it good to the inner casing, passing it through the space between the casings and the outer casing so that it communicates with the inside of the vessel only.—Patent completed.

325 J. SLATER, Fitzroy Works, Euston-road. *Railway carriages.* Dated February 3, 1869.

In addition to the two sets of buffers at present in use, the inventor places two or more single or sets of buffers on each railway carriage, truck, van, waggon, or car, on any part thereof, but, in preference, on the top, and placed so as to act in a manner similar to the ordinary buffers, and to meet at the same time.—Patent completed.

326 J. G. WILLANS, St. Stephen's-crescent, Paddington. *Iron and steel.* Dated February 3, 1869.

This consists chiefly in applying one or more jets of steam, either superheated or intermittently, in iron blast furnaces, not at the tuyeres, but by preference in that part in which the ores and fuel are at a red heat, but not fused in order to carry off sulphur therefrom.—Patent completed.

327 J. MACINTOSH, North Bank, Regent's Park. *Ornamenting surfaces.* Dated February 3, 1869.

This consists in using a combination of paraffin or stearic acid, india-rubber, and collodion mixed with metallic powders or gold or silver leaf, for the ornamentation of surfaces whereby they are rendered waterproof, and not liable to tarnish or oxidation. In some cases the compound of india-rubber and paraffin or stearic acid is used as a ground, and the metallic powder or leaf spread or laid thereon, and the whole coated with a clear solution of varnish to prevent oxidation.—Patent completed.

328 J. H. TYRRELL, Hadleigh, Rochford. *Liquid register and drawer off.* Dated February 3, 1869.

This consists of improved mechanical arrangements connected with a tap or cock, whereby the quantity of liquid required to be drawn off is first measured into a closed vessel from the vessel that contains it in bulk, and the plug of the tap or cock is so constructed that when it is opened to discharge the contents of the aforesaid closed vessel containing the precise quantity to be drawn off, the tap shuts off the communication between the closed vessel and the vessel from which it is supplied. In connection with the plug is a pin or stud, which as the cock is shut operates upon a train of wheels for indicating by dials, and a hand on each pointing to figures on the dials, which indicate the gross number of measures of quantity of the liquid drawn off, the dials being visible through a piece of glass fixed in front of them.—Patent abandoned.

329 A. S. STOCKER and A. R. STOCKER, Horsleydown. *Infants' feeding bottles.* Dated February 3, 1869.

This consists, first, in adding to screwed caps or stoppers to be applied to and employed with infants' feeding bottles, necks or collars for the purpose of holding the india-rubber feeding bottle, sucking-tube, and its appendages as well as for holding an india-rubber washer intended to act as a valve or passage way round the edge of the centre orifice and to admit the air between the edges of the neck or collar and the edge or edges of the hole made through the centre of the india-rubber or other ring which is held by this neck or collar, when suction takes place into the vessel.—Patent completed.

330 C. D. ABEL, Southampton-buildings. *Artificial stone.* (A communication.) Dated February 3, 1869.

The principal components of this hydraulic cement are lime, silica, and alumina, the two latter being by preference extracted from refractory clays. In order to bring about the formation of the double silicate of alumina and lime, sulphuric and boracic acid are added in small quantities to the compound.—Patent completed.

332 C. E. BROOMAN, 166, Fleet-street. *Corsets and stays.* (A communication.) Dated February 7, 1869.

This consists in employing in corsets or stays, instead of the ordinary full body of stuff, an openwork of tapes or ribbons laced or crossed over each other, and over or at the back of the covering of the bones, stays, or uprights, which form the frame of the corset, such ribbons or tapes being crossed vertically and horizontally, or diagonally, as required.—Patent completed.

333 W. LISTER, Chicago. *Syrup filter.* Dated February 3, 1869.

The inventor employs charcoal, dust, or charcoal in a fine state of division instead of charcoal in a granular condition as hitherto, and forces the solutions or syrups through the charcoal dust or powder by pressure produced by a circulating pump or by the direct application of steam or other fluid to the surface of the said solutions or syrups. The filtering vessel, which may be of any desired outline (although he prefers a cylindrical vessel placed in a vertical position) is fitted with a false bottom, whereon a blanket or other piece of woven fabric supporting or carrying the fine charcoal is placed.—Patent abandoned.

334 W. MADDICK, Manchester. *Boilers.* Dated February 3, 1869.

This consists in coating or covering the exteriors of the tubes with lead either in the state of sheet metal or by dipping them into lead in a molten state, which operations are for the purpose of preventing the tubes from incrustation and corrosion.—Patent completed.

335 R. R. FROHOCK, Boston. *Last machine.* Dated February 3, 1869.

This consists, first, in placing the model last upon mandrels parallel to the mandrels upon which the block revolves, the mandrels running in fixed housings and being connected by reversible gear so that they may be made to revolve in the same or in opposite directions; second, in hanging the guides upon one set of swinging frames and the cutter wheels upon another set, one set of swinging frames being connected by a peculiar device to a second bar to which the other set of swinging frames is connected, the distance from the point of contact of the guide to the axis of oscillation of the guide frame being equal to the distance of the cutting point of the cutter wheels from the axis of oscillation of the cutter wheel frames.—Patent completed.

336 J. R. JOHNSON, Haymarket. *Photographic pictures.* Dated February 3, 1869.

This consists of a new mode of treating the pigment to be used in the production of these pictures, which is required for this purpose to be in the finest possible state of division, and has hitherto only been successively used in a moist condition fresh from the mill or grinder. If kept for some time after grinding aggregation takes place among the particles of the pigment, and the results are then no longer of the same degree of perfection. A moist pigment, unless specially treated, is also of unequal density and cannot be used conveniently to obtain definite shades of colour, equal portions of such pigment giving unequal depth of colour. The inventor obviates this inconvenience by mixing thoroughly by mechanical means the finely ground pigments, black, red, or other colours, with gelatine and sugar, these being in much smaller proportions than that which is required for the production of the sensitive compound, say four parts of the gelatine and two of sugar to one part of the dry colour, but these proportions may be greatly varied, and he pours the mixture upon a slab or surface where it is allowed to set and dry. The sheet of prepared pigments is then cut up into leaves or cakes. He prepares in the same manner transparent or colourless sheets or cakes of the gelatine or similar substance mixed with its proper quantity of sugar or like material, and he forms the tissue of variable tint by dissolving variable quantities of these, that is of the prepared gelatinized pigment and of the transparent or colourless compound, and spreading the tissue compound so prepared upon paper, as is well understood, the result being definite, and the pigment being in its most perfect state of division. By pigment the inventor means not only those pigments used in oil or water colour painting, but those used for painting upon glass, enamel, and ceramic surfaces.—Patent completed.

337 L. WRAY, Ramsgate. *Wrought-iron carboniser.* Dated February 3, 1869.

The inventor heats the articles in a reheating furnace, and while thus heated he plunges them into a bath of molten cast iron. The length of time they are to remain in the molten cast-iron bath will depend upon the nature of the article to be operated upon and the effect it is desired to produce. For instance, railway bars or rails will require a much longer time than articles not subject to such rough and severe wear and tear.—Patent abandoned.

338 A. V. NEWTON, Chancery-lane. *Sewing machinery.* (A communication). Dated February 3, 1869.

This relates to a novel arrangement of machinery which by the use of two threads will produce a whip stitch suitable for sewing the seams and backs of gloves. The material to be sewn is put in a travelling spring cramp, set at right angles to a horizontally working needle, or it may be that the material is held between rotating cylinders, which will form the cramp. In either case the upper edge of the cramp or holder is notched to receive and guide the needle. The upper edge of the crank is level with the needle, so that the latter in working to and fro will advance into one of the notches on the upper edges of the cramp, and which give the latter a saw-like appearance.—Patent abandoned.

339 J. HOWARD, Bedford. *Turn wrest ploughs.* Dated February 3, 1869.

The plough is constructed as is usual with two bodies, the one right handed and the other left handed, which are fixed on opposite sides of a common beam, the heads of their respective frames being secured to the beam by screw bolts, which pass through both heads and through the beam. The construction of the beam is somewhat peculiar. It is formed of two bars trussed or strutted at the middle, and for the greater portion of their length and terminating at both ends in solid portions. The foremost end of the beam carries the head and brake of the plough, and the rear end of the beam carries the handles. The portion to which the handles are fitted is made cylindrical to allow of the beam turning on its axis without the handles in order to invert the plough bodies at pleasure, and it is provided with catches or teeth, which fit into notches formed on the sliding socket or collar that carries the handle, and thus serve to lock the handles to the beam while the plough is in use. The plough carriage is fitted with a pair of running wheels and capable of adjustment (through the action of a vertical screw) to any height to suit the work in hand.—Patent completed.

340 H. and J. BRYCESON and T. H. MORTEN, Stanhope-street, N.W. *Electric organs.* Dated February 4, 1869.

The first improvement relates to an arrangement for maintaining for any required length of time the current of electricity round the electro-magnets of the drawstop apparatus, however great the rapidity with which the knobs are moved by the performer, and for actuating on the inflation of the main bellows of the organ the positive

or negative electro-magnet of each drawstop apparatus, so as to insure a correspondence between the position of each slider and the position of the knob at the keyboard to which it belongs. The second improvement relates to an adaptation of hydraulic cylinders and a column of water for opening the swell louvres, whereby a great saving of friction is effected when the motion is required to be transmitted to a distance or in an indirect line. The third improvement relates to an adaptation of hydraulic cylinders and a pressure of water for working the combination movements, so that they can be commanded by the performer without offering the usual great resistance.—Patent completed.

341 T. PARKINSON, Liverpool. *Furnace "air doors."* Dated February 4, 1869.

This consists in casting, forming, or attaching on or to the door a tank or vessel to contain water or other liquid, and in placing within the tank a so-called aerometer, which aerometer gives motion to the regulating shutter or valve (the latter of novel construction) acting in or over air entrance apertures formed in the door.—Patent abandoned.

342 J. J. BAGSHAWE, Sheffield, and W. F. BATHO, Birmingham. *Semolina and flour machinery.* Dated February 4, 1869.

The inventors construct, first, rolls of a corrugated or wavy longitudinal section, so that at different points in their axial line they will be of different diameters, the corrugated or wavy surface of the rolls being grooved or toothed in any convenient manner for acting upon the grain or semolina. Secondly, they use grooved or fluted rolls in pairs of unequal diameter driven at equal angular velocities, thus causing a different surface velocity and more effectually operating upon the grain and semolina. —Patent abandoned.

343 E. D'ARTOIS, Charlotte-street, Fitzroy-square. *Inkstands.* Dated February 4, 1869.

The inventor preferably gives to the inkstand the form of a gun, although any other shape may be used. The inside of the gun is a glass tube, which is closed at one end in a rather conical form at half an inch over that end, and perpendicular to it the glass is pulled in so as to form a cone filling very nearly all the diameter of the tube; the bottom of that cone is terminated with a small hole giving communication inside the tube. The other end of the tube is quite open in its diameter to receive the ink, and is after that corked or sealed very tight. This being done the tube is surrounded with a plastic stuff, wood, or any kind of metal or stuff which has received before the form of a gun.—Patent abandoned.

344 T. PANKHURST, Chatham. *Gulley traps.* Dated February 4, 1869.

This consists in furnishing sewer gratings or gulleys with an under or catch receptacle having a passage way or hole in it furnished with a movable pan, flap, or door, pressing against such passage way or hole attached to a lever bearing an equipoise. The pan, flap, or door will therefore be self-acting when any material or fluid falls on it from or through the catch receptacle by reason of the weight of such material or fluid, and after allowing it to pass will then close and so trap the hole or passage way in the bottom of the catch receptacle, and thus prevent the escape of effluvia.—Patent abandoned.

345 E. LORD, Todmorden. *Furnaces for steam boilers.* Dated February 4, 1869.

To the under side of each grate bar is cast a clip or fork, which rests upon an eccentric, and there are as many eccentrics as there are grate bars in the furnace, the eccentrics being fixed on a shaft, so that the high part of one is near the low part of the adjoining one; consequently as the eccentrics revolve the grate bars are raised and lowered and caused to advance and retreat alternately. The inner ends of the grate bars pass partly under the bridge, and are supported on a cross rail or other equivalent.—Patent abandoned.

346 P. JENSEN, Chiswell-street, E.C. *Propelling ships.* (A communication.) Dated February 4, 1869.

For utilising the pitching of the vessel its stem is provided with a false stem some distance in advance of the other strongly joined to the keel at the bottom and to the stem at the top, and preferably made in one piece with them, forming together a frame resembling the sternpost of a screw steamer. Bracing rods unite the false stem with the sides of the ship if required. In the frame there is an upright pillar fastened at top and bottom. Somewhat below the water level this pillar passes through the centre line between two flaps or systems of flaps, jointed together by a hinge joint running fore and aft, fastened to or pivoting in the stem and false stem. At or near the middle of the outer edge of each of these flaps, starboard and larboard, a rod or system of rods is jointed, running up to and jointed with a sliding sleeve or collar working freely on the vertical pillar.—Patent abandoned.

348 J. VAVASSEUR, Gravel-lane, S. *Working ordnance.* Dated February 4, 1869.

The inventor mounts on the gun carriage an axle carrying a toothed pinion or pinions gearing into a rack or racks fixed to the bed or slide upon which the carriage recoils, such racks being by preference formed by cutting slots in metal plates fixed to the slide or bed. Near each end of this axle is a toothed wheel, which during the recoil of the gun is loose upon the axle, but which when the gun is to be run forward or moved is made fast therewith by a clutch. With the toothed wheel gears a pinion, which is actuated by a crank handle, so that when the toothed wheel is fast on its axle the gun may be run forward by turning this crank handle. At the front end of the carriage are two rollers so arranged that when the carriage is down on the slide ready for firing these rollers are just clear of the slide and take no part of the weight. —Patent abandoned.

349 E. MOREWOOD, Briton Ferry. *Tin and terne plates.* Dated February 4, 1869.

In coating with tin or terne metal the inventor causes the plates which are to be coated to pass through a flux of such as chloride of zinc or other soluble metallic salt heretofore employed, so as to give them a tendency to rust if it remains on their surface after they have obtained their coating. This flux causes the surface of the iron to take a coating with melted metal very readily.—Patent abandoned.

350 G. BRAY, Deptford. *Slip hook.* Dated February 4, 1869.

This consists in hinging, swivelling, or jointing the loop of the hook so that one half of it turns back sideways. One means of forming this hinge or joint is to use a hinge pin having its axis in the same plane with the hook, and the effect of dividing and hinging the hook is that in case of accident when a considerable strain is put on the trace or other attachment, the upper or under half of the hook as the case may be is free to turn on the hinge pin without any increased strain on either part or on the point of the hook.—Patent abandoned.

351 W. E. NEWTON, Chancery-lane. *Railways for elevations.* (A communication.) Dated February 4, 1869.

This consists, first, in a novel construction of the endless rope or chain, which is provided with a series of knots, protuberances, or bosses arranged at regular distances apart to give to it a pitched character for gear with an indented wheel carried by the carriage or vehicle. Second, the invention consists in the combination of a brake and indented wheels carried by the carriage so arranged and operated that while the indented wheel with which the endless rope gears is free to rotate when the brake is off (or during the early application of the brake), and until the extreme or gripping pressure is applied by the rim of the endless rope over and in gear with it, a positive as contra-distinguished from a frictional hold of the indented wheel on the rope is established by or through the operation of the brake so as to effect the traction of the engine.—Patent completed.

352 H. JONES, Portland-place. *Tuning forks.* Dated February 4, 1869.

The inventor uses a sheath or case, into which he fits a tuning fork so that the forked ends remain free to vibrate therein, and near such ends openings can be made in the above-named case or sheath, a striker being fitted therein, usually radiated with three, four, or more radii, so that two remain within and one, two, or more protrude beyond the case or sheath, which striker, upon being pressed by the thumb or finger, presses the end of the tuning fork, which, when suddenly relieved, emits the musical sound.—Patent completed.

353 G. and E. ASHWORTH, Manchester. *Paper fasteners.* Dated February 5, 1869.

This consists generally in effecting all the operations requisite to make the fasteners from a continuous sheet, riband, or strip of metal in one apparatus, all the operations being self-acting. That is to say, when the apparatus is driven by power, and is supplied with a continuous riband or strip of metal, it will continue for some time to form fasteners therefrom without the intervention of the hand, the fasteners requiring only to be lacquered, tinned, silvered, or otherwise similarly finished in order to be fit for sale. The invention also consists in certain methods of supplying material to the apparatus or to modifications thereof, and also in the general construction and operation of the apparatus.—Patent abandoned.

354 J. JOBSON, Derby. *Explosive projectiles.* Dated February 5, 1869.

The object of these improvements is to admit of the head or fore end or part of the projectile being split or broken up into a number of definite forms or parts. Also by the form of a portion of this head or end to facilitate the separation and distribution of parts composing the cylindrical or parallel portion or body of the projectile. Another object of the improvements is to ensure the fracture or division of the parts of the projectile into definite portions or sections by forming such parts with surfaces inclining in opposite and other directions, or partly inclined and partly in a frame at right angles to the axis of the projectile, or parallel to such right angle, the object being to form the rings so that the parts of them, by being of varying thickness, may be better adapted for the portions of one ring in their action upon those of another on the explosion of the contained explosive matter to effect fracture thereof into definite forms.—Patent completed.

355 F. BRABY, Camberwell. *Utilising sulphate of iron.* Dated February 5, 1869.

This consists in bringing the ammoniacal liquor or vapour obtained by distillation from any solution or liquid containing ammonia, such as the waste liquor from gasworks, into contact with the crude solution of sulphate of iron.—Patent completed.

356 W. BLUNDELL, Upper Thames-street. *Chimney guards.* Dated February 5, 1869.

The guard or casing, which is to be placed on the chimney top in the usual manner, is made rectangular in cross section, and covered at its top by a suitable cap. The sides at their upper parts are formed with openings, the combined total area of the openings at each side of the guard or casing being equal to the cross sectional area of the guard or casing itself. Each opening is provided with a flap or louvre piece working horizontally on pivots or centres in such manner that the upper part of the flap or louvre piece, when it is closed, shall slightly overlap the inner edge of the upper part of its opening, while the lower part of the flap or louvre-piece in the same position, in like manner overlaps the outer part of the lower edge of the opening. Each flap or louvre-piece is so balanced by a weight (or by other suitable means) as to stand at an angle when at rest, thus leaving its opening clear for the escape of smoke or vitiated air, but so, nevertheless, that the slightest current of air from without shall have the effect of causing it to close its opening.—Patent completed.

357 J. PAGE, Glasgow. *Pipe joints.* Dated February 5, 1869.

The external joint service of the spigot is made either cylindrical or slightly conical, and the internal joint surface of the faucet (or of the ring when a ring is used) is made slightly conical and with the more contracted part towards the outside of the joint. A hydraulic cement of any suitable kind, but, by preference, such as is hereinafter described, is rammed into the space between the joint surfaces, and forms a ring of a wedge form in longitudinal section, the internal pressure acting on the base of the wedge so as to jam it the tighter the greater that pressure is.—Patent completed.

358 J. HENDERSON, Leith. *Surface condensers and refrigerators.* Dated February 5, 1869.

This consists in entirely surrounding an ordinary condenser or refrigerator with water spaces, and may be carried out in practice by making the condenser with double casings or shells, and by admitting part of the condensing or cooling water between such shells. The invention is most conveniently applicable to surface condensers of the kind fitted with tubes through which the water passes whilst the steam surrounds them, but it may also be adopted in those in which the steam is inside of the tubes and the water outside, and in the latter case there will be three shells or casings, water being between the outermost and the second, and steam between the second and innermost.—Patent abandoned.

359 W. ADAMS, Bow, and W. G. BEATTIE, Surbiton. *Bearing springs.* Dated February 5, 1869.

To some convenient part of the frame or body of the carriage, and at each end of the bearing spring, the inventors secure a scroll iron or hanger having a jaw projecting downwards with holes or slots formed in such jaw to receive two revolving trunnions formed on the sides of a socket tube, through which tube a rod passes secured to the end of the spring by a suitable jaw and pin. On this rod, and bearing against the end of the socket tube, they place a spring of india-rubber, or steel, or other suitable elastic material, such spring being confined at the ends by two metal plates, and secured by screw nuts or collars so as to allow of adjustment.—Patent completed.

360 J. TAYLOR, Birkenhead. *Raising and lowering apparatus.* Dated February 5, 1869.

The inventor provides the apparatus with steam cylinders of long stroke, the piston rods of which are connected either directly (if oscillating cylinders are used) or by connecting rods to a crank or crank plate on the ends of the chain barrel, so that the motion of the piston directly effects the rotation of the barrel without the intervention of gearing.—Patent completed.

361 J. H. JOHNSON, Lincoln's Inn-fields. *Mounting ordnance.* (A communication.) Dated February 5, 1869.

The trunnions of the gun are mounted upon a pair of upright levers, which turn on centres at their lower ends in the body of the carriage, and which levers form the front portion of a perfect parallelogram on each side of the gun composed of the two upright levers referred to, and other upright levers in the rear, and two horizontal rods or links coupling the trunnions with the upper ends of the hinder upright levers. The base of the parallelogram is formed by the main body of the carriage or support. It will be readily understood that the gun may be drawn inwards and simultaneously lowered below the parapet, so as to be completely concealed, this motion being perfectly parallel and the gun preserving the same direction as to aim both in its elevated and lowered position. The recoil of the gun is caused to contract a spring or springs, or elevate a counter weight which shall subsequently produce or assist in producing the movement requisite for elevating the gun.—Patent completed.

362 J. HALFORD, Kingswinford. *Puddling furnaces* Dated February 5, 1869.

Instead of the ordinary fireplace in which the combustion of the fuel is effected, the inventor constructs an oven or chamber without fire bars, on the bottom of which oven the fuel to be burned is supported. The fuel is supplied to the oven by an opening at one side or other convenient part. The air to support the combustion of the fuel may either enter the oven direct from the atmosphere, or be supplied by flues made in the top or roof and vertical walls of the oven. The air passes along the flues at the top of the said oven, descending the vertical flues at the back of the said oven, passes into the said oven through holes in the vertical back wall.—Patent completed.

363 A. CLARK, Chancery-lane. *Mules.* (A communication.) Dated February 5, 1869.

The wool when prepared for spinning is in the condition of roving or prepared sliver wound upon spools. These spools are placed upon drums at the back of the rolls The roving passes from the spools between the rolls, and thence to the spindles, which are in the usual position in the carriage. When the machine is ready to start, the carriage and spindles are at the nearest point to the rolls. When the mule is started, the carriage begins to recede from the rolls, the rolls running at the same time, and delivering the roving at about the same speed as the traverse of the carriage. The rolls continue delivering the roving until the carriage is about half way out. The rolls are then stopped by what the inventor terms the "roller motion," the carriage still continuing out to the end of its traverse. The rolls being stopped and the carriage continuing its way out, the yarn is consequently drawn and made finer.—Patent completed.

364 A. BROWNE, King William-street. *Making stearine.* (A communication.) Dated February 5, 1869.

The fatty substances are melted and treated mechanically with sulphuric acid of 66deg. to 68deg. Beaume more or less, after which they are boiled with water, by which the oxide of glycerye is separated therefrom in a hydrated form, as glycerye water or sulphate of glycerye, and the fatty substances separate by themselves, but still contain traces of sulphuric acid, or rather chemical compounds of the two acids, sulphur stearine and sulphurlain acid, and sulphurpalmitin acid, and afterwards they are repeatedly washed in water until they cease to contain any trace of sulphuric acid for the finest re-action.—Patent abandoned

366 C. G. HILL, Nottingham. *Making rosettes.* Dated February 5, 1869.

The inventor produces rosettes much more readily and advantageously by first causing the band to take a curved or coiled form by corrugating the back or selvage of the band by passing it through crimping rollers. Then in attaching the band to the pad he dispenses in great part with the use of the needle, simply attaching the outer ring or rings to the pad by sewing, and causing the remaining convolutions to adhere by means of gum or cement.—Patent completed.

367 C. S. DAWSON, Thames Ditton. *Elastic stamp.* Dated February 6, 1869.

This stamp is made by taking a stereotype mould in plaster of Paris or papier mache from printer's type or from an engraved surface made in either wood, steel, copper, stone, or type metal. A composition of glue dissolved in glycerine by heat, and when of a suitable consistency, is then poured upon the mould above mentioned, which has been previously varnished and greased in order that the composition may be removed from the mould without injuring any of the lines in the matter from which the impression is taken, and when cold is both elastic and pliable.—Patent completed.

368 H. A. DUFRENE, Paris. *Ice apparatus.* (A communication.) Dated February 6, 1869.

The improved apparatus employed in carrying out this invention, and in which mechanical pressure is the acting agent, is based upon the principle that certain liquid agents, such as methylic ether and ammonia, in evaporising immediately take up from the surrounding bodies the caloric necessary for vaporisation. The consequence

of this action is that it is necessary to collect the vapours produced as soon as they are disengaged, and to reliquefy them in such a manner as to be able to use the freezing agent over again, and the invention consists in the means for so doing.—Patent completed.

369 J. S. OFFORD, Norwich. *Clipping and shearing.* Dated February 6, 1869.

This consists in the use of a fixed comb with an upright rib or flange on each tooth, leaving a receptacle thereon for the teeth of a movable plain comb-shaped holder, by the movement of which the hair, wool, or other material is held between each tooth of the holder and the outer side of each rib or flange of the fixed comb, against which it is brought in contact and firmly held ready to be cut off by the action of a cutting blade moving over the comb and holder, in a direction from the base to the top of the ribs or flanges.—Patent completed.

370 W. R. LAKE, Southampton-buildings. *Puddling furnaces.* (A communication.) Dated February 6, 1869.

These improvements are chiefly designed for the kind of puddling furnaces in which the mass or ball of iron is formed by the mechanical action of a rotary refining chamber. The first part of the invention consists in a form of the rotary refining chamber, adapted to hold and properly preserve the fettling, and so constructed as to be preserved from overheating by means of water. The second part of the invention consists in making removable that portion of the flue which fronts the rotary refinery so as by turns to discharge the functions of a flue and of a door. The third part of the invention consists in the combination of a water back with a rotary refining chamber.—Patent completed.

371 R. SNOOK, New-steeet, Horsleydown. *Cocks, taps, and valves.* Dated February 6, 1869.

This consists of a chamber or barrel of suitable form and material, fitted to receive a conical plug, which plug is disposed horizontally and centrally within the barrel. This conical plug is made hollow and has the larger end of the cone open, which opening serves for the admission of the fluid, which fluid has its exit through an orifice left in the side of the conical plug.—Patent abandoned.

372 J. C. SHAW, Patricroft. *Cutting wire.* (A communication.) Dated February 6, 1869.

The machine forming the subject of this invention consists of a pair of cutting discs, both of which are perforated with any number of holes of different diameters to suit the size of the wire or rod to be cu . These holes are drilled in a slightly diagonal direction in order that the end of the wire or rod may be perfectly square when cut. One of the cutting discs is cast in a case, which is secured to the floor or to a bench or held in a vice, and the other disc is held up to the cutting face by the cover of the case, both parts of the case being bolted together. The second cutting disc has a projecting tongue, against which a cam at the end of a lever acts. This lever is hinged to the case, and through the lever passes the spindle of an adjustable gauge.—Patent completed.

373 J. T. EDMONDS, City-road. *Cattle medicine vessels.* Dated February 6, 1869.

This consists of an instrument or apparatus constructed as hereafter described for administering drinks to horses or other cattle. It is composed of a tube, by preference made of metal, having at its lower end a piece of flexible tubing, but not necessarily, as the whole tube may be made of metal. This tube is intended to contain the drink it may be desired to give an animal, and its size is regulated according to the amount it is to contain—a half pint or pint, for example. In this cylinder or tube the inventor places a piston or plug connected to a long rod passing through a stuffing box at the other end, and surrounded by a second tube outside and beyond the first and larger tube; a spring is placed in the smaller tube and round the piston or plug rod, which always gives the rod a tendency to escape from the tube.—Patent abandoned.

374 H. A. BONNEVILLE, Paris. *Solid broth compositions.* (A communication.) Dated February 6, 1869.

A ball of salt is covered in successive layers and in proportional quantities with the following substances in the following order, viz.:—Extract of meat, grease, dissolved gelatine, and aromatised with a proportional quantity of vegetable extracts.—Patent completed.

375 C. D. J. SEITZ, Bury. *Recovering soda from waste lyes.* Dated February 6, 1869.

This consists in placing a hearth or roaster and a furnace in close connection, so that the residuum is transferred to the furnace without contact with the atmosphere. The hearth and furnace communicate with each other either back to back or otherwise by an opening occasionally provided with a damper. The furnace is supplied with pans, in which the lyes are evaporated, and is provided with firebars; there is an opening between one end of the lower pan and the wall, while at the other side there is a flue leading to the chimney.—Patent completed.

376 E. MELDRUM, Dechmont. *Treating paraffin.* Dated February 6, 1869.

An apparatus, such as an iron tube or a common retort such as is used in the distillation of shale or coal, is built up over or alongside of a fire, so that the temperature can be so regulated as to attain a range of temperature not exceeding a visible red heat, and in order that a large heating surface may be obtained, such apparatus may be filled with broken stones, spent shale, or other refractory substance in a divided state. The heavy oil or oils or the melted paraffin are to be run slowly in at one end of a retort or decomposing tube, or are passed through the same in a state of vapour from a still or distillatory apparatus connected therewith, and the products thus resulting are condensed by passing off through a cooling worm or condenser proceeding from or connected with the other end of the retort.—Patent completed.

377 T. HARRISON, Lincoln. *Drills.* Dated February 6, 1869.

This consists in arranging the corn, seed, or manure box or reservoir in such manner that it may remain constantly in a level position, whether the drill is being moved up hill or down hill or over undulating land, so that the delivery of the corn, seed, or manure will not vary.—Patent abandoned.

378 B. WALKER and W. TILSON, Lenton, Notts. *Jacquards.* Dated February 6, 1869.

The inventor employs a reading machine capable of making its own fabric, which fabric forms a substitute for the cards. He works paper from a circular or other shaped cylinder, movable or otherwise, such paper being independent of the fabric made in the reading machine. The jacquard wires which he employs are lifted independently of the motion of the cylinder, and the fabric and the paper while at work are kept in sufficient tension by rollers or by other equivalent mechanical contrivance.—Patent completed.

379 E. W. HAWES, Clintarf, Dublin. *Buoys and sea marks.* Dated February 8, 1869.

This consists in forming or making a buoy or other floating sea mark of such materials as that it shall be more buoyant than any at present in use, so that in the event of its receiving any of the injuries consequent to such sea marks, it shall not be lost, but from its being composed of floating materials any or all of its parts individually or collectively can be picked up and recovered.—Patent abandoned.

380 T. NICHOLS and J. PARR, Talke, Chester. *Signal bells.* Dated February 8, 1869.

This consists in making signal bells for collieries and for other purposes with a tumbler catch acting on the striker or hammer and in making the bell (or apparatus for giving forth sound) of metal in the shape of a fork or ∩ shaped—that is to say, U inverted or otherwise.—Patent completed.

381 L. S. and A. SECKBACH, Wiesbaden, Prussia. *Preserving beer.* (A communication.) Dated February 8, 1869.

Carbonic acid gas is generated and caused to act upon the liquid or beverage to be treated so as to preserve it and improve its quality, and it also may aid in forcing it up to the required level in order to be discharged.—Patent abandoned.

382 E. J. D. FOSSARD, Paris. *Cyster pump.* Dated February 8, 1869.

The inventor dispenses with any bifurcation of the suction of delivery tubes, and maintains them in a right line with each other or nearly so. He places the pump at any convenient point on this right line, connecting it at one end with the suction pipe and at the other end with the delivery pipe. He forms the pump simply of a straight tube, having at its lower extremity a loose valve opening upwards from the suction tube, and at its upper end another loose valve opening upwards into the delivery tube.—Patent abandoned.

383 R. W. ROW, Alton, Hants. *Solitaires, links, and fasteners.* Dated February 8, 1869.

This consists in the construction of a screw fastener and nut, with hook combined for an eyelet hole in the glove band, or belt.—Patent abandoned.

384 J. H. JOHNSON, Lincoln's Inn-fields. *Steam engine governors.* (A communication.) Dated February 8, 1869.

It is proposed to construct the governor valve in the form of a triple disc valve, the three discs being of equal size, and connected together by spiral or other arms or rods. This triple disc valve works through two valvular openings made in the two upper horizontal portions of an S-shaped diaphragm or partition cast inside a closed valve chamber, the spindle of the valve working through a stuffing box and being coupled to the governor spindle.—Patent completed.

385 O. SARONY, Scarborough. *Photography.* Dated February 8, 1869.

The inventor takes a small negative portrait, and enlarges the same to any suitable extent or variation upon glass, either by sun or artificial light, which portrait he backs up with, by preference, rough drawing paper or other suitable equivalent material, on which has been lithographed hatched, shading, or free-hand lines or tint, such lining or tinting being so arranged on the paper backing as to properly surround the transparent picture on the glass when placed before it.—Patent completed.

386 W. R. LAKE, Southampton-buildings. *Puddling furnaces.* Dated February 8, 1869.

This consists in mixing an alkali or alkalies or lime, separately or combined with common salt, with the cinder of the puddling or boiling furnaces whilst in a fluid state, or when pulverised after tapping from the furnace. The mixture is to be used as a "fix" for the puddling or boiling furnace; alkali or alkalies, lime or salt, may be mixed with pulverised or melted iron ore for "fixing" puddling furnaces.—Patent abandoned.

387 W. R. LAKE, Southampton-buildings. *Knitting machines.* (A communication.) Dated February 8, 1869.

This consists in the arrangement of two conical needle carriers placed one opposite the other, connected together by gear wheels, and constructed in such a manner that the needles of one needle carrier work between those of the other, and that by the combined action of the needles in the two carriers an elastic fabric can be produced of one or more colours. Also in the arrangement of cam cases in combination with the needle carriers, in such a manner that by the action of the cams in the cam cases, the desired rising and falling motion is imparted to the needles.—Patent completed.

388 B. HUNT, Serle-street, W.C. *Manometric-barometric apparatus.* (A communication.) Dated February 8, 1869.

This apparatus chiefly consists of a metallic lens formed by two very thin membranes, and having a glass tube connected to any part of its circumference. If this lens be filled with liquid and submitted to an external pressure the liquid which fills the same will be forced into the glass tube to a distance which will be longer in proportion as the internal diameter of the glass tube is smaller than the volume of the lens. The latter is enclosed in a case connected by means of a pipe with the pressure to be indicated. If the pressure to which the lens is submitted externally does not deflect the membranes beyond the limits of their elasticity as soon as the pressure ceases they will return to their original position and the liquid will re-enter the lens.—Patent completed.

389 H. J. RICHMAN, Porchester-terrace, W. *Fans.* (A communication.) Dated February 8, 1869.

The inventor makes a turbine or fan with two discs, the one solid or close, the other open in the centre to admit the air. A ring or flange is formed round this opening and revolves air-tight in an opening at the front end of the casing. The spindle or shaft is fixed in the centre of the solid disc and passes through the opening in the other end of the turbine or fan without being attached to it to a bearing in which this end of the spindle which carries the pulley turns.—Patent completed.

390 F. JENKIN, Fittis-row, Edinburgh. *Electric light.* Dated February 8, 1869.

The light is produced by a rapid succession of sparks due to successive charges and discharges of a condenser charged directly from a voltaic battery without the intervention of any induction coil. When the invention is used for this purpose the condenser is on the beacon and the battery on shore is connected with a terminal on the beacon by a submarine cable or aerial wire. The condenser is charged and discharged by a tongue or contact maker moving backwards and forwards between the battery terminal and an earth terminal.—Patent completed.

391 W. A. LYTTLE, Hammersmith. *Magneto-electric apparatus.* Dated February 9, 1869.

In order to obtain the intermittent suspension or rather short circuiting of the attractive force of a permanent magnet or continuously acting electro-magnet, the inventor connects the opposite poles of the permanent magnet by means of a stationary armature of any convenient shape, but the longer the better up to the length of the permanent magnet; and he surrounds this armature at one or more points preferably at or near its two extremities with a coiled conductor of any suitable kind, so that at pleasure it can be converted into an electro-magnet.—Patent abandoned.

392 R., G., and C. W. PHELPS, Birmingham. *Feeding bottles.* Dated February 9, 1869.

This consists in applying to the elastic tube of the feeding bottles a clamping or regulating apparatus whereby the elastic tube may be compressed and wholly or partially closed at pleasure, and the quantity of liquid capable of passing through it in a given time thereby regulated or the passage of liquid altogether prevented. The clamping or regulating apparatus which it is preferred to employ consists of a frame through which the elastic tube is passed. A screw passes through one end of the frame and carries at its lower end a plate and at its upper end a nut or head.—Patent abandoned.

393 G. REES, Holloway. *Devices on glass.* Dated February 9, 1869.

The object of this invention is to produce ornaments or devices by vitrifying pounded glass upon glass and glazed ware. Powdered glass, either dry or as a paste, is taken, and the cavities of a mould are filled with it, if a design is required or the surface of a plain mould is to be covered. The mould is then built up to the required depth with the same material to form a backing. The material is then vitrified in a kiln in the ordinary manner in the mould or not. When a coloured design is required the powdered glass is mixed with metallic or mineral oxides.—Patent abandoned.

394 W. WILLIAMS, Sneinton Elements, Nottingham. *Communicating in trains.* Dated February 9, 1869.

The inventor attaches a tube shaft or equivalent contrivance to the whole length of a railway carriage. At each end of this shaft is inserted a rod, and in the space between these rods are placed springs or their equivalents, which press or force the rods out of the tube to any required distance to meet the ends of the rods affixed to the adjoining carriages. At the outward end of each rod is affixed a disc or buffer, the outward face of which is formed with raised segments or their equivalents which gear with the discs or buffers of the adjoining carriages. On the shaft adjoining the guards' and drivers' carriages is placed a wheel or its equivalent, and in a position suitable for the convenience of the guard and driver is placed another wheel which, when turned, will communicate rotary motion to the shaft. On this last-mentioned wheel or its equivalent is fixed a camber wheel with which is connected a rod attached to a bell.—Patent abandoned.

395 J. and G. W. DENNELL, Leeds. *Boot machine.* Dated February 9, 1869.

The inventor employs the usual kind of ring or stamp knife, that is, a knife with its edge formed to the required shape of the sole or heel to be cut out, and so as to be pressed through the material, but in constructing this knife he forms the interior thereof wider at its back than its edge, so that the soles or heels as cut will easily pass through the knife. This knife he fixes with its edge upwards by means of adjustable clamps upon a suitable bed or table, and above it he mounts in suitable framework a reciprocatory stem or slide bar upon which he fixes a block or presser of wood or other suitable material to be pressed into contact with the edge of the knife and then removed from it; motion to the presser may be given from a rotary shaft by crank or eccentric and rod, or by cams, tappets, or other suitable means.—Patent completed.

396 J. WILKINSON and W. SCOTT, Bradford. *Looms.* Dated February 9, 1869.

This consists in the application of a toothed wheel to the beam to gear into another toothed wheel of smaller diameter mounted on a stud fixed to the loom frame, and to which stud wheel is fixed a brake pulley for a cord or belt to pass around, and then be attached to a weighted lever. This lever is provided with a catch taking into the toothed wheel fixed on the beam, so that the attendant by operating the lever may lift the weight and thereby remove the pressure from the brake pulley and let slack the warp, and also by means of the catch set up the beam so as to increase the tension of the warp.—Patent abandoned.

397 G. WHITE, Queen-street, Cheapside. *Automator.* (A communication.) Dated February 9, 1869.

This consists in imparting a suitable rotating motion to one or more wheels fixed parallel to each other on an arbor revolving in suitable bearings, the rotating motion of the wheels being kept up so as to allow of applying the revolving motion of the arbor as a prime mover for driving machinery.—Patent abandoned.

398 W. MITCHELL, Stacksteads. *Felt carpeting.* Dated February 9, 1869.

This relates, first, to making felt carpeting with three layers or slivers, the central one of which is of an inferior or different material to the front and back layers, which latter may be both of the same quality or material, or also different from each other. In carrying out this part of the invention the inventor employs three separate carding engines and folders arranged side by side or otherwise, and each delivering its own slivers on to the same "batt cloth," but superseded, that is one over the other, so that the upper one may be of fine wool, the lower one of inferior wool, and the central or middle one of almost any inferior or other fibrous material or mixture of materials.—Patent abandoned.

399 L. A. C. ST. PAUL DE SINCAY, Paris. *Roofing tiles.* Dated February 9, 1869.

The inventor provides the tiles with lateral flanges by which they are connected together, and also with ears for securing the tiles to the framing of the roof. The ears are fixed at one corner of the tiles, while the ears are made to hook on to the flanges and are also secured by nailing to the rafters. The number of these ears varies accord-

ing to the size of the tiles; by making the tiles of small dimensions the inventor is enabled to use much thinner and cheaper metal than is the case when the tiles are made of considerable size.—Patent completed.

400 G. CRITCHLEY, Liverpool, and H. B. FOX, Oxton. *Rocking chairs.* Dated February 9, 1869.

This consists in applying to the bottom or feet of any ordinary chair or similar article a spiral or other spring or any elastic material, preferably made with a broad, flat surface at the bottom, and attached to the chair or other article by a piece similar in form to a castor-socket or castor-plate, to which the spring or other elastic material is made fast.—Patent abandoned.

401 G. F. G. DESVIGNES, Tulse-hill, S. *Steam boilers.* Dated February 9, 1869.

The inventor increases the heating surface of the boiler so as to admit of steam being got up rapidly by the application of syphon-like pipes inserted into the crown of the firebox. Each pipe is fixed at one end into the crown of the firebox, and after projecting a convenient distance into the firebox is bent round and led up again into the boiler, when it is made to ascend almost to the water level of the boiler. A constant circulation then takes place in the syphon pipes so long as the fire is burning, the heated water ascending by the longer leg of the syphon and the cooler water descending from the boiler by the shorter leg.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated August 24, 1869.

2511 J. Frengley, Dublin. An improved tell-tale clock.

2512 Z. Colburn, Bedford-street, Westminster. Improvements in the construction and mode of launching subaqueous ways.

2513 J. Williams, South Castle-street, Liverpool. An improved junction of barrel and action for breech-loading firearms and sporting guns, with self-acting exploded cartridge extractor.

2514 H. Taylor, Kensington, Middlesex. Improvements in velocipedes.

2515 F. Oakley, Toronto, York, Ontario, Canada. Holding firmly and securely in their place bolt nuts.

2516 J. E. Hodgkin, Liverpool. Improvements in machinery for breaking the woody parts of flax, straw, and other similar fibrous plants, and for scutching or removing such parts therefrom.

2517 T. Briggs, Manchester. Improvements applicable to machinery for spinning and doubling cotton and other fibrous materials.

2518 J. D. Nietscke, Somerset, Perry, Ohio, U.S.A. Preserving dead bodies.

2519 J. Valters, Great Dunmow, Essex. An improved agent for fining and clarifying ale and other fermented liquors.

2520 T. Webb, Clarence-road, Bow, Middlesex. Improvements in the ventilation of mines.

Dated August 25, 1869.

2521 W. J. Cockburn-Muir, Westminster. Improvements in the construction of the permanent way of railways.

2522 R. Maynard, Whittlesford, Cambridgeshire. An improvement in portable chaff-cutting machines.

2523 C. Mackay and T. K. Wheeler, jun., Clarendon-place, Belfast. Improvements in cops for wefting and warping purposes, and in machinery for making and in shuttles for containing the same.

2524 T. Shakespear and G. Illston, Birmingham. Improvements in sewing machines.

2525 O. and F. H. Varley, Stonecutter-street, Farringdon-street, Middlesex. Improvements in instruments for transmitting and recording electric signals, part of the invention being applicable to other purposes.

2526 C. Cerisier, Mung-sur-Loire, France. A system of ventilation and airing of millstones.

2527 T. Coley, Bower Farm, Maidstone, Kent. Improved means or appliances to be employed in the cultivation of hops.

2528 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in braiding or platting machines.

2529 H. Call, Concord, Merimac, New Hampshire, U.S.A. An improved mode of, and machinery for, obtaining and applying motive power, more especially designed for the transmission of the same to long distances.

2530 G. Zoeh and A. Lehmann, Havre, Department of the Seine Inferieure, France. A novel process of manufacturing yeast or artificial ferment.

2531 A. F. Cederwaller, Viborg, Finland, and A. F. Westerlund, Stockholm, Sweden. Certain improvements of the porcelain-faience and pottery manufactory.

2532 W. Brown, St. Mary-street, Portsmouth. Improvements in the mode of constructing and disposing ships' cabins to prevent sea sickness, the said improvements being also applicable to gun carriages on board ship.

Dated August 26, 1869.

2533 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the means and apparatus for separating or dividing the carded fleece into slivers in carding machines for all kinds of filaments.

2534 H. P. Stephenson, Abingdon-street, Westminster, E. G. Bartholomew, Chepstow Villas, York-road, Upper Holloway, Middlesex, and R. King, St. Mary Axe, City. Improvements in lighting and extinguishing gas lamps.

2535 B. Hunt, Serle-street, Lincoln's Inn. Improvements in steam condensers, and in supplying steam generators with water.

2536 H. Yates, Rue Lafayette, St. Pierre les Calais, France. Improvements in the manufacture of lace on bobbin net or twist lace machinery.

2537 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for carding and spinning fibrous materials.

Dated August 27, 1869.

2538 E. A. Cowper, Great George-street, Westminster. Improvements in treating cast iron for the production of wrought iron and steel therefrom, and in apparatus employed for that purpose.

2539 A. Moncrieff, Culfargie, Perthshire. Improvements in the means and apparatus for absorbing, storing, and utilising the force of recoil of ordnance, and in applying and working covers, roofs, or shields to gun platforms.

2540 J. M. Stanley, Sheffield. Improvements in the manufacture of iron and steel, and in furnaces and converting crucibles used in connection therewith.

2541 O. Vivier, Sekforde-street, Clerkenwell, Middlesex. Improvements in means or apparatus for measuring and indicating the distance travelled by vehicles.

2542 F. J. Drechsler, Cockspur-street, Westminster. Improvements in stoves and grates or apparatus for cooking, heating, and other stove or grate uses, with rotary motion arrangements and with appliances for rendering the same useful for fumigating, refrigerating, sifting, winnowing, churning, cutting, and other purposes where such rotary motion arrangements may be capable of being used.

2543 W. E. Gedge, Wellington-street, Strand. A novel construction of railway sleeper.

2544 B. Hunt, Serle-street, Lincoln's Inn. Improvements in machinery or apparatus for hulling, cleansing, and polishing or preparing coffee, rice, and other berries or grain.

2545 J. Toychenne, Rue Pregon House, Small Heath, near Birmingham. Improvements in, or additions to, springs for mattresses, sofas, chairs, and other articles of furniture.

2546 E. A. Campbell, Bilton-road, Rugby, Warwickshire. The extraction of essence of roasted coffee by a machine called coffee essence extractor.

2547 W. R. Lake, Southampton-buildings, Chancery-lane. An improved method of, and apparatus for, rendering and refining lard, tallow, and other fatty and oleaginous matter.

2548 J. Flon and W. Charlet, Brussels, Belgium. A new system of sash or framework for landau and landaulet carriage doors.

2549 S. C. Lister, Bradford, Yorkshire. Improvements in looms for weaving pile and other fabrics, and in yarns for pile fabrics, and in sizing them.

2550 R. C. Rapier, Westminster Chambers. Improvements in railway water cranes.

2551 J. Ritchie, Stonefield-street, Barnsbury, Middlesex. Improvements in the construction of tents and sunshades or weather protectors suitable for carriages and other vehicles.

Dated August 28, 1869.

2552 C. Duff, Russell-street, Bermondsey, Surrey. Improvements in the manufacture of paper pulp and paper.

2553 T. S. Blair and F. Ellerhausen, Southampton-buildings, Chancery-lane. Improvements in treating conglomerates of cast iron and other substances.

2554 J. Butterworth and J. Ainsworth, Bury, Lancashire. Improvements in mangling and squeezing machines.

2555 J. Spencer and J. Consterdine, Hollingwood, near Manchester. Certain improvements in portable drilling machinery, parts of which are applicable to machines for other purposes.

2556 J. Holdsworth, Kingston-upon-Hull. Improvements in apparatus for loading or discharging grain, coals, ballast, or other materials.

2557 R. H. Herriott, Skegby, Nottinghamshire, C. Plumbe, Mansfield, Nottinghamshire, and W. A. Plumbe, Sutton, Ashfield, Nottinghamshire. Improvements in communicating between passengers and the guard and driver of railway trains, and in the machinery or apparatus employed therein.

2558 J. Brown, Padiham, Lancashire. Improved means of, and appliances for, facilitating the exercise or riding of bicycles or velocipedes.

2559 C. S. W. Muir, Kilmarnock, Ayrshire. Improvements in safety apparatus for steam boilers; in apparatus to provide for and regulate the admission of air to steam boiler and other furnaces; and in apparatus to provide for the escape of water from steam pipes.

2560 R. O. Robinson, Avenham-terrace, Preston, Lancashire. An improved construction of stove or firegrate.

2561 J. Loader, Upper Clifton-street, Worship-square, Middlesex. Improvements in rotary engines and pumps.

2562 R. Priestley, London Wall, City. Improvements in fastenings for gloves.

Dated August 30, 1869.

2563 L. Goldberg, Love lane, City. Improvements in watches, toy watches, personal ornaments, purses, pocket-books, walking sticks, and certain other portable articles.

2564 R. J. Westley, Camden-road, Camden Town, Middlesex. Improved methods of constructing, converting, and using billiard and other tables.

3565 W. Young, Foyle-road, Londonderry. An improved method of clarifying and refining butter and other fatty matters.

2566 T. Cattell, Strand. An improved method of treating wood for the production of paper pulp.

2567 W. F. Williams, Broad-street, Golden-square, Middlesex. Improvements in boxes for holding jewellery and other articles.

2568 W. Winter, Leeds. An improved metallic driving belt or band, and the means of manufacturing same, also the application thereof and other metallic belts for driving sewing machines.

2569 W. E. Newton, Chancery-lane. Improved machinery for manufacturing nails, brads, and other analogous articles.

2570 H. E. Newton, Chancery-lane. Improvements in furnaces.

2571 C. R. Stooke, Teignmouth, Devonshire. Improvements in safety cages for mine shafts, which improvements are also applicable to lifts for warehouses, hotels, and for other places.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2165	2341	2361	2379	2403	2420	2444	2460
2198	2343	2363	2381	2404	2422	2446	2462
2290	2347	2365	2385	2405	2424	2448	2464
2315	2349	2367	2389	2407	2426	2450	2466
2331	2351	2371	2391	2409	2428	2452	2468
2332	2353	2373	2393	2410	2430	2454	2470
2335	2355	2375	2397	2412	2432	2456	2472
2337	2359	2377	2401	2414	2434	2458	2474
2339							

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2374 R. Sims
2401 W. Owen
2441 R. A. Brooman
2951 J. G. Marshall

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2188 G. Little
2195 J. F. M. Pollock
2199 C. T. Porter
2204 H. A. Dufrene
2218 J. Foster
2222 W. T. Eley
2226 J. Richards
2238 T. Gall
2212 W. E. Newton
2313 J. Silvester
2490 A. F. Johnson and M. P. Griffin

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," August 31, 1869.

1205 N. Wilson
1208 R. C. Rapier
1222 J. W. M'Carter
1224 M. Henry
1227 C. D. Abel
1234 J. Holding
1238 G. White
1247 W. Palliser and T. English
1250 W. A. Lyttle
1254 J. Whittaker
1258 E. Tatham
1263 A. Muir
1265 R. Foster
1280 G. White
1281 I. Farrell and W. Turner
1283 J. Cunningham
1286 J. Smith
1288 W. E. Newton
1290 S. Oakman
1294 J. P. Cooper
1305 J. A. Haberkorn and B. Rudolph
1362 W. Seed
1380 W. Mackean
1384 C. Moore
1486 J. H. Johnson
1490 I. M. Millbank
1735 G. E. King
1858 B. Hunt
1865 J. H. Johnson
1892 R. Olpherts
1930 R. Olpherts
1997 S. Brooke
2824 T. Grace
2332 E. H. de Bodmer
2342 W. Brown
2343 G. W. Murray and G. M. Garrard
2364 W. E. Newton
2380 H. Wimshurst
2409 J. H. Johnson
2432 H. T. Yates
2435 E. H. C. Monckton
2501 J. Baur

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed, within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed August 27, 1869.

618 P. S. Regnauld
621 J. Rust
622 W. E. Gedge
629 A. H. Honegger
631 C. E. Brooman
645 R. Law and S. Hargreaves
650 H. A. Bonneville
685 A. M. Clark
743 W. Wells
763 J. Porteous
789 C. D. Abel
889 J. B. Fell
1045 R. Norfolk
1295 B. Dobson
1442 B. Latham
1844 R. M'Hardy
1939 C. Cochrane
1964 H. Yates

Sealed August 31, 1869.

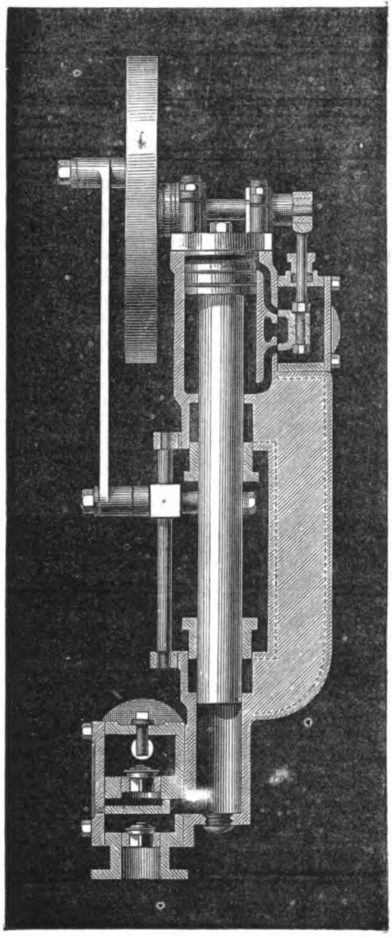
312 A. Barclay
619 J. Ladley
627 J. Cliff
633 W. Olley
635 F. N. Gisborne and H. Allman
643 J. Sloper
644 H. W. Goldring
646 F. Andoe
647 J. Robertson and J. Shanks
659 S. Marsden
661 J. B. Spence
665 W. Betts
678 W. S. Meldrum
680 A. Morrall
698 H. W. Cook
714 H. Mason, G. Hartley, and J. Hindle
717 B. Hunt
719 A. M. Clark
746 J. and A. Waddington, and F. Bell
747 W. Betts
755 J. M. Napier
758 T. Beeley and D. Hanson
760 W. Coxhead
857 H. E. Newton
884 J. H. Johnson
943 S. Firth
962 A. Chambers
1022 J. Woods, J. Hampson, and L. and G. Fish
1105 O. Vivier
1134 W. E. Newton
1365 R. Wappenstein
1795 J. Foster and J. Hollinrake
1884 H. A. Bonneville
2013 T. Grahame
2028 G. Buchanan
2068 M. A. Muir and J. M'Ilwham
2070 G. A. Nowell

LIST OF SPECIFICATIONS PUBLISHED

For the week ending August 28, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
3739	0 10	3972	0 8	16	1 4	83	0 8	196	0 4	221	0 4
3881	9 0	3974	0 6	17	0 6	90	0 10	197	0 4	222	0 4
3905	1 4	3976	0 8	18	0 10	97	0 8	198	0 4	223	0 4
3916	0 10	3977	1 0	21	0 8	103	0 8	200	0 4	224	0 4
3931	0 8	3980	0 8	27	0 6	107	0 8	201	0 4	225	0 4
3941	0 8	3982	0 10	29	1 2	168	0 4	203	0 4	227	0 4
3950	1 0	3983	0 10	30	0 8	180	0 4	204	0 4	230	0 4
3951	0 8	3985	0 8	34	0 10	181	0 4	205	0 4	231	0 4
3952	0 8	3987	0 8	35	1 6	183	0 4	206	0 4	232	0 4
3953	1 4	3989	0 8	37	0 6	185	0 4	209	0 4	234	0 4
3959	0 8	3990	0 8	45	1 4	189	0 4	211	0 4	238	0 4
3964	1 2	6	0 8	50	0 10	190	0 4	212	0 4	246	0 6
3968	1 0	10	2 0	57	1 4	191	0 4	216	0 4	287	0 4
3969	0 10	13	0 10	63	0 8	192	0 4	218	0 4	484	0 6
3971	1 4										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.



ALEXR. WILSON & CO.,

ENGINEERS,

VAUXHALL IRON WORKS,

NINE ELMS, LONDON, S.W.,

MANUFACTURERS OF

IMPROVED DONKEY PUMPS, INJECTORS, SAFETY VALVES, STOP VALVES, AND BOILER MOUNTINGS OF EVERY DESCRIPTION.

PRIZE MEDAL, HAVRE MARITIME EXHIBITION.

The attention of Engineers is particularly called to the "Vauxhall" Improved Donkey Pumps and Injectors, which are now used by all engineers. They are the best Boiler Feeders ever brought before the users of steam power, and for boilers supplying steam to apparatus, other than the steam engine, they are indispensable, while they are rapidly supplanting the feed pump on the engine itself, as they dispense with the necessity of running a large engine merely to get a little water into the boiler. They are at work on board ships and steamers, in breweries, distilleries, gas works, tanneries, hemical works, and in every situation where single, double, and three-throw pumps have hitherto been used.

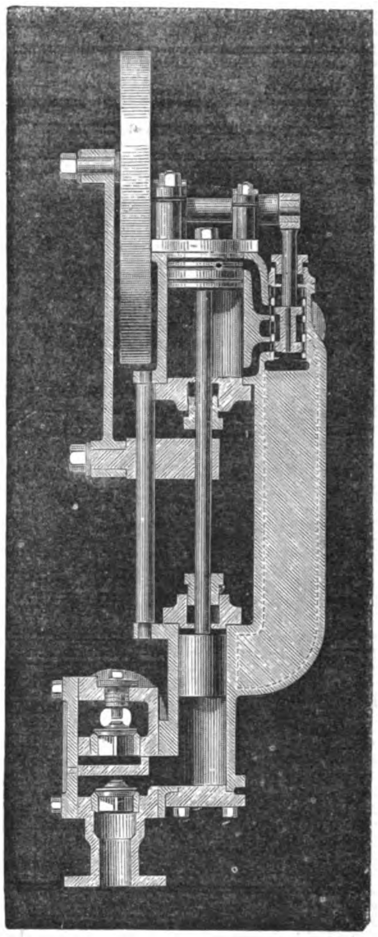
N.B—They are proportioned to draw 15ft. and force into the boiler supplying steam to them; when they draw more than 15ft. the rams have to be made smaller. In pumping water they will throw it 2ft. high for every pound pressure of steam in the boiler.

REDUCED PRICE LIST

Size.	Diameter.	Stroke.	Gallons thrown per hour.	Horse power of boiler supplied.	Price. £.	s.	d.
4		2½	150	10	6	10	0
5	1¼	3	230	15	8	10	0
6	1½	4	460	30	11	0	0
7	2¼	4	600	40	13	0	0
*8	2¼	4	900	60	15	10	0
9	2½	6	1,200	75	17	0	0
*10	2½	6	1,300	120	19	0	0
11	2¾	6	1,500	100	22	0	0
*12	2¾	6	2,250	150	25	0	0
*14	3	9	3,750	250	35	0	0
*16	4	12	7,500	500	45	0	0

Those marked * are double action.

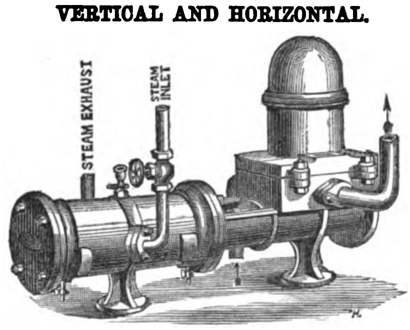
A Stock of One Hundred always on Hand, from which Orders can be Executed Without Delay.



PATENT

UNIVERSAL STEAM PUMPS,

VERTICAL AND HORIZONTAL.



POWERFUL—SIMPLE—DURABLE—RELIABLE—CHEAP.

Superior to all other Inventions.

SOLE MAKERS—

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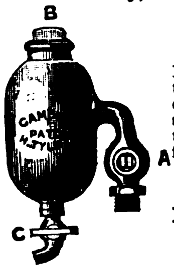
84 & 85, UPPER WHITECROSS STREET, LONDON, E.C.

⁎ Where it can be seen at work.

GAMBLE'S PATENT STEAM LUBRICATOR.

For Stationary, Locomotive, & Marine Engines.



SELF-ACTING.

Lubricates all the valves and internal parts of the cylinder continuously. Effects a most important saving in the oil or tallow. Increases the regularity of working. Prevents frequent repairs.

SOLE MAKERS—

HAYWARD TYLER & CO.,

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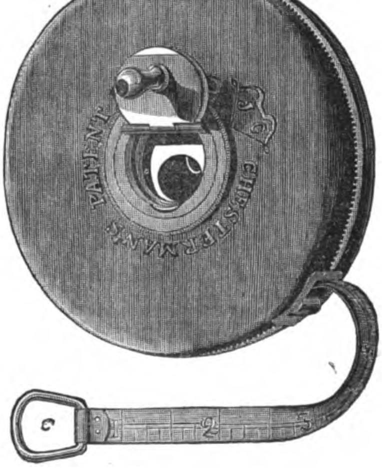


(Half-size drawing of Chesterman's Patent Steel Measuring Tape, 66 feet.)

JAMES CHESTERMAN & CO.

SOLE MANUFACTURERS OF CHESTERMAN'S PATENT

SPRING, METALLIC, STEEL,

AND OTHER

MEASURING TAPES;

IRON AND STEEL LAND CHAINS;

SINGLE & DOUBLE-ACTING DOOR SPRINGS,

ENGINEERS' TOOLS, &c., &c.

BOW WORKS, ECCLESALL ROAD, SHEFFIELD.

NOTICE.—*All goods marked with the name and* TRADE J C MARK.

A 27

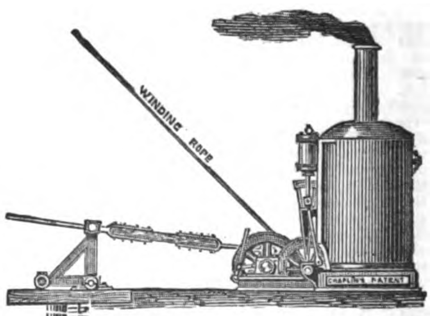
Prize Medal, International Exhibition, 1862.

CHAPLIN'S

PATENT PORTABLE

STEAM ENGINES,

FOR PUMPING AND WINDING.



SPECIALLY ADAPTED FOR PITS, QUARRIES, &c.; SIMPLE AND STRONG; REQUIRE NO FOUNDATION OR CHIMNEY STALK, AND ARE EASILY ERECTED OR REMOVED.

Sizes, from 2 to 30-horse power

Stationary Engines, 1 to 30-horse power, with or without gearing.
Steam Cranes, 30 cwt. to 20 tons, for Wharf or Rail.
Hoisting Engines, 2 to 30-horse power, with or without jib.
Contractors' Locomotives, 6 to 27-horse power.
Traction Engines, 6 to 27-horse power.
Ships' Engines, for Winding, Cooking, and Distilling, passed by H.M. Government for half-water.
Steam Winches. Engines and Boilers for Light Screw and Paddle Steamers.

ALEXANDER CHAPLIN & CO.,

CRANSTON HILL ENGINE WORKS,

GLASGOW. A 51

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, SEPTEMBER 10, 1869.

ON THE REPORT OF THE METEOROLOGICAL COMMITTEE.

IN resuming our criticisms upon the above report, we will first refer to the intelligence respecting storms sent by the office to places sanctioned to receive it gratuitously by the Board of Trade. "The messages consist of an order to hoist the drum accompanied by a brief explanation of the reasons why it is to be hoisted. The message is posted up at many stations as soon as it is received for the public to read. It continues in force for thirty-six hours, and no longer, from the time of its receipt, unless modified by subsequent telegram, which is frequently sent, either when the danger is known to have passed over or when there are signs of the approach of another storm." "The system of telegraphy of storms to foreign countries is not uniform in its character. To the Marine Ministry in Paris, the same messages are sent as to our own south coast and to Jersey; Holland and Hamburg receive special telegrams similar to those which are sent to the Underwriters' Association, of Liverpool. They convey the amount of atmospherical disturbances whenever the difference of readings over the same definite area exceeds 0·8in. The authorities at Hamburg hoist a drum at that port and at Cuxhaven whenever a telegram is received from London. These stations are thus precisely similar to those on our own coasts. In return for this intelligence immediate intimation is sent to London from France, Holland, and Hamburg by the meteorological authorities in their respective countries whenever a storm strikes any part of their coasts."

The ports on the east coast of England, we are informed, "can usually be warned of a storm in ample time, owing to the general tendency of storms to advance from the westward." These are the most important ports to warn, and when omissions occur, the results may be excessively serious. Thus early on the 16th of June last, a gale which did great havoc in the North Sea was not announced at all from London. The Rev. F. Stow, writing from Shields, says:* "A thunderstorm occurred on the 15th. The barometer had sunk at 9 a.m. to 29·04; at 3 p.m. clouds gathered; and between 3h. 30m. and 5h. 30m. 0·66in. fell, the wind veering from S.E. to W. Soon after midnight a terrific gale from N. awoke everyone. It is remarkable that the coming storm escaped the vigilance of the Meteorological Office, although their returns for the 15th show a rapidly increasing difference of barometrical pressure between stations in the W. and E. The absence of warning doubtless increases the number of disasters. Next morning rain to the amount of 1·02in. was measured for twenty-four hours, and the thermometer was as low as 44deg."

As the Committee claim to have improved the means and deductions for predicting storms, a further advance towards the system pursued by Admiral Fitzroy seems desirable. Prediction may be easily derided, but if the strength of wind cannot be forecast with so close an approach to certainty as direction, for time and place, there is always some satisfaction to the seafaring class in being put on their guard against a gale which may happen to-day or to-morrow, and cause devastation to shipping from the violence of its force. If the Committee will announce nothing but facts, it seems to us that more frequent reports from the coasts are occasionally desirable, besides the usual once or twice a day, and we should like to have a clearer understanding of the principles upon which the orders for hoisting the drum are issued. Are they sent indiscriminately to all the signal stations, and if so, what satisfaction is there in knowing that atmospheric disturbance exists somewhere on the British Isles, unless people are told where, whither it may extend, how rapidly, and with what result? Only the central office receives the data necessary for arriving at these particulars, and, therefore, the duty of giving the information can only be expected from it. When the Committee commenced their system of telegraphing weather facts, they thought it necessary to establish a check system of observation through the Coastguard. We could never learn why this was deemed expedient, and now these observations have been discontinued.

* Symons' Monthly Meteorological Magazine for July 1869.

It appears to be in contemplation to publish a daily weather chart, but we cannot anticipate its utility. Printed matter cannot be delivered with sufficient despatch to announce the arrival of gales from one place to any other. The office must confine its attention to its main duty, that of giving our seamen, fishermen, and pilots premonitory notice of storms. We are the more concerned in urging this because the Director of the office, Mr. R. H. Scott, has reported to the Committee very favourably upon the indications afforded for foretelling strong winds.

A few remarks as to what is being done for meteorology inland. The committee have established observatories at Kew, Falmouth, Valentia, Armagh, Stonyhurst, Glasgow, and Aberdeen. These have in two years cost the country £7,268, notwithstanding they were founded upon establishments already in existence. We hope they will prove worth the cost of maintenance. The report shows that stringent care has been taken to ensure efficient scientific superintendence, and opens out to the mental view the extraordinary amount of labour that will be requisite to work up and properly utilise their records. "Specimens of proposed forms of publication of the actual barograms, thermograms, and anemograms have been lithographed and distributed to meteorologists in order to elicit suggestions as to their discussion. The calculation of meteorological mean results from the tabulations has been commenced."

A closing remark in praise of the businesslike manner in which the sum voted is accounted for seems deserved. The outlay on instruments has been reduced by recalling those that were either superabundant or misapplied, and a careful regard to economy with efficiency seems generally kept in view. Knowing the tendency of government departments to overspend their votes, it is gratifying to find that but for the expense of furnishing a new office and moving to it, the expenditure would have been considerably less than the £10,000 voted for the year.

VISIT OF THE SOCIETY OF ENGINEERS TO THE BECKTON GAS WORKS.

AT a time when so many of the industrial and manufacturing establishments that were reared on the banks of the Thames have been compelled to suspend operations and close their doors, it is gratifying to witness the construction of works and the erection of premises, on a scale of magnitude hitherto unparalleled, with the same object in view. It is not, however, the vastness of the undertaking, promising as it does employment for a large number of persons, that is its most important feature, but the fact that the employment must by the very character of the enterprise be of a permanent nature. Hence arises the difference—a difference which closely concerns our working classes—between manufactories intended for the production of necessaries and those which fabricate articles for which the demand is uncertain and capricious. Take a shipbuilding yard for example. To-day it may be "full of people," to-morrow "left unto you desolate." During the last three years how many instances of such desolation have not occurred in the vicinity of the locality we are alluding to? A run "down stream" reveals to the eye empty sheds, deserted workshops, neglected wharves, and abandoned premises. The ear listens in vain for the whirr of the wheel and the ring of the anvil; the "hum of men" is no longer borne on the breeze, and the silent waves return no echo to the voiceless shores. Under these circumstances, the project in progress of execution by the Chartered Gas Company should be regarded in a very encouraging light. The object it has in view is not the manufacture of an article the demand for which might at one moment be almost unbounded and at the next diminished to *nil*, but the preparation of a product which at the present time may be considered as a necessity and indispensable to the comfort and convenience of mankind.

At an early hour in the afternoon of Friday last, a large party of the Society of Engineers visited the site of the new gas works at Beckton, and were received by Mr. Wyatt, the resident engineer for the company, and Mr. J. Aird, one of the firm of the contractors. The steamer "Sibyl" was chartered for the outward and homeward voyages, and the party included, among others, the President of the Society, Mr. F. W. Bryant; the Hon. Sec., Mr. A. Williams; the Secretary, Mr. G. Harris; Mr. Sanders, Mr. Cook, Mr. Cargill, C.E., Mr. Walker, &c. Making their way through the scaffolding and timbering, the party reached a temporary platform laid on some of the cast-iron cylinders which carry the pier. As yet, the pier can only be said to be "lined out," as some of the cylinders have been "got down," while of others, the position only is determined. The method of sinking these cylinders is very simple, and is one that has been employed in numerous similar situations. It consists in excavating the ground from the interior, and allowing the consecutive sections to sink by their own gravity. If necessary they can be weighted, should any obstacle obstruct their descent, and should they get fast, the aid of a diver is called in to ascertain the cause. Being 6ft. in diameter, these cylinders offer great facilities for carrying on the sinking operations. The separate lengths are 1¼in. in thickness, with flanges on the inside, through which they are bolted together. As it is necessary to carry them down about 10ft. into the hard gravel, they are sunk some 30ft. below the Ordnance datum, and their total height is not far short of 60ft. The superstructure will consist of wrought-iron girders fixed on the cylinders, and the pier will form a direct communication between the river and the retort houses. It projects at right angles from the river wall, and after continuing in this direction for about 400ft., it turns suddenly "up stream" for nearly double that distance. The coal will be raised by steam or hydraulic power from the barges into trucks on the pier, which will run from it along a viaduct, which forms, in fact, a continuation of this pier, into the retort houses. There is nothing remarkable about the river wall. It extends for nearly 1,000ft. of the 1,500ft. frontage belonging to the company. It is built of brick coped with stone, and protected in the usual manner by fender piles, which are bolted right through the wall in a secure and substantial manner. The gas having been made will pass into gasholders which have a diameter of 180ft., and the united contents of the four will amount to 4,000,000 cubic feet. To supply these enormous reservoirs, the retort houses, which are also four in number, will contain 1,080 retorts, each of

which is 20ft. in length and capable of being charged at both extremities. The main pipes are 4ft. and 3ft. in diameter respectively, and the operation of laying them was inspected by the party. They were conveyed to the spot over a light railway which has been laid down on a road which will eventually connect the gas works with a point on the Barking-road. In consequence of the isolated nature of the locality, it was necessary to construct this road in order to effect inland intercommunication. An inspection of the lithographed plans and drawings furnished satisfactory evidence that some attention had been paid to æsthetical principles, a point commonly neglected by engineers. Although £600,000 is a considerable sum of money, even in these days of large estimates, yet when it is borne in mind that the project is completely metropolitan in character, it is a small one in comparison with the capital raised for other schemes, which, moreover, were not based upon so sound a financial or commercial foundation. Solidity and durability are the principal characteristics of the works under notice. In some measure, the nature of the foundations, which is very bad, necessitates a more massive style of construction than might otherwise be required, but, in addition, there is very little doubt that the magnitude and importance of the undertaking has had its proper weight with the engineer of the company, Mr. Evans, M.I.C.E., from whose designs emanate the whole of the works. A cordial vote of thanks was proposed by the President and unanimously accorded to the engineers and contractors, who, by their courtesy, assistance, and hospitality, had rendered the visit valuable to the professional man, instructive to the young members of the society, and agreeable to all.

THE MINERAL RESOURCES OF THE WEST ROCKY MOUNTAINS.

A FEW years since, Congress voted a sum of money which was to be expended in collecting reliable statistics of the mineral resources of the United States. A special appointment was conferred upon Mr. J. Ross Browne, under which he performed this service in the states and territories west of the Rocky Mountains. To Mr. James W. Taylor was assigned the duty of collecting similar statistics on the east of the Rocky Mountains. Mr. Browne issued two reports upon the subject, and then vacated the position. The United States Government, seeing the importance of continuing Mr. Browne's labours, appointed, in April, 1868, Mr. Rossiter W. Raymond a special commissioner for the collection of mining statistics in the western division, which had been the scene of Mr. Browne's labours. On receiving the appointment, Mr. Raymond found that there was but a small remnant of previous appropriations left in the treasury. However, with the spirit of a man who meant to do his work, and not merely to spend the funds placed at his disposal, he decided not to wait for a further appropriation, but to start with what there was at his command. By the general courtesy of railroad, steamboat, stage, and express companies, Mr. Raymond was able to economize the little he had, and to complete, during the summer of 1868, a journey of some 13,000 miles. The result of this journey is now before us in the form of a very interesting as well as useful report, which has been printed at Washington, and, by the courtesy of the United States Government, we have just received a copy. In the preparation of this volume of some 260 pages, Mr. Raymond has personally worked very hard, as the lack of means placed it out of his power to engage competent assistants, or even to employ a clerk for tabulating and calculating statistics. Under these exceptional circumstances, the report is very creditable; it is necessarily somewhat partial, but it is accurate, and contains a fund of information of value both to the Government and people of the United States.

The subjects to which Mr. Raymond was instructed to give his special attention were, first, the different processes of treating the ores, their chemical combinations, and the system demonstrated by practical experience to be the most successful. Next, the relative merits of the various inventions, machines, and mechanical contrivances, in use or proposed, for the reduction of the precious metals, and for all other matters connected with mining and metallurgy. Thirdly, the special needs of the great mining interest, how it can be encouraged and rendered most productive; how far individual enterprise should be left untrammelled by legislative action; and to what extent, and in what instances, Government aid might with propriety be afforded to facilitate the development of the mines, and thus arrest the annual decrease in the production of bullion. Finally, Mr. Raymond was to note the experience of other countries resulting from the establishment of national institutions for the education of miners, and to point out how far the prevalent European systems were applicable to the people of America, and appropriate under their government. The report is divided into two parts, the first of which contains such observations on the present condition of American mining industry as Mr. Raymond could collect, and the second discusses, at considerable length, the subjects involved in the relation of the government to that industry. The subject of methods and processes of mining and reductions have been postponed, and will form the subject of a further report.

Under the head of relations of Government to mining, Mr. Raymond gives us, first, a history of mining and mining laws as practised among the ancients, as well as in the Middle Ages. We then have, successively, epitomes of the Spanish mining law, the modern German codes, the code of France, the mining laws of Switzerland and of England, mining regulations in Australia, and the mining laws of Canada. After comparing these various codes together, and stating the American mining laws, Mr. Raymond recommends various amendments in the latter by which the various conflicting customs which now obtain shall be merged in one general principle, and by which all rights and titles should be specifically determined, which they do not appear to be at present. The necessity of mining education is fully recognized by Mr. Raymond, who recommends the appointment of a Government commissioner, a bureau, and a national school. The latter means of imparting information is fully discussed, and particulars are given of the Frieburg School of Mines, the Paris School of Mines, the Prussian Royal Schools of Mines at Berlin, and the School of Mines at Clausthal, Prussia. The history of the world proves that all nations eminent for profitable and permanent mining have employed two agencies for success—a national mining code, and a national mining school. These, says Mr. Raymond, the United States must have, and must have at once, if any real good is to be effected thereby.

The present report is illustrated with several woodcuts of underground workings, th mines selected being such as were capable of being represented by simple profiles. These profiles are taken on the plane of the vein (local irregularities being disregarded) and show the quantity of ground already excavated and the quantity remaining either unopened or so far opened as to come under the head of reserves, which includes the portions of a vein where stoping or extracting ore may at once be commenced, the preparatory shafting and drifting (or opening of galleries) being complete. The Eureka mine of Amador county, California, and the Social and Steptoe mine of Egan canon, Nevada, are examples in which the amount of reserves or ground opened in advance is very large. Many of the Grass Valley mines are characterized by the same peculiarity, as the sketches show; and in this case the prudence of the management is worthy of high praise, since the Grass Valley veins are narrow and hard, and the maintenance of large reserves is a matter of difficulty and expense. Many mines of celebrity and interest are not represented by sketches, because (as is the case with the Comstock mines) they could not be shown in simple profile, or because the expense of making the necessary measurements and drawings (in cases where none were accessible) was greater than Mr. Raymond felt justified in assuming; or, finally, because the character of the underground workings was so irregular and unskilful as to confer no credit upon the owners, and convey no instruction to the public.

From the report before us we find that the bullion product of the last year was more difficult to be estimated than that of almost any preceding one. The bullion tax having been abolished, the best source of knowledge on the subject was taken away. Messrs. Wells, Fargo, and Co.'s express returns, which have hitherto been an important aid in estimating the movement, and thus the product, of bullion on the Pacific coast, have lost their comprehensive character by the establishment of a rival express company (the Union Pacific), the amount of the business of which is said to be considerable, but which had not been, at the date of the report, authoritatively stated. From the best authorities and such official returns as could be collected, Mr. Raymond estimates the product of the whole country as follows:—

	dollars.
California	22,000,000
Nevada	14,000,000
Montana	15,000,000
Idaho	7,000,000
Washington and Oregon	4,000,000
Arizona	500,000
New Mexico	250,000
Colorado and Wyoming	3,250,000
All other sources.	1,000,000
	67,000,000

This is a decrease of 8,000,000 dollars from the product of 1867, which showed a falling off of some 8,000,000 dollars as compared with that of the year before. Montana, Idaho, and Colorado manifest a satisfactory improvement; but there is a decrease of 5,000,000 dollars from California, and 6,000,000 dollars from Nevada, the latter being due to the exhaustion of many of the Comstock ore-bodies. It is an instructive fact that the greater part of the product from deep mining was furnished by the same mines in 1868 as in 1867, and the year before, indicating that a more general adoption of systematic and economical methods would result in greater stability of production. The yield from placer mining must be expected to decrease, and its place must be supplied by the cement and quartz mines.

The causes of the decrease in American production of bullion are enumerated as follows:—1. The exhaustion of many surface deposits. 2. The reaction following upon a period of excited speculation, and the collapse of numerous dishonest schemes. 3. The increasing and novel difficulties attendant upon the management of deep mines, and the reduction of refractory ores. 4. The lack of communications, capital, and knowledge, such as are required for the creation of enterprises based on the extraction and reduction of ores of low grade in large quantity—the only stable form of mining; and, 5. The vexatious and ruinous litigation which waits upon mining on the public domain, and which is most troublesome and expensive where mining is, in other respects, most profitable—thus operating to destroy those

enterprises which have overcome other difficulties—all these may be summed up in one sentence. Mining in the States has been found, in too many instances, to be unprofitable; and the individuals who have lost money have retired from the business. It certainly is not the duty of the government to give bounties to bolster up mining industry, if that industry is, by the nature of the case, an unprofitable one. Yet it cannot be denied that the decrease of the product of gold and silver in America is a matter which particularly concerns the government at this time; and it may well be inquired whether the causes of it are remediable. Mr. Raymond believes that time will remove many of them, and that the action of the government, based upon a just appreciation of its relations to the mining industry, will do away with the rest.

Concerning the extent of the mineral resources in the States, the half has never been told; but those resources are but one factor, which must be joined with labour and intelligence to make the product wealth. When the industry of mining in these rich fields is based upon a foundation of universal law, and shaped by the hand of educated skill, then, says Mr. Raymond, "we may expect it to become a stately and enduring edifice, not a mere tent, pitched to-day and folded to-morrow. This industry has been the pioneer in our far western territory. It has founded states, attracted population, enlarged the boundaries of civilization; and it has done this great work in a lawless and careless way, without much regard to the future. All other parts of society springing from it are gradually becoming systematized and consolidated, but the primitive industry remains in its primitive condition. Establishing everything else, it has not established itself. I believe that with the extension of the government surveys over the public domain, and the reduction of its vast area to order and law, the consolidation and definite adjustment of the mining interests will become imperatively necessary; and inasmuch as mining outruns all other activities in our new territories, and needs more than any other the aid of judicious legislation, I believe it should receive immediate attention." We believe that the views and suggestions contained in the report, and which are an enlargement of the summary contained in the foregoing extract, based, as they are, upon Mr. Raymond's personal observation, experience, and study, will prove of value to America if acted upon by the government with promptitude. A timely support to her mining industry will stimulate the settlement of her vast territory, and the organization of stable communities upon it, and secure the future material progress of the country.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

ELECTRIC ALARUMS FOR VARIATIONS OF TEMPERATURE—EFFECT OF AIR IN DIMINISHING THE ILLUMINATING POWER OF COAL GAS—EXTRACTION OF BENZOLE FROM GAS—NEW USES FOR OLD SHOES.

It is in many cases—notably in some stoving operations and in the management of hot-houses—very desirable to have warning when the temperature rises above or falls below a certain heat. A rise of temperature is easily made known by what may be called a maximum thermometer alarum, a well-known instrument, which is made by carrying one platinum wire in connection with a battery and bell into the bulb of a mercurial thermometer, and another wire down the tube to the degree it is not desired to exceed. When the mercury rises to this point the circuit is completed and notice is given by the ringing of the bell. But an instrument to give warning of a fall of temperature is new to us, and we borrow a description of it from the account of MM. Besson and Kneider, who have contrived it. It consists of a spirit thermometer, the bulb of which is placed above, and the tube curved in a U shape. A platinum wire is carried into the bulb and down to the degree of heat it is wished to notify. Below this minimum the curvature is filled with mercury, which is in free communication with a second platinum wire. As the alcohol contracts with the cold the mercury will, of course, rise, and reaching the first platinum wire complete the circuit and give the warning. One bell and the same battery will serve for the two thermometers; but it will be necessary to interpose a commutator to ascertain through which circuit the current is passing and whether a rise or fall is indicated when the bell is rung.

The effect of atmospheric air in diminishing the illuminating power of gas when the two are mixed together has recently been investigated by two very able experimenters, Dr. Silliman and Professor Wurtz. Their results, which differ somewhat from those of previous experimenters, may be summed up in a few words. When gas is mixed with anything less than five per cent. of air the loss of illuminating power is a little over one-tenth of a candle for every one per cent. of air. With more than five per cent. and up to twelve per cent., the loss rises to half a candle for every one per cent. of air. Above twelve and up to twenty-five per cent., however, the loss of illuminating power is but four-tenths of a candle for the one per cent. of air. Twelve per cent. of air, they tell us, destroys forty per cent. of illuminating power. The experiments of MM. Audouin and Bèrard, made for the municipality of Paris, show a higher rate of loss than this, while those of Schultz are to a certain extent in accordance. He gives, as a general statement of results, a loss of half a candle for every one per cent. of air. The last-named experimenter, however, made the observation that with very rich cannel gas no loss of illuminating power, but rather an increase, took place up to twelve per cent. of air. If this be established the information will be very useful to cannel gas makers.

The demand for benzole has created a general desire to increase the yield. At present, the only available source is coal tar. But it is known that much benzole vapour remains uncondensed and passes on with the gas, and experiments, we read, have been made with the idea of securing this quantity. In Germany, it would seem, they have tried scrubbing the raw gas with the heavier tar oils with much success. The benzole is said to be taken out of the gas by this means, and is afterwards separated as usual by fractional distillation. The results are vaguely stated, and we can give no opinion on the process which, does not look to us promising, although it is said to yield immense quantities of benzole. The experiments of M. Berthelot point to a not distant day in which the heavier oils will be easily transformed into benzole in any quantity. He has already succeeded in effecting the transformation on a small scale, and his most recent researches seem to show that it may be done on a manufacturing scale. It is hardly necessary to say that if all benzole vapour be removed from gas, the illuminating power will be very considerably diminished.

Old shoes are not altogether wasted, but they have been put to a new use by M. Guyot. He cuts them up into thin shreds, and treats these with chloride of sulphur. Under this treatment, the shreds at first swell up and then become friable and brittle When this stage is arrived at, they are washed, dried, and ground to a fine powder, which we are told is of a grey-rose colour. This is mixed with some gummy or glutinous matter, and the mass is pressed into moulds to form combs, buttons, knife-handles, and such like articles. During the treatment with chloride of sulphur, it must be mentioned that the vapour of hydrochloric acid is given off, which on hygienic grounds requires to be condensed. Then when the shreds arrive at the brittle state, it is necessary to remove the excess of chloride of sulphur, and we imagine sulphur also. This is done by washing with sulphide of carbon, the recovery of which demands precaution. Taking all things into consideration, we doubt whether M. Guyot can make much profit by his process for converting old shoes into combs, although, by putting on the head what was once on the feet, he may, in one sense, be said to make both ends meet.

PROCEEDINGS OF THE BRITISH ASSOCIATION.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

SELF-REGISTERING HYGROMETER.

BY MR. E. VIVIAN.

MR. E. VIVIAN, of Torquay, read a paper on his new self-registering hygrometer. At a former meeting, he exhibited a self-registering instrument on the cumulative principle of recording mean values of the differences between wet and dry bulb thermometers, and a self-registering maximum and minimum hygrometer. He now produced an improved form of the former instrument, with a series of curves showing the comparative results of Leslie's hygrometer, his maximum and minimum differential, and his mean self-registering, which he now offered as the standard. He gave the uses to which it might be put. He had used it in recording the aggregate differences of solar heat of the sun and shade, the duration of rain, and the amount of nocturnal radiations, and many other similar purposes. He now proposed to apply it to recording the actual mean temperature, which would be an important feature if it could be worked out, and he believed it could, and also to the anemometer. He gave a full description of the instrument and its mode of working.

Mr. Symons thought the instrument valuable, and said he should like to see such a one at every watering place. He referred to the differences in the meteorological instruments used, and their position in different parts of the country, and said he should like to see every town furnished with a good set of instruments, placed in suitable and open positions.

Mr. Vivian said he should be happy to present one of his instruments to any watering-place that would like to possess it.

REFLECTION OF HEAT.

BY PROFESSOR MAGNUS.

IN this paper, Professor Gustav Magnus made known a curious discovery of his own that fluor spar has the property of reflecting, very largely, the dark invisible rays emitted by rock salt.

Dr. Balfour Stewart then called attention to the fact that there is much evidence tending to prove that the heat rays from rock salt are of very great wave length, belonging almost to one of the extremities of the spectrum.

REPORT ON GOVERNMENT AID TO SCIENCE.

BY LIEUTENANT-COLONEL STRANGE.

IN introducing the report, Lieutenant-Colonel Strange alluded to the proceedings last year at Norwich, which resulted in the formation of a committee to determine whether there is at present adequate provision in Great Britain for the vigorous prosecution of scientific research. The committee had, he said, come unanimously to the conclusion that science had not adequate means for its vigorous prosecution. He, personally, did not hold the very general opinion that it was a hopeless step to ask the present Chancellor of the Exchequer for Government aid. He then read the following report of a committee appointed by the British Association for the Advancement of Science at Norwich for the purpose of inquiring into, and of reporting to, the British Association the opinion at which they may arrive concerning the following questions:—I. Does there exist in the United Kingdom of Great Britain and Ireland sufficient provision for the vigorous prosecution of physical research? II. If not, what further provision is needed? and what measures should be taken to secure it?

Your committee, having sought the counsel of many of the most eminent men of science of the United Kingdom upon these questions, so far as it was found practicable to do so, and having carefully deliberated thereon, have arrived at the following conclusions:—I. That the provision now existing in the United Kingdom of Great Britain and Ireland is far from sufficient for the vigorous prosecution of physical research. II. It is universally admitted that scientific investigation is productive of enormous advantages to the community at large; but these advantages cannot be duly reaped without largely extending and systematising physical research. Though of opinion that greatly increased facilities are undoubtedly required, your committee do not consider it expedient that they should attempt to define categorically how these facilities should be provided, for the following reason:—Any scheme of scientific extension should be based on a full

and accurate knowledge of the amount of aid now given to science, of the sources from which that aid is derived, and of the functions performed by individuals and institutions receiving such aid. Your committee have found it impossible, with the means and powers at their command, to acquire this knowledge. A formal inquiry, including the inspection of records to which your committee have not access, and the examination of witnesses whom they are not empowered to summon, alone can elicit the information that is required; and, as the whole question of the relation of the State to science, at present in a very unsettled and unsatisfactory position, is involved, they urge that a Royal Commission alone is competent to deal with the subject. Your committee hold that this inquiry is of a character sufficiently important to the nation, and sufficiently wide in its scope, to demand the use of the most ample and most powerful machinery that can be brought to bear upon it. Your committee therefore submit, as the substance of their report, the recommendation that the full influence of the British Association for the Advancement of Science should at once be exerted to obtain the appointment of a Royal Commission, to consider—1. The character and value of existing institutions and facilities for scientific investigations, and the amount of time and money devoted to such purposes. 2. What modifications or augmentations of the means and facilities that are at present available for the maintenance and extension of science are requisite; and 3. In what manner these can be best applied.

On the Determination of the Real Amount of Evaporation from the Surface of Water.

BY MESSRS. G. J. SYMONS AND ROGERS FIELD.

The authors begin by pointing out the very inconsistent statements of even able meteorologists, and quote returns in proof of this. Thus for the same year, one observer gives the evaporation as 11in., and another observer gives it as 48in. They then quote the meteorological essays of the late Professor Daniell, to show how strongly he condemned the existing forms of evaporations, and then pass on to criticise the mode of computing the quantity of evaporation from hygrometric observations, proposed by Professor Daniell as a substitute for quantitative measurement. After a few words upon what the authors believe to be the great source of error in all existing forms of evaporation, namely, undue heating of the water experimented upon, they proceed to describe a series of experiments at Dijon and other places on the canal of Burgundy, in which the evaporation was measured in large tanks, and found to be only about half what was generally assumed to be the amount. Reference was then made to a very ingenious and accurate instrument for measuring the depth of water used by the authors; this apparatus—called a "Hook Gauge"—being exhibited and tried by members of the committee. Large drawings illustrated the apparatus Messrs. Symons and Field have hitherto used, and a number of tables were "taken as read." The authors epitomised the results of their experiments, showing what very erroneous measurements, even to the extent of 10 per cent. of error, were yielded by the best of ordinary evaporators, and concluded with a strong plea for further investigation by quoting the words of M. Valles, the French engineer, who first called attention to the great inconsistency of existing experiments:—"We do not understand how, in a country like ours, and with reference to one of the most important hydraulic data, we can rest content with only knowing that the numerical value of this datum lies between two limits, one of which is double the other."

The Refractive Energies of Metals.

BY DR. G. H. GLADSTONE, F.R.S.

This was a short instructive address on the relation between the refractive energies and the combining proportions of the metals. He pointed out that in most cases, but not all, the less the combining proportion of the metal the greater is the refractive energy. As metals are opaque and do not in the simple state refract light, in his experiments he had to use their salts in solution. The rule just mentioned does not hold at all with nonmetallic elements, and proves most accurate with those metals which form good definite salts, such as magnesium, iron, and zinc.

SECTION B.—CHEMICAL SCIENCE.

On the Measurement of Gases as a Branch of Volumetric Analysis.

BY DR. W. J. RUSSELL.

The author of this interesting paper stated that at present the measurement of the amount of gas given off during a reaction has been but little, if at all, used as a means of quantitative analysis. This, he observed, has arisen from the want of some simple and easy way of collecting the gas evolved. In a paper read before the Chemical Society last year he showed how carbonates might with very considerable accuracy be estimated in this way; and since then he has used the same method of determining the atomic of weights of nickel and cobalt. This form of volumetric analysis is of more general application than might at first sight appear probable, and will, it is believed, in certain cases be found of considerable importance. Having no standard solutions to prepare and keep in order is an obvious advantage; the gas apparatus, once in order, is then always ready for any kind of analysis in which gas is evolved; the reactions made use of, as a rule, take place rapidly, and the volume of gas, as far as the measurement of it is concerned, can be effected with very considerable accuracy. The amount of material used is generally very small, and the whole analysis occupies but a very short time, and can be very easily performed. The form of apparatus used for collecting and measuring gas has been already described in the "Journal of the Chemical Society" for August of last year. The lecturer gave some very interesting illustrations of the method he adopted in the analysis, and concluded by showing the results obtained by his method of volumetric analysis.

On Jargonia.

BY MR. SORBY.

The substances known as zirconia and jargonia were supposed to be identical. Recent experiments have shown them to be different, especially in colour, which is probably a characteristic peculiarity. The colour was thought due to the existence of iron, but subsequent experiments may show the colour is due to some other substances.

On the Amount of Soluble and Insoluble Phosphates in Seeds.

BY PROFESSOR GRACE CALVERT.

The Professor said that the results of various experiments he had made was that 100 parts of cotton fibre yield, when repeatedly washed with water, a quantity of acid phosphate of magnesia. Both husks and seeds also yield certain proportions, and these results show that the phosphates exist in much larger quantity in the seed than in the other parts of the pod. Experiments upon wheat flour of various kinds showed that whilst the flour contains only a trace of phosphates, especially soluble ones, the bran contains a large quantity. These facts tend to prove that the phosphates and the mineral matters contained in wheat are not combined with the organic matter, but are in a free condition. Other investigations go to prove that, although habit and pride have gradually led us to prefer white bread to brown, yet this is an error when we consider the nutritious properties of wheat, especially as food for children, phosphates being essential for the formation of bone and blood.

On the Economic Distillation of Gas from Cannel Coal.

BY DR. MACADAM.

The experimental observations which form the basis of this communication were undertaken for the purpose of determining the quantity and quality of gas obtained by the distillation of certain mixture of coals, as contrasted with the coals taken separately. Some samples of coals were selected for examination, and these were distilled in a small gaswork connected with a fully equipped apparatus. Each of the coals was examined separately, and thereafter the various coals were mixed in the proportions indicated by the separate analyses as likely to yield 10,500 cubic feet of gas, with 30 candle power, for every 5 cubic feet of gas consumed during a single hour. The mixed coals were in each trial placed in the same retort heated to a uniform temperature, and the experimental results demonstrated that where coals of different gas-producing power are heated in the same retort they yield a gas of superior illuminating power to that obtained from a mixture of the gases evolved from the same coals heated in the same proportions in separate retorts. Thus, two coals, which heated separately would yield from one ton, 10,806 cubic feet of gas of 30·09 candle power, when heated together give 10,714 cubic feet of gas, of 32·27 candle power; three coals were then used with similar differential results. Nine trials of mixed coals showed that the average increase of the illuminating power of the gas evolved from the mixtures of coals heated together in the same retort, as contrasted with the gas yielded by the same coals distilled in separate retorts, was 7·57 per cent., or one-thirteenth more of illuminating power.

On Some New Substances Extracted from the Walnut.

BY DR. T. L. PHIPSON.

Between the shell and the kernel of the walnut there exists a thin membrane called the episperm which closely envelopes the cotyledons, and is composed here, as in most other fruits, of a double membrane, the inner one being very thin, quite white, translucid, and perfectly devoid of taste, while the external one is much coarser in structure, more or less coloured, has a very bitter disagreeable taste, and contains certain substances which form the subject of this paper. From this membrane Dr. Phipson had extracted a substance which he called *nucitannic acid*, the most remarkable property of which is that, when boiled with dilute hydrochloric acid, it splits up into glucose and another new substance called *rothic acid*.

On the Solubility of Lead and Copper in Pure and Impure Water.

BY DR. T. L. PHIPSON.

Within the last few years a number of samples of water have been sent to me for analysis, said Dr. Phipson, with the question, "Will it attack lead pipes?" Having, at various intervals, tested a large number of specimens of commercial lead used for domestic and other purposes, the result of my experiments is that lead, copper, and perhaps zinc, are metals which can be dissolved in water at ordinary temperature, and in presence of air when submitted to friction, and that the water need not be so pure as the Surrey spring water in order to exert this solvent action.

Utilisation of Sewage.

BY DR. PAUL.

Dr. Paul, in his paper on the treatment and utilisation of sewage, alluded first to the necessity of adopting better regulations in large cities and towns for that purpose. He very justly insisted on the necessity of pure air and water to ensure the health of the vast population of this country. In thinly populated towns no great difficulty would be experienced in devising simple measures sufficient to meet all requirements, and the mode of effecting the object in view would of course be a matter to be determined and carried out by the individual residents of a place. As the magnitude of towns increased, the difficulty of dealing with the question became greater, and the offensive consequences of accumulation near dwellings became more sensible, and hence the subject became more and more a matter to be dealt with by the local authorities. The lecturer showed conclusively the deleterious effects of some gases by the pollution of water, and from refuse allowed to accumulate in a state of putrefaction or decay near dwellings. Opinions vary as to the precise mode this baneful influence is exercised, whether by the evolution of deleterious gases, by the development of those minute organisms which are now considered very generally to be the media of infection, or in all these ways conjointly; but there is no longer any doubt or difference of opinion as to the general truth that, in regard to the mode of dealing with excretal refuse, the sanitary point of view is far more important than any other.

Extraction of Ammonia from Gas Liquor.

BY MR. F. BRAY.

A few years ago the refuse from coal gas works was perfectly useless, but the progress of science has discovered valuable uses for gas liquor. From coal tar not only now are obtained naphtha, benzole, carbolic acid, but various brilliant dyes and colours. The paper fully described the apparatus for extracting the ammonia by the author's plan; and the advantages effected are economy in labour, time, and occupation, of plant, together with the facility of extracting the whole of the ammonia in a pure condition. A manufactory previously consuming 10,000 gallons of gas liquor per week may now utilise 24,100 gallons, and at about half the expense of fuel that was formerly incurred.

On the Supposed Action of Light on Combustion.

BY MR. C. TOMLINSON.

The popular idea that "light puts out the fire" is so fixed that probably no conclusions drawn from

actual experiment are likely to disturb it, especially if they be adverse to the notion. It is a matter of daily experience, as people say, that if a fire is nearly out in a well-lighted room, you have only to draw down the blinds in order to revive the fire. Experiments on the subject are not easily made, in consequence of the many disturbing causes; but, from some experiments found in an old volume of the "Annals of Philosophy," made upon coloured tapers, the conclusion arrived at was that the solar rays, in proportion to their intensity, have the power of retarding to a considerable extent the process of combustion, but this conclusion is open to objection—from a series of experiments on candles of different sizes and weights in dark chambers and day and sunlight. It was found that the increase of temperature led to increased consumption of material and *vice versa*, and the whole result may be stated that, in any case, the difference is so small that it may be referred to accidental circumstances, such as temperature and material—the final conclusion being that the direct light of the sun, or the diffused light of day, has no action on the rate of burning, or in retarding the combustion of an ordinary candle.

SECTION C.—GEOLOGY.

KENT'S CAVERN.

BY MR. PENGELLY.

MR. PENGELLY read the fifth report of the committee on the exploration of Kent's Cavern. He said that beneath the floor of the vestibule was a layer of black soil, 6in. to 9in. deep, which had yielded 366 flint implements, bones and teeth of recent and extinct animals, charcoal, flint cones, &c. It had been objected that people could never have lived in the caverns, because smoke would have suffocated them. An experiment which had been tried, in burning six faggots of wood, showed the fallacy of the objection. In the exploration of the cavern, a daily journal had been kept, and every circumstance was noted down. 3,948 boxes of fossil bones had been found, and these Professor Boyd Dawkins undertook to examine for the purpose of determining the species to which they belonged. Among other objects, a bone needle had been found in the black band beneath the stalagmitic floor. The eye was capable of carrying a thread the thickness of thin twine. A bone harpoon or fish-spear, forked on one side only, had been met with. Other undoubted evidences of early human art had been found. During the years 1868-9, Mr. Everitt, who is engaged by the Rajah of Sarawak to explore the cave of Borneo, visited Kent's Hole for the purpose of familiarising himself with the mode of operation. Mr. Pengelly then detailed the various layers underlying the stalagmitic floor, in which he was aided by a series of large diagrams. The cave earth, or floor underneath the stalagmite, was full of flint implements, teeth of the mammoth, bear, hyena, &c., and gnawed and split bones. Inscriptions dated 1688 had been found on the stalagmitic walls of that part of the cavern known as the crypt. The deduction drawn by Mr. Pengelly was that this period of time, although the dripping of water was very copious, had been insufficient to coat over and obliterate the writing. This gives some idea of the immense age of the stalagmite floor, and of the time occupied in its formation. Beneath the earth was a breccia, and up to last year not the slightest traces of man had been found. This year, however, a flint flake was met with, thus carrying the antiquity of man further back. A monthly report had been sent up to Sir Charles Lyell. In some places, the stalagmitic floor was as much as 12ft. thick. Associated with the flakes were the remains of the cave lion, the cave bear, the mammoth, &c. In fact, this was the most important anthropological relic which the cavern had yielded. Mr. John Evans, F.R.S., had seen the flint flake, and had declared it to be of undoubtedly human workmanship.

Professor Boyd Dawkins read a few notes on the mammalian remains mentioned by Mr. Pengelly. He showed that the various strata of the floor of the cavern contained remains of animals of different epochs, from the post-glacial upwards. During the time the black or upper band was being formed, a race of cannibals inhabited the cavern. The older deposits contained remains of the glutton, a species of hare larger than the existing type, the beaver, &c. Mr. Dawkins concluded by remarking on the vast antiquity of the human race as indicated by the facts mentioned in the report.

ON THE TRAPPEAN CONGLOMERATES OF MIDDLETOWN HILL.

BY MR. GEORGE MAW.

THIS was a description of the contemporaneous traps of Lower Silurian age in the ridge known as the Middletown Hill, running parallel with the Breidden, on the borders of Shropshire and Montgomeryshire. Especial reference was made to the great beds of bouldered trap, consisting of boulders of felstone, of compact texture, imbedded in a matrix of felstone tuff. The nodules occupy about half the mass of the conglomerate, and are unaccompanied by pebbles of any other rock. They vary from the size of a walnut to rounded masses weighing more than a hundredweight. Sir R. Murchison's description of these beds was referred to, and the author took exception to the term concretionary trap, employed in the Silurian system, as he considered the rounded outline of the boulders was unquestionably due to mechanical causes. The interbedded traps, bounded on either side by the Lower Llandeils Flags, are of a collective thickness of about 780ft., including two beds of the bouldered felstone, 114ft. and 140ft. thick, alternating with two beds of a whitish green felspathic breccia, 210ft. thick and 315ft. The line of separation between the breccia beds and the beds of boulder trap is remarkably sudden, and no graduation of character occurred between them. The breccia is worked for hard felspar, used for pottery purposes, and contains small nests of steatite. The bouldered condition of the felstone beds was considered due to their partial breaking up on being erupted under water, the soft matrix of felspathic tuff being the portion more intimately divided, and the compact boulder fragments that had resisted watery disintegration. The sudden alternation in Middletown Hill of eruptive beds of very dissimilar character was noticed. They seem all to have been emitted in immediate succession, as, although overlaid and underlaid by sedimentary rocks, there is no evidence of the interstratification of sedimentary beds. The author, in conclusion, pointed out the close geographical association with these bedded traps of the much later porphyritic greenstone of the Breidden Hills, which, it was suggested, might have been emitted from the same point of eruption; and the local association of the intrusive greenstones with the Lower Silurian interbedded felstones was noticed as being very general in North Wales.

Specimens of the conglomerates were exhibited, and the President of the Section, Professor Harkness, said he had no doubt they were of mechanical origin. In this view also, Mr. Maw was borne out by Mr. Boyd Dawkins, Mr. Moore, and others, although exception was taken to it by Mr. Edward Hull, who thought the rounded pebbles might be due to weathering, as spheroidal weathering was characteristic of felspathic rocks.

Mr. Godwin-Austen said one of the chief benefits of the Association meetings was that they showed how much could be said on both sides. He referred to recent volcanic eruptions as illustrating how the beds mentioned might be deposited.

A short communication was made by Mr. W. Carruthers on reptilian eggs from secondary strata. Some of the eggs were *Chelonian*, or turtle, in their character. Many of them had all the appearance of fruit. They had a peculiarly glossy appearance, and were very thin. Mr. Carruthers went into some detail on the origin of small shakeneides found in coal shale, and explained how they had been formed by gas or air.

THE EXTINCTION OF THE MAMMOTH.

BY MR. H. H. HOWORTH.

IN this interesting paper the various historical notices in old authors of the Mammoth remains in Siberia and elsewhere, were well condensed. The usual idea was that the mammoth was a sort of huge mole, which rarely came to the surface. This was the way their vast remains were accounted for. Mr. Howorth did not think the extinction of the mammoth ought to be ascribed to the men of the early stone age.

Professor Phillips and Professor Boyd Dawkins made some remarks on the paper, the former dwelling at some length upon the more popular geological notions of the former conditions of northern geography, and the latter observing that Mr. Howorth had misunderstood him. He had never said that the extinction of the mammoth in Siberia was owing to his being hunted down; but he had stated that in England and Western Europe generally, there was no doubt that the mammoth had become extinct by the hand of man.

Mr. Howorth briefly replied, stating that he still differed from Mr. Dawkins as to the extinction of the animals mentioned. He thought that different races of man had become extinct along with the animals.

ON THE FOSSILS OF KILTORCAN.

BY MR. BAILEY.

THIS was a report on the fossils of Kiltorcan, county Kilkenny, of the Geological Survey. The fossils in question are those of the Old Red Sandstone. Some of them were exhibited, and the appearance of the fine fronds of ferns, two feet across, extending over the surface of the greenish sandstone, was very striking. Some of the large fluted stems of another fossil plant, six inches in diameter, were also shown. The most important additions made by the researches of Mr. Bailey were among the fossil crustacea, belonging to the family *Eurypteridæ*, many of the forms being new to palæontology. Fossil fish had also been met with, allied to the genera *Dendrodus*, &c.

In the discussion which followed, the President remarked that the systematic excavations which had been made at Kiltorcan had been of considerable importance to Irish geology. Sir Philip Egerton confirmed the fish relationship of many of the triangular scales.

Mr. Carwithers said that the discovery of the large fossil ferns was very valuable. The finding of the *Sagenaria* in fructification was rare, and this specimen in its root, leaves, and fruit, was a valuable contribution to fossil botany.

Mr. Henry Woodward said the association of fossil ferns with crustacea was unique. He hoped that Mr. Bailey would be aided by a further grant from the British Association, in order that he might continue his researches in those very interesting beds. The crustacean remains were of a most important character, and he thought they might expect to find innumerable new forms. In the present controversy, as to the fresh-water or marine origin of the Old Red Sandstone, such researches would be of immense importance.

Mr. Charles Moore, F.G.S., then made a communication relative to a specimen of *Teleosaurus* from the Upper Lias. He said he had discovered shells (*Leptæna*) in the Middle Lias, which had been thought peculiar to the Palæozoic rocks. Above these was a bed rich in nodules, and these nodules when broken open were seen to be full of the bones and other remains of *Teleosaurus*.

SECTION D.—BIOLOGY.

MAN AND THE ANIMALS.

BY ARCHDEACON FREEMAN.

THIS paper involved a counter-theory to Mr. Darwin's as to the origin of species. The author referred to the similarities existing between man and animals, and triumphantly asked how were those similarities of appearance to be accounted for but by such a theory? The answer might be found in a counter-theory. Darwin's theory, in answer to his question, was that there was unity of type, explained by unity of descent—he supposed that all animals had graduated from each other. Why not accept the teachings of the biblical record on this point; and could not a foundation be found for the similarity in animals in the biblical account of creation? At that time after the fall of man, certain mysterious creatures appeared, and appeared, too, externally to the proper cosmos or creation, and which were placed at the entrance to Paradise to bar man from the happiness which he had forfeited. By the description of those creatures, they appeared to unite in themselves the characteristics of four of the noblest of animals, man—he lion, the ox, and the eagle. Did not the existence of those mysterious creatures seem to suggest that the creation was a modification of those mysterious creatures, a doctrine which was largely believed by Plato? Here they had an answer to Darwin's theory, and an answer which they had never seen put forward at present. They would meet his question, in fact, by the answer that there was another answer to his question than that which had been given. The answer to Darwin was that a nobler page was given the animals bearing a noble relation, but not relationship to man, and that this view would be found consistent with the phenomena noticed by Darwin.

THE DIFFICULTIES OF DARWINISM.

BY THE REV. F. O. MORRIS.

THIS paper commenced by describing Darwin' argument as a *non sequitur*—a mere assumption that because there was similarity in different

animals, therefore there must be continuity. The writer also had collected a variety of instances of fixity of species, under circumstances in which a change might have been expected where no change had taken place, and said that there was abundant proof, both in the animal and in the vegetable world, that no change from one species to another had ever or would ever take place. The writer pointed to the well-known difficulty experienced by those who wished to preserve either plants or animals of some artificial type in preventing a return to the original. When he found small birds of a peculiar kind on an island, Darwin's theory was that they had come from the main land, and had become changed in consequence of the altered conditions. That theory, however, gave no *cui bono* for such an argument—it was merely an assumption. Moreover, had the birds, when they came to the island, found it suitable, they need not have changed, and if unsuitable why did they stay there? The proceedings in regard to acclimatisation during the last few years had almost served to upset the theory of a change from one species to another on account of altered conditions, as salmon were naturalised in waters very distant from their original home, and under vastly changed conditions, without altering them, and in many directions in the animal kingdom they found animals subjected to great changes, and submitting to them without making any change in the race, or individuals of the race.

PHILOSOPHICAL OBJECTIONS TO DARWINISM OR EVOLUTIONISM.

BY THE REV. J. M'CANN, D.D.

THE author of this paper complained that scientific men did not allow the subject to be treated philosophically. He also examined some of Professor Huxley's statements concerning the origin of life, and entered upon an elaborate argument concerning consciousness and the sufficiency of the evidence of the senses. He handled some of Professor Huxley's arguments and theories very severely, and contended that they led necessarily to materialism and fatalism, although he wished to speak with feelings of brotherly love of the Professor himself.

At the close of the reading of these papers, which bore upon one and the same subject, there were loud calls for Professor Huxley, who stepped at once upon the platform at the request of the President, who characterised the papers as having had nothing to do certainly with the Darwinian hypothesis. Professor Huxley said it was painful to men of science, who were working on those great and serious questions with all the sense of responsibility which the grave nature of the task created, to have brought under their notice year after year—and it was now ten years since the Darwinian discussion first commenced—the same arguments, which had been answered and counteranswered again and again, and the answers to which might be found scattered broadcast. As he heard paper after paper of that kind read, it seemed to him to be one of the strongest arguments against the doctrine of progress, for they were no further than they were ten years ago. The last paper which had been read, and which was fresh in their minds, should receive some of his attention. He, like Dr. M'Cann, held for no divorce between philosophy and physical science. But it was exactly the philosophy which he desired so much to see that was so conspicuous by its absence from the Rev. Doctor's address. He failed to trace in the address the least acquaintance with those who had attempted to solve the great problem of philosophy—Comte Berkeley or Mill. He had made it his business to make himself acquainted with philosophy, and he believed all men of science did the same, and, if Dr. M'Cann had done so, it would surely not have occurred to him that the theory of the learned and pious Berkeley, Bishop of Clayne, tended to materialism. Surely Dr. M'Cann ought to know that Berkeley had denied the existence of substance apart from its attributes. Dr. M'Cann had contended that consciousness was necessarily to be relied on, but he could not have surely known that the famous maxim of Des Cartes, *Cogito, ergo sum*, had had its foundation broken up in every way long ago, and that no man would care to rest his convictions upon the most unstable of foundations. The learned Professor ridiculed the idea that conscientiousness could be a guide in starting upon so great a problem, and, speaking of Archdeacon Freeman's paper, said he highly commended the courage with which the gentleman had gone back to the Bible for his argument instead of sheltering himself as so many did behind the assertion that the Bible was not intended to teach physical science. He (Professor Huxley) never could understand how men could read the first chapter of Genesis and not see that the writer intended to give an account of the cosmogony. He would, however, say that the Archdeacon's argument was not a new one, and, in fact, a considerable period of his (Professor Huxley's) scientific life had been spent in dealing with those arguments. Archdeacon Freeman had also made a mistake in supposing that the similarity of types was only to be found in the higher animals, for the lower they went, the greater was the similarity.

Drs. Hooker, Wilkes, Vivian, and Professor Wallace also defended the Darwinian theory, and contended that no argument had been put forward in any of the papers which at all affected it. The Rev. J. M'Cann made a spirited reply, in which he quoted as his authority on the reliability of consciousness, Sir John Hamilton, and denied, in general terms, that he had assigned too much power to the faculty in his argument in favour of the introduction of a philosophical method of treating scientific subjects.

SECTION E.—GEOGRAPHY.

THE MOUTH OF THE LIMPOPO.

BY DR. MANN.

THE author gave a description of Erskine's Discovery of the Mouth of the Limpopo. For a considerable time there had been very great difference amongst geographers as to what really was the outlet of the great African river into the ocean. It was a matter of interest upon double ground, because it had been a reproach to geographers hitherto that the outfall of the great river, well known in its higher part, was entirely unknown, and in the next case because there was something to tell of bold and brave adventure on the part of a young man, connected with a geographical result. The gentleman accomplishing it was Mr. St. Vincent Erskine, the young son of the Colonial Secretary of Natal. The reason that made him undertake the journey was that just before he had heard from a great German traveller, who had travelled between the Limpopo and Zambesi, that he had seen old workings of gold mines, and that he had reason to believe there was a rich auriferous district lying around. Dr. Mann read an abstract containing the main points of the account, which was exceedingly interesting. The journey occupied four months. The stream was found to be 300 yards wide at full tide where it flowed into the ocean, and the sea was breaking for three miles out in a succession of small rollers, indicating a shoal coast. There was a broad lagoon shut in by dry sand, except where an open channel, 100 yards long, ploughed through it. He took an observation of the altitude of the sun at noon, showing that the river was 25deg. 15min. South, but he was not able to get the longitude, through having had to abandon his instrument. If he had been supplied with Colonel Strange's instrument it would have been the very thing to have secured him against the unfortunate result. The geological point was that the line of the river taken from its confluence into the Indian Ocean, had been almost accurately laid down, which it had not been hitherto, in the maps. He expressed a hope that the Geographical Society would be true to itself and encourage Mr. Erskine in further prosecuting his work, and get the problem settled so far as the astronomical supply of the accurate longitude of the mouth of the river was concerned.

THE RUNN OF CUTCH, INDIA.

BY THE PRESIDENT.

SIR BARTLE FRERE gave a lengthy and interesting description of the country which lies between India proper and the valley of the Indus, more especially with reference to the curious geographical phenomena marked on the maps as the Runn of Cutch. The nature and peculiar characteristics of this country were so little to be gathered in ordinary maps or books of reference that a few remarks upon it, derived from personal observation, might stimulate those who were in a position to make exact inquiries by means of scientific appliances, to do so. In the maps, between India proper and Rajpootana and the valley of the Indus, appeared a space nearly blank, not because it was unknown or not traversed, but because there was very little to mark on it. It was variously designated as the great Indian Desert, or sometimes as the Thurr, a term which did not convey any very distinct idea to the European mind, and it terminated in a district generally known to our map-makers as appropriated to a marshy tract or morass. He himself did not know any ordinary term used in geography which would precisely describe either of the regions. Cutch was a district 600 miles long, and nowhere less than seventy miles in breadth. It was divided into two great portions. The north was generally marked by great sand hills, and was called the Great Desert, and the southern portion, generally marked as a morass, was called the Runn. The country, however, described as a desert did not answer to our ideas of a desert, because it was inhabited by a people who had the appliances of civilised life, though on a very humble scale and after a very peculiar fashion. They were a very ancient people and much attached to their sand hills. It was not altogether entirely uncultivated either, because there were oases here and there, and in the middle of it was the celebrated city of Jessulmere, the capital of one of the principal Rajpoo dynasties, that had existed there over 1,200 years. The country was hedged in throughout its whole space by sand hills, some of which were said to be 200ft. high. The people generally spoke of the sand hills as having been formed by the wind, but he (Sir Bartle) did not believe that; but, from observations, he came to the conclusion that they were formed by subterranean forces, by an upheaval of the earth during an earthquake. He then described the particular part called the "Runn," which was not a bog, but a perfectly flat hard plain, composed of sand and clay. This district contained no animals, no vegetables, no hollows, nothing that they might expect to see on any part of the earth's surface. It extended for a hundred miles in length and forty miles in width, and formed a very serious obstruction to travellers from the cultivated and peopled portion of Cutch. He would not pretend to solve the problem how this table was formed, but would hazard the conjecture that it was somehow connected with the constant vibration caused by the very active and persistent volcanic action, evidence of which was found in the country around the basin, formed on the one side by the Thurr, and on the south by the semicircular land and Cutch proper. There could be no doubt that volcanic action all round there was more active than in any other part of the world.

Sir Charles Trevelyan thought that the sand hills in the north-western part were more or less connected with the wind. He asked Sir Bartle whether the idea that was prevalent in India that the Runn was an inexhaustible magazine of salt was correct, and whether the salt existed ready made or only to be obtained by evaporation.

The President described the three ways in which salt was formed; and then said that just below the surface of the Runn, extending for miles, sheets of salt had been found 2ft. or 3ft. thick, and there could be no doubt that an action was going on which ages hence might produce such salt caverns as they saw in Cheshire and the Tyrol.

PLAN OF A CANAL TO UNITE THE UPPER NILE WITH THE RED SEA.

BY DR. BEKE.

THIS paper shadowed forth a project for forming a water communication between the Red Sea and the interior of Africa, not by turning the water of the sea inland, as it was said M. Lesseps contemplated doing, and thus submerging the Sahara, or great desert, but by diverging into the Arabian Gulf a portion of the head waters of the Nile. Dr. Beke said of the feasibility of the scheme there could be no doubt, inasmuch as the main features were already formed by nature. The proposed canal would simply follow the line of a natural water-course, running from south-west to north-east, between the sixteenth and nineteenth parallels of north latitude, whilst its operation would be to convey a portion of the waters of the Atbara, the last great tributary of the Nile, into the Red Sea, at a short distance to the south of the port of Suwakin. Sir John Bowring's "Report on Egypt and Candia" (1840) stated, on the authority of M. Linant, that the Ashbarra or Bahr Mogren might easily be turned into the Red Sea at Souakim. It passed over plains and sands, and the remains of a bed or canal already traced by human hands existed from the Ashbarra to the Red Sea; and in 1852 MM. de Malzac and Vayssière proceeded from Surakim up a khor or wady to Fillik, in Taka, and stated that the waters of the Gash, when at their highest, partly found their way to Tokar down the valley, along which they had travelled, while in 1855 Dr. Schweinfürth proceeded from Suwakim to Karsala, and found the Gash to be a tributary, if not identical with the

Wady Langeb. A junction between the Gash at Atbarra might be easily made. Referring to the cotton supply, he pointed to the Egyptian province of Taka and the neighbouring districts watered by the Gash and the Atbarra as a region capable of furnishing to our manufacturers an almost unlimited supply of an article which was absolutely essential to the millions whose subsistence was dependent on the great branch of our national industry. The cotton fields of Upper Ethiopia had occupied his attention for many years past. The regions in question were described by Pliny, the naturalist, as possessing scarcely any trees of importance, except those bearing wool, and that it was from thence that the seeds of the cotton plant were in 1820 introduced into Egypt, where its cultivation made such rapid progress that the quantity exported in 1824 was 30,000,000lb., which, at the Government price, realised £848,478. That was the produce of an exotic plant, of which a stranger, M. Jumel, had accidentally seen a specimen growing in a garden only four years previously. In any case the establishment of this line of transport would be attended with most important and beneficial results, for, in addition to the conveyance of cotton and other products from Taka to the coast, the distance of Khartum on the Nile to the shores of the Red Sea was little more than 400 miles, through a fertile and well watered country, whilst from thence to Egypt it was double the distance by a desolate and difficult route, so that the canal now proposed could not fail to become ere long the main channel for the commerce of Sennaar and the surrounding country, and it would eventually bring into connection with the shores of the Red Sea, and so with the civilised world, the more extensive, most fertile, and most populous regions of inter-tropical Africa. Now that the expedition, under the direction of Sir Samuel Baker, had been set on foot for the exploration, subjugation, and civilisation of those regions, the great importance of this short and direct means of communication with the interior of Africa became still more apparent.

The President thought the paper did not contain such an impracticable suggestion as might at first sight appear.

Dr. Blanc, who, it will be remembered, was one of the captives in Abyssinia, could not quite agree with Dr. Beke's canal. He thought the streams would be too rapid for any boat that had ever been built to live in. Besides that, the natives in that part of the country were Bedouins, who had been roving tribes for centuries, and nothing would induce them to settle down. He was afraid if the canal were made it would not be navigable on account of them, and that it would require the expatriation of those natives from the plains before ships would be able to pass unmolested.

Mr. Trelawny Sanders said he should be sorry if the subject were to stand where Dr. Blanc had left it, for he left the question of the civilization of Africa in a very hopeless state. There were many who looked on that question as one of the grandest that at present agitated the philanthropic world, and this proposition of Dr. Beke's bore upon it. He believed they had only to establish a revival of good government and proper administration over the people of that country, to protect life and industry, to bring about as great a state of civilization as existed there under the Romans. He believed if Western Europe applied its mind to the civilization of Africa that it would be successful. He did not advocate Dr. Beke's details, and merely spoke on the question generally, but he believed the time was not far distant when the mystery that enshrouded the continent of Africa would be removed.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

UNIFORMITY OF WEIGHTS AND COINS.

BY PROFESSOR LEONE LEVI.

THIS was the report of the committee on the uniformity of weights and coins, which was presented by the learned Professor in the interest of science. The report opened by stating that considerable progress had been made during the year in the assimilation of weights, measures, and coins in all countries. The North German Confederation had adopted the metric nomenclature, and added corresponding idiomatic names. By a law dated June 13th, 1868, the metre was adopted as the basis of weights and measures, and they resolved to take as a primary measure of length the platinum bar in possession of the Prussian government, which in the year 1863 was found by a commission appointed by the French and Prussian governments to be equal to 1·00000301 metre of the temperature of melting ice by comparison with the metre deposited at the archives in Paris. Still greater progress had been made in the introduction of the metrical system into India, and the report entered into particulars of the same. The committee had made efforts to extend the system to the colonies and dependencies of the empire, and they trusted that before long there would be decided uniformity of weights and measures. The second report of the standard commission, just published, recommended the removal of every difficulty, and the full and legal introduction of the metric system. Chambers of commerce and agriculture (including the Barnstaple Farmers' Club) had petitioned in favour of uniformity. With regard to international coinage no steps had been taken since the report of the Royal commissioners. The Chancellor of the Exchequer, however, had recently enunciated his views in favour of imposing a seigniorage of about one per cent. for converting gold into sovereigns. This was a difficult question, and the committee contented themselves in echoing the recommendation of the Royal commissioners that another international conference be speedily held. The committee, in conclusion, recommended their reappointment with a grant of at least £50, for the purpose of further stimulating the early realisation of one uniform system of weights, measures, and coins in all countries—an object of the highest importance in the interest of science, education, commerce, and peace.

NAVAL FINANCE.

BY MR. ROBERT MAIN.

THIS subject was treated by Mr. Robert Main, of the Admiralty, in an able paper. Its object was to show the causes of increase in naval expenditure in the last twenty years. The increase, which was nearly five millions sterling, involved a positive increase of four millions to taxation. The improvements to the navy, such as the increase to seamen's pay, the increased cost and value of provisions and stores, the extended basin accommodation for ships, &c., accounted for more than a million and a half sterling; nearly the same amount has gone to actual additions to the navy, such as the naval reserve, the maintenance of a large force of seamen in reserve, and the establishment of a Channel squadron; while the remaining million has gone in the establishment of factories, the increased use of steam power in the navy, and the construction of iron-clads. The difficulties, therefore, of financial reformers and economists were greater than in contending against extravagance alone, which was light in comparison to the costliness of the navy now in every point, both in *materiel* and *personnel*. Their exertions would now have to be directed principally to substituting a more elastic system of naval defence for that in existence at the present time.

INTERNATIONAL COINAGE.

BY DR. FARR.

THE author read a very elaborate and learned paper on this subject. He examined at considerable length the proposal of the Chancellor of the Exchequer to charge at the Mint a seigniorage of about one per cent. for coining gold into sovereigns, fully approving of the scheme, and contending that a seigniorage within certain limits need not cause any change in the current value of the sovereign; the sovereign will never purchase less in the market by reason of the Mint charging something (not too much) for converting the metal into the coin, and the only sufferers by the change will be the holders of uncoined gold, and theirs will not be a grievance of any great importance. With regard to international coinage, Dr. Farr recommended, as the international unit of values, a new gold coin weighing ten grains and worth 25s., retaining our present sovereign and half-sovereign for a time, and working them gradually out of circulation. He recommended this in preference to the 25 franc piece for several reasons, especially because the French masters of currency themselves were generally of opinion that the 25 franc piece would not be a convenient standard.

Mr. Burn, of America, contended that while the English sovereign stood at its present value, there would be no international standard. He ridiculed the system of a mixed currency of paper and coin, contending that one or the other should be adopted exclusively. With regard to weights, he pointed out the anomaly of a discrepancy between avoirdupois and troy weight, neither the lb. nor the oz being identical in the two systems.

Mr. F. Fellows argued that if we adopted Mr. Lowe's proposal of a seigniorage upon coining sovereigns, reducing the sovereign from an intrinsic value of 25 francs and twopence to 25 francs, we should lose a very large sum in exchange with France and other countries.

Sir John Lubbock, a member of the Royal Commission on International Coinage, Weights, and Measures, said he was in a minority of one on the commission in favour of charging a seigniorage, and he was glad to find the Chancellor of the Exchequer and Dr. Farr of the same opinion with himself. The sovereign among ourselves would be of the present value, and in exchange with other countries the difficulty suggested by Mr. Fellows would not arise, for we do not pay for imports with coin but with bills, and the value of bills would remain unaltered.

Professor Newton, of the United States, was opposed to Dr. Farr's suggestion of a new common standard worth 25s., as it would overturn every system in the world, and be a change so large as to be an immense inconvenience. What was wanted was a scheme to bring the sovereign and a certain number of francs into identity. In his opinion, the simplest way to do this was to follow up the Chancellor of the Exchequer's scheme of charging a certain seigniorage upon the minting of the sovereign by trying to induce the French Government to charge exactly the same seigniorage for minting the 25 franc piece as our Government would charge for coining the sovereign, and so making the sovereign and the 25 franc piece at once of the same nominal value and the same intrinsic value.

Sir John Bowring was opposed to the Chancellor of the Exchequer's proposal, as one introducing great inconvenience, and spoke strongly in favour of maintaining the English sovereign at its present value, that being the coin best understood and appreciated in every quarter of the world.

AGRICULTURAL ECONOMIES AND WAGES.

BY PROFESSOR LEONE LEVI.

THIS was a most elaborate paper, and one full of interest to the Devon agriculturists. The Professor concluded with the following summary propositions:—

1. That the great causes of low wages in agriculture, as compared with other industries, appear to be the prevalence of physical labour and the permanent and general excess of labourers.

2. That it being highly important for the welfare of the labourer to raise the condition of agricultural labour from that of unskilled to skilled labour, it is necessary to extend elementary education, to promote technical education among farmers and stewards, and to offer liberal remuneration to superior skill and careful working in any of the operations of farm labour by the extension of payment by piecework and the greater adoption of machinery.

3. That, with a view to the greater efficiency of labourers, nothing is more important than that the labourer should receive wages sufficient to maintain him in a condition of health and vigour.

4. That, in order to modify the excess of labourers in agriculture, it is requisite to remove any obstacle, by the law of settlement or otherwise, to the free removal of labourers from county to county, to promote emigration direct from the country districts, to extend the cultivation of land, and to increase the commerce and manufacture of the country.

5. That the difference existing in agricultural wages in different counties in the kingdom, though greatly modified by the allowance in kind in some of them only, mainly arises from a greater or less excess of labour, greater or less efficiency of labour, different degrees of productiveness of the soil, difference in the capital invested in agriculture, and the presence of other industries.

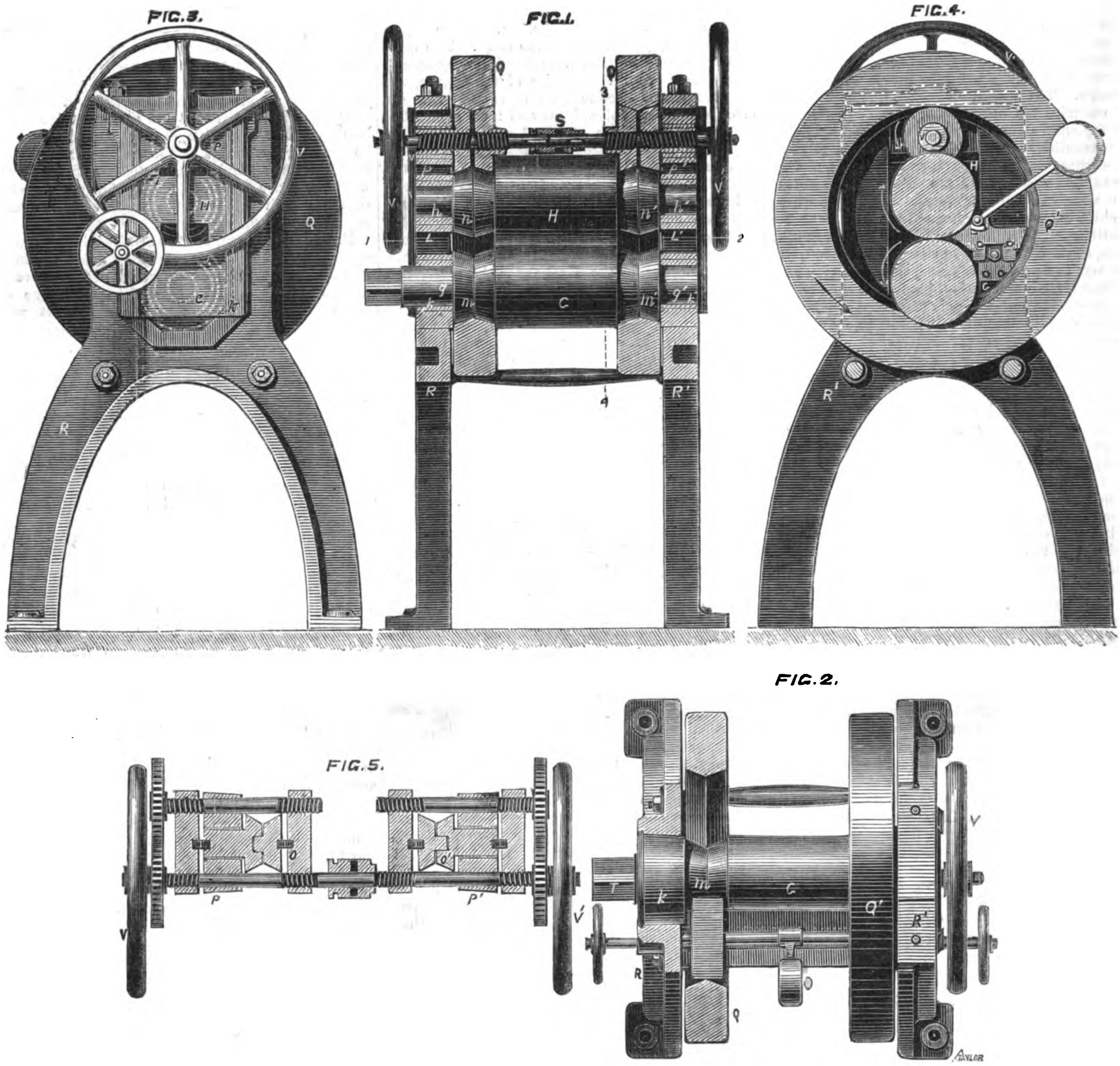
6. That, for the purpose of encouraging the investment of capital in agriculture, it is important to extend the custom of granting long leases, to secure compensations for agricultural improvements, and to remove any inequalities in the burden of taxation wherever they exist, and to extend as far as possible railway accommodation in agricultural districts.

7. That, having regard to the advantages connected with the system of yearly hiring, as the best mode of securing a continuity of labour in the same service, and of promoting the welfare and contentment of the labourers, it is highly desirable to extend the custom in all counties, provided it may be introduced without the objectionable practice of hiring fairs and markets, substituting for them registry offices in all the market towns.

(Continued on page 192.)

ROLLING MILL.

BY M C. MONGIN.



IMPROVEMENTS IN ROLLING MILLS.

THE invention illustrated in the accompanying engraving has for its object to convert the sliding friction of the axles of the rolls of rolling mills in their bearings into a rolling friction, and thus to obviate almost entirely the loss of power which results under existing arrangements from the first-named friction. For this purpose the rolls have gudgeons running in ordinary bearings in the headstocks as hitherto, but these bearings do not take any of the upward and downward pressure exerted by the rolls, but only serve to steady them in their motion, the pressure being taken by the following arrangement:—At the inner side of the headstocks or framing, necks are formed on the rolls, the necks on the lower roller being made with V groves, while those of the upper roller are made with projecting V surfaces. The necks of the lower roller take a bearing directly upon corresponding projecting V surfaces on the inner circumferences of large strong rings or hoops which pass round the necks of both rollers, being of such a diameter, however, that the upper roller does not bear directly upon their inner surface, but through the intervention of antifriction rollers having V grooves corresponding with the V surfaces of the upper roller and the ring.

From this arrangement it will be seen that when reversed motion is imparted to the rolls in the ordinary manner, on the metal to be acted upon being passed between them the pressure of the lower roller will be taken at the lowest point of the ring, while that of the upper roller will be transmitted by the antifriction roller to a diametrically opposite point of the rings. As the antifriction rollers transfer the rotary motion of the upper roller to the rings in the same direction as the motion imparted to them by the lower roller, it follows that the rings will be caused to travel round as the rolls revolve, and the necks of the lower roller will consequently roll on their inner surfaces, while the necks of the upper roller will roll on the antifriction rollers. In place of imparting the required motion directly to the rolls it may be imparted either by toothed gearing or by driving belts to the revolving rings, or even to the antifriction rollers. The adjustment of the rolls nearer to or farther apart from each other may be effected by making the antifriction rollers of two parts, divided in a direction at right angles to their axis, and connecting them by right and left handed screws, by turning which the two parts may be either brought nearer together, thereby forcing the upper roller nearer to the lower roller, or be moved farther apart, thereby allowing greater play between the rollers. We would here observe that this invention is due to M. Charles Mongin, of the well-known firm of Ch. Mongin and Co., saw manufacturers, of Paris, and has recently been patented in England.

Figs. 1 to 5 in our engraving show the improved construction of rolling mill. Fig. 1 shows a longitudinal section of the same; fig. 2 shows a part plan and part sectional plan on line 1 2, fig. 1; fig. 3 shows an end elevation; fig. 4 shows a transverse section on line 3 4, fig. 1. The lower roll G rests with its trunnions g and g^1 in the brasses $k\ k^1$, fixed in the guides of the side frames R R^1 while the upper roll H rests upon the lower roll The trunnions $h\ h^1$ of the upper roll carry brasses L L^1 situated between the guides of the side frames, and the upper roll carries the rollers O O^1 resting upon the parts $n\ n^1$ of the roll, which rollers carry on their trunnions the brasses P P^1, also working between the guides of the side frames. Lastly, two strong rings Q Q^1 rest upon the rollers O O^1.

As shown in fig. 1, the inner surfaces of the rings Q Q^1 are V shaped, and fit accurately into the peripheries of the rollers O O^1 formed with V grooves, into which fit also the V surfaces of the parts $n\ n^1$ of the roll H, while the peripheries of the parts $m\ m^1$ of the roll G are formed with V grooves fitting accurately upon the V surface of the rings Q Q^1; these latter are consequently prevented from altering their position laterally upon the rolls. The rollers O O^1 are made in halves connected together by the right and left handed screw spindles $v\ v^1$, by turning which by means of the handwheels V V^1 the two parts of the rollers may be brought closer together or moved farther apart, thus allowing greater or less play between the parts $m\ m^1$ of the roll G and the inner circumference of the rings Q Q^1. If now the metal to be rolled be introduced between the rolls these will be forced asunder until the inner surfaces of the rings Q Q^1 are pressed against the parts $m\ m^1$ of the lower roll, whereupon, if rotary motion be imparted to

MACHINERY FOR FORGING.

BY MR. W. CLAY.

FIG. 1.

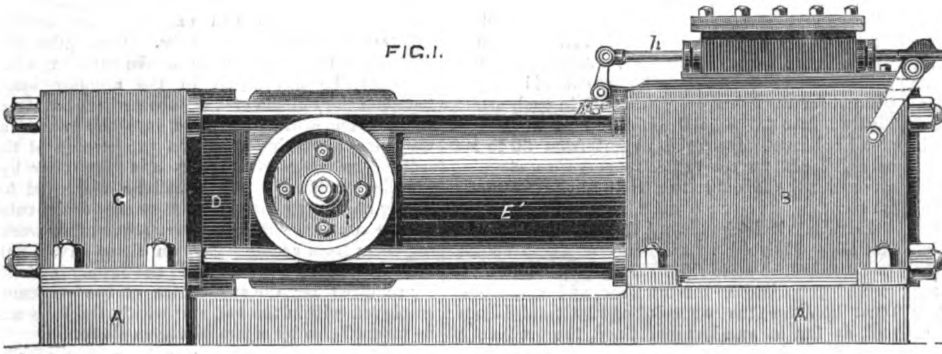


FIG. 4.

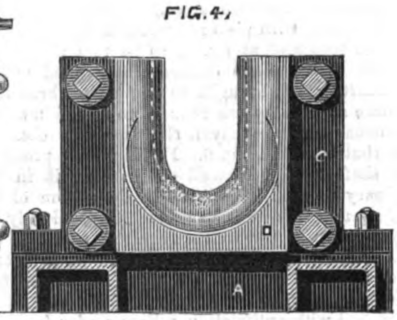


FIG. 6.

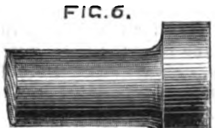


FIG. 5.

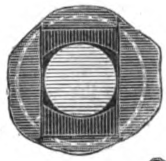


FIG. 2.

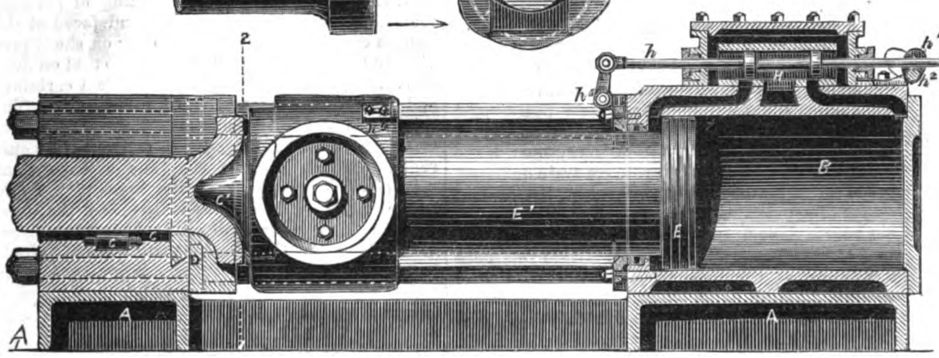
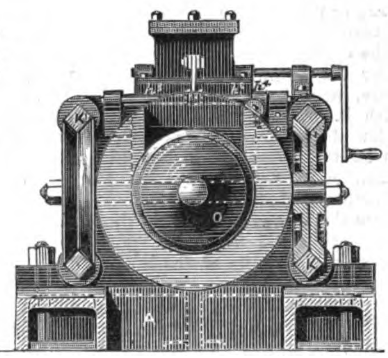


FIG. 3.



the latter in the direction of the arrow, fig. 4, it will impart motion in the same direction to the rings Q Q^1, and these will in their turn impart motion in the same direction to the rollers O O^1, which will consequently impart to the upper roll H the requisite rotary motion in the reverse direction to that of the roll G.

The space between the rolls is regulated for rolling different thicknesses of metal by screwing the two parts of the rollers farther apart or nearer together, as already described. In the arrangement of screw spindles shown for this purpose it will be seen that the screw spindles and their wheels V V^1 revolve with the rollers, and consequently it might be difficult to regulate these while in motion. In place, therefore, of this arrangement, that shown in sectional plan at fig. 5 may be used, in which the two halves of the rollers bear against two crossheads, through which work two right and left handed screw spindles carried by the framing P P^1, whereby the wheels V V^1, and consequently the rollers, can readily be operated, and thus the thickness of the metal be reduced while the rolling mill is in motion. In either arrangement of mechanism for regulating the distance of the rolls an oblique position may be imparted to the latter so as to roll the metal of a greater thickness on the one side than on the other, by screwing the two parts of one roller nearer together than the parts of the other roller, which may be readily effected by rendering the screw spindles independent of each other by disengaging the clutch S.

From this arrangement it will be seen that the pressure exerted by the rolls, instead of being transmitted to their bearings in the headstocks, as is usually the case, is transmitted through the rollers O O^1 to the revolving rings Q Q^1, whereby the great loss of power arising ordinarily through the sliding friction in the bearings is almost entirely obviated by substituting rolling friction for such sliding friction. This system may be readily applied by means of slight modifications to all existing rolling mills; and where it is not desired to render the gauge of the rolls adjustable, the arrangement may be simplified by making the rollers O O^1 of one piece and without the adjusting mechanism. In this case the rollers might with advantage be replaced by a third roll formed similarly to the roll H, so as to constitute a three-roll mill. The motion may be imparted to the mill either through a coupling on the trunnion of the one roll, as indicated at T, or by driving the rings Q Q^1, either by driving belts or by forming teeth on their periphery in gear with spur driving gear.

MACHINERY FOR THE MANUFACTURE OF FORGINGS.

MR. WILLIAM CLAY, of Liverpool, has patented an invention which relates to that class of forgings known in the trade as heavy forgings, the object sought being to ensure sound forgings, which it is very difficult to obtain when manufacturing bulky articles, the thickness of the metal in which greatly and suddenly varies. In manufacturing, for example, marine engine shafts with disc couplings the point of junction of the disc with the shaft will generally be found when cut into to exhibit internal fissures which greatly detract from the strength of the shaft. In order to avoid this defect and to ensure solidity throughout the metal of large forgings, Mr. Clay proposes when forming heads, collars, or flanges upon the ends of shafts or rods to employ a horizontal hammer of peculiar construction, which is connected with and operated by a piston working in a horizontal steam cylinder, and thereby materially to reduce the sectional thickness of the metal at the line of junction of the head, collar, or flange with the shaft.

In the accompanying engraving, fig. 1 shows in side elevation the kind of steam hammer which Mr. Clay employs in manufacturing heavy forgings; fig. 2 is a partial longitudinal section of the same; fig. 3 is a transverse section taken at the line 1 2 of fig. 2, and looking in the direction of the arrow; and fig. 4 is a transverse section taken in the same line, but looking in an opposite direction. A A is the bed of the machine formed in one casting. To one end of this bed the steam cylinder B is bolted, and to the other is secured a block C for receiving on its face the anvil D. The face of this anvil is shaped to correspond to the form the end of the shaft is intended to receive by its lateral expansion, and in order to allow of the anvil being changed to suit different sizes or kinds of work it is made to fit into V's formed on the face of the block C. The anvil is U-shaped, as shown at fig. 4, and the block has a corresponding vertical hollow to enable it to receive the heated shaft that is intended to be brought under the action of the hammer. To facilitate the turning of the shaft on the anvil the block C is fitted with antifriction rollers *c c c* which support the shaft when it is presented to the hammer. E is the piston of the cylinder B, fitted to a cylindrical trunk E^1, which carries at its other end the hammer block.

Fitted centrally in the face of this block is a conical piece G^1, which forms the striking part of the hammer; its object is to form a cavity in the end of the shaft, and thus by reducing the thickness of the metal at that part to remove the liability of fissures occurring in the forging. H is the slide valve, the rod *h* of which extends through the opposite ends of the valve box. At its rear end this rod is formed into a link to receive a cam h^1, which is keyed to a cross shaft h^2. This shaft rocks in bearings on the top of the cylinder B, and it is fitted with a handle, by raising or depressing which the attendant is enabled to operate the valve, and thus regulate the advancing and retrograde movements of the hammer at pleasure.

To prevent the risk of damage to the machinery from inattention the valve rod is jointed at its front end to the arm of a rock shaft h^3 mounted in bracket bearings at the front of the cylinder B, and fitted with a pendant arm h^4 carrying an antifriction bowl. In a line with this bowl on the hammer head is fitted an adjustable stop h^5, which as the piston is nearing its back stroke will strike the bowl of the arm h^4 and rock the shaft h^3. This motion of the rock shaft will, by reason of its connection with the valve rod, cause the valve to advance and cut off the supply of steam to the cylinder, while at the same time it will stop the escape of the exhaust steam, and thus provide an elastic cushion for the piston to strike against.

An incidental advantage derivable from making the cylindrical trunk E^1 of the large diameter indicated in the engraving is that it will allow of but a small amount of steam being used in the return stroke of the piston, while a powerful propelling force may be used for its advance. The hammer head is fitted with a pair of V-grooved wheels I, which turn freely on a fixed axle that passes through the hammer head. These wheels are intended to carry the weight and facilitate the traverse of the hammer, and for this purpose they run upon and between angular rails K K^1, which constitute also tie rods for connecting the cylinder B and blocks C together, and enabling the machine the better to resist the strain to which it is sub-

jected. The lower rails K serve as track rails for the traverse to and fro of the hammer, and the upper rails K ' assist in steadying the wheels on the track rails.

In order to form a head or enlargement on a shaft according to Mr. Clay's invention he first takes a shaft forged in any approved manner, and piles the end with pieces of wrought iron, after the manner indicated at fig. 5, so as to approximate roughly to the shape desired. The piled end of the shaft is next brought to a welding heat in a furnace and the pieces reduced to a solid mass in the usual way, whereby a shaft head is obtained like that shown at fig. 6. Having thus prepared the shaft forging instead of finishing it in the ordinary way it is submitted to the action of the forging machine we have described, previously reheating the shaft, if that is required, to enable the machine to act efficiently upon it. The heated shaft is placed with its head opposite the hammer head, as shown at fig. 2, in the block or rest C, furnished with antifriction rollers c c for facilitating the turning of the shaft when required. The head of the shaft overlies the anvil which forms the face of the block C, and the hammer by reason of its shape will, in delivering its blows, form a conical hollow in the head of the shaft, and thereby to a considerable extent reduce the bulk and equalise the thickness of the metal at the centre or the junction of the head with the shaft. By turning the shaft from time to time on its axis as the operation proceeds its head will be reduced under the blows of the hammer to a regular figure, requiring comparatively little turning to finish it. This mode of forging thick portions hollow also ensures a more equable contraction of the metal when cooling than hitherto, and the formation of fissures in large forgings of the character illustrated will be thereby avoided. To ensure the best practical effect the cooling of the metal (when the forging is completed) is commenced at the centre of the head by the application of a jet of water or other cooling medium. By thus causing the metal to shrink towards the interior instead of the exterior the chief difficulty of obtaining sound forgings will be removed.

(Continued from page 189.)

8. That whilst payment in kind is objectionable, as it is liable to great abuse, produces much uncertainty, throwing the dangers of the market on the party less able to bear them, it is still more objectionable where any part of the wages is paid in the shape of cider or spirits.

9. That the bondage system prevailing in Northumberland operates most unjustly to the labourer, and acts most disadvantageously on the moral condition of women in that district.

10. That, upon a comparison of the purely agricultural with the purely industrial counties, the agricultural exhibit a smaller rate of births, deaths, and marriages, a better state of education among the adults, especially among women, nearly an equal proportional number of children at school, less drunkenness, and less crime, but more pauperism and more illegitimacy than the industrial counties.

11. That the house accommodation in the rural districts appears to demand decided improvement, many of the old cottages being inconsistent with the moral and physical well-being of their inhabitants.

12. That it were much to be desired that to every cottage a small garden should be attached; and that where that is impossible an allotment of land, conveniently situated, should be granted with it.

13. That for the purpose of stimulating habits of self-reliance and independence of character among the agricultural labourers, it is most important to restrict as much as possible the operation of the poor law, to promote the establishment of savings banks, insurance companies, and friendly societies under proper control, and to limit to the utmost extent the licensing of public-houses and the inordinate consumption of spirits.

14. That, taking into account the large excess of agricultural labourers, and the probability of a still further displacement of labour in proportion with the introduction of machinery and skill, the need of regulating the efflux of such labourers to the towns and manufacturing districts in relation to the power of commerce and manufactures to absorb them; the importance of procuring the contentment of such agricultural population, and the universal desire of the most industrious among them to own a plot of land or to farm it on his own account; as well as the great advantage of offering means for the investment of savings in the mode most consonant with their habits, and in almost the only way within their reach, it seems highly expedient, even regardless of other economic considerations of a conflicting character, that facilities should be afforded for the purchase of lots of land of reasonable size, capable of being cultivated by the proprietors themselves; that any land now held by corporate or public bodies should be appropriated for that purpose; and that in each estate, divided into large holdings, a limited number of small holdings, varying in extent from 30 to 100 acres, should be set aside, to serve as stepping stones for the labourer to rise to the position of a farmer.

15. That it is important that the agricultural statistics published by the Board of Trade should be extended, so as to show the number and extent of land proprietors, the number and acreage of farm holdings, the wages of agricultural labour, and, as far as can be ascertained, the produce of the soil.

SECTION G.—MECHANICAL SCIENCE.

THE CHANNEL RAILWAY.

BY MR. J. F. BATEMAN.

THE author referred at some length to the advantages which would accrue from a continuous railway communication between England and France, and to the various proposals for effecting that object by a tunnel to be driven beneath the bed of the sea—by submerged roadways and tubes—by large ferry boats carrying trains on board—and by bridges to be carried on piers formed on islands to be sunk in the Straits. A ferry boat, large enough to receive a whole ordinary train on board, would be a material improvement on the present means of conveyance. Such boats, however, cannot be employed, except by the construction of special harbours on each coast. With reference to a tunnel, it has been proposed to drive one of ordinary size for a double line of railway, which shall descend by a gradient of 1 in 60 on each side of the Channel to a depth of about 270ft. below the bed of the sea. The total length of the tunnel would be thirty miles, of which twenty-two would be beneath the sea. A special commission, appointed by the Emperor of the French recently reported in favour of a submarine tunnel. We propose to lay a tube of cast iron on the bottom of the sea, between coast and coast, to be commenced on one side of the Channel, and to be built up within the inside of a horizontal cylinder or bell, or chamber, which shall be constantly pushed forward as the building up of the tube proceeds. The bell or chamber within which the tube is to be constructed will be about 80ft. in length, 18ft. internal diameter, and composed of cast-iron rings 8in. thick, securely bolted together. The interior of the bell will be bored out to a true cylindrical surface like the inside of a steam cylinder. The tube to be constructed within it will consist of cast-iron plates, in segments 4in. in thickness, connected by flanges bolted together inside the tube, leaving a clear diameter of 13ft, Surrounding this tube and forming part of it, will be constructed annular discs or diaphragms, the outside circumference of which will accurately fit the interior of the bell. These diaphragms will be furnished with arrangements for making perfectly water-tight joints for the purpose of excluding sea water and securing a dry chamber, within which the various operations for building up the tube, and for pressing forward the bell as each ring of the tube is added, will be performed. There will always be three, and generally four, of these water-tight joints contained within the bell. A clear space between the end of the tube and the end or projecting part of the bell of 36ft. will be left as a chamber for the various operations.

Within this chamber powerful hydraulic presses, using the built and completed portion of the tube as a fulcrum, will, as each ring is completed, push forward the bell to a sufficient distance to admit the addition of another ring to the tube. The bell will slide over the watertight joints described, one of which will be left behind as the bell is projected forward, leaving three always in operation against the sea. The weight of the bell and of the machinery within it will be a little in excess of the weight of water displaced, and therefore the only resistance to be overcome by the hydraulic presses when pushing forward the bell is the friction due to the slight difference in weight and the head or column of water pressing upon the sectional area of the bell against its forward motion. In like manner the specific gravity of the tube will be a little in excess of the weight of water which it displaces; and in order to obtain a firm footing upon the bottom of the sea, the tube will be weighted by a lining of brick in cement, and for further protection will be tied to the ground by screw piles, which will pass through stuffing boxes in the bottom of the tube. These piles will, during the construction of the tube within the bell chamber, be introduced in the annular space between the outside of the tube and the inside of the bell, and will be screwed into the ground as they are left behind by the progression of the bell. The hydraulic presses and the other hydraulic machinery, which will be employed for lifting and fixing the various segments of the tube, will be supplied with the power required for working them from accumulators on shore on Sir William Armstrong's system, and the supply of fresh air required for the sustenance of the workmen employed within the bell and within the tube will be insured also by steam power on shore.

As the tube is completed, the rails will be laid within it for the trains of waggons to be employed in bringing up segments of the rings as they may be required for the construction of the tube, and for taking back the waste water from the hydraulic presses, or any water from leakage during the construction. The tube will be formed of rings of 10ft. in length, each ring consisting of six segments, all precisely alike, turned and faced at the flanges or joints, and fitted together on shore previously to being taken into the bell, so that on their arrival the segments may, with perfect certainty and precision, be attached to each other. The tube when laid will be secure from all dangers arising from anchors or wrecks or submarine currents. The building of the tube will be commenced on dry land above the level of the sea, and will be gradually submerged as the tube lengthens. The first half mile will test the feasibility of construction, for that will have to be built both above and under water. When once fairly under water the progress should be rapid, and it is estimated that the whole undertaking may be easily completed in five years.

The precise line to be taken will probably be between a point in close proximity to Dover and a point in close proximity to Cape Grisnez on the French coast, where the sea bed on this line appears to be the most uniform in level, and, while free from hard rocks and broken ground, to consist of coarse sand, gravel, and clay. The average depth of water is about 110ft., the maximum about 200ft. On the line suggested the water increases in depth on both sides more rapidly than elsewhere, although in no instance will the gradient be more than about 1 in 100. The tube, when completed, will occupy about 16ft. in depth above the present bottom of the sea. Up to the point on each shore at which the depth of water above the depth of the tube would reach (say) 30ft. at low water, an open pier or other protection would have to be constructed for the purpose of pointing out its position, and of preventing vessels striking against the tube. The tube at each end would gradually emerge from the water, and on arriving above the level of the sea would be connected with the existing railway systems. The distance across the Channel on the line chosen is about twenty-two miles.

The tube as proposed is large enough for the passage of carriages of the present ordinary construction, and to avoid the objections to the use of locomotives in a tube of so great a length, it is proposed to work the traffic by pneumatic pressure. The air will be exhausted on one side of the train and forced in on the other, and so the required difference of pressure will be given for carrying the train through at any determined speed. Powerful steam engines, for exhausting and forcing the air into the tube, will be erected on shore at each end. This system of working the traffic will secure a constant supply of the purest air. By this system of working there would scarcely exist the chance of accident—no collision could take place. There would never be foul air within the tube. The pneumatic system can be as cheaply worked, and be in every way preferable to locomotive power. Combined goods and passenger trains might be sent through the tube at twenty miles an hour, with occasional express trains at thirty miles an hour. The estimated cost of the whole undertaking is £8,000,000. Mr. Chalmers estimated the total annual revenue at £1,800,000. The working expenses would be amply covered by £150,000, leaving about 14 or 15 per cent. dividend.

Mr. Bidder remarked that this subject had not been without interest to him, as it would be recol-

lected that he made a few remarks on it when presiding over the Section at Norwich last year. The atmospheric system, which was a very old subject, and which had been tried to a very great extent in this neighbourhood, failed on account of using a small tube with a large pressure, but it was different with a large tube. He believed the pneumatic principle was the only one that could be adopted to work the tunnel. He thought there would be a difficulty in getting the united actions of the two Governments to carry out the work. Unless the tunnel was worked pneumatically, he would rather cross in the present boats. Until an experiment had been made to test this plan, and the probable cost, it would be more reasonable to construct a huge breakwater and build vessels that should be adapted to cross, except on special occasions, with certainty and despatch.

Mr. C. Vignoles believed that if ever there was to be a tunnel to Calais it must be on this principle. The real cause of the failure of the atmospheric system was not as Mr. Bidder put it, but from an accumulation of heat in the air pumps. It would never pay as a commercial undertaking, as there was not sufficient traffic; but it might be done by the Governments. They, as engineers, considered the scheme a practical one; but he was afraid it must be left to the next generation to carry out.

Mr. Bateman, in reply, contended that the cost would not exceed his estimate.

TRAIN COMMUNICATION.

BY MR. F. VARLEY.

THIS was a paper on a system of communication between guards and passengers on railway trains when in motion. The system was applied in 1866, and is now in use on the Royal train, and it has since been adopted in other trains. The author believed electricity to be the best agent for signalling on rolling stock, and the difficulty in applying it, he believed, was more with reference to the mechanical parts than the electrical. Three electrical systems had been applied to railway travelling, one used by Mr. Preece, on the South-Western Railway; one by Mr. C. V. Walker, on the Great Eastern Railway, applied to trains which run twenty miles without stopping; and one by Mr. Martin, on the North-Western Railway, and this was the one which formed the subject of this paper. Insulated wire is run underneath the carriages, and the ironworks, the coupling bars, and the wheels are connected electrically together. Two insulated wires (one of which is connected with the wire underneath the carriages, the other to the ironwork) are led up to each compartment, and when these two wires are brought in contact the telegraph circuit is closed, and the alarum set ringing. The carriages are connected together by means of flexible conductors, and these are also laterally connected with the insulated wire underneath the vehicles. The apparatus in the guard's van consists of a battery placed in a box and an electric alarum, and on the engine is another alarum. By moving a handle in any of the carriages the alarums are set going. The action of moving the handle sets free a spring, and the handle is locked and cannot be put in its original position until the spring or lock is opened, which is done by means of a key in the possession of the guard. No electrical knowledge is needed to work or keep in order the apparatus, the maintenance of it is not costly, and the alarums, batteries, &c., can be easily shifted from one train to another. At the request of the Board of Trade, in 1866, a train was fitted up with this apparatus which had travelled 250 miles each day, and been started and stopped by its means.

GOVERNMENT INSPECTION OF BOILERS.

BY MR. L. E. FLETCHER.

MR. FLETCHER read the report of the committee on boiler explosions. The conclusions at which the committee arrived were—First, that a lamentable loss of life is annually caused by steam boiler explosions, which urgently calls for public attention. Second, that these explosions, as a rule, are not accidental, but may be prevented by the exercise of common knowledge and common care. Third, that the present investigations conducted by coroners with regard to steam boiler explosions are eminently unsatisfactory, and call for immediate improvement. Fourth, that coroners should, when conducting inquiries on boiler explosions, be instructed and empowered to avail themselves of competent engineering advice, so that the cause of every boiler explosion may be fully investigated, while the information acquired should be widely circulated. Fifth, the committee entertain a sanguine hope that this course alone would do much towards the prevention of the present recurrence of steam boiler explosions, without any further Governmental action.

Mr. Fletcher subsequently read a paper on Government action with regard to boiler explosions. It was, he said, a question whether it is expedient or not for the Government to interfere in the matter of the prevention of steam boiler explosions; and if so, in the second place, what would be the best mode for action to be taken. It is proposed that the Government should take the supervision of every boiler in the country, with the exception of locomotive and marine, and through the medium of the Board of Trade should test all new boilers, and periodically examine them when set to work, as well as all others already in use. Another plan is to render inspection compulsory, but not that Government should take the task of examining boilers into its own hands. A third plan was that the user should be free to use his boiler as he pleased, but would be responsible for any accident, and liable to an action for injury or loss of life in case of an explosion. This last plan, it was urged, would, if adopted, arouse to suitable vigilance those connected with the use of steam, which was all that was required.

Mr. Alcock was of opinion that inspection on the part of the Government was not desirable. The result of Government supervision might be seen in mines, where explosions frequently occur. He thought the present law would sufficiently punish any neglect. A comparison of the number of boiler explosions in 1860 and 1868 would show that the insurance companies were doing good work.

Mr. Bramwell believed that the whole of the deaths resulting from the boiler explosions of last year was not one-fourth of the number of persons who were run over and killed in the streets of London. The coroner's court should be made more efficient. He threw out two suggestions—(1) that there should be a Government inspector to whom persons using boilers might apply for inspection; and (2) that no person should be allowed to make a boiler who was not efficient.

Captain Galton thought the best way to secure safety was to apply to the insurance company, and said he had got the whole of the steam boilers under the authority of the War Office placed under the Boiler Explosion Prevention Company. He thought the persons using steam should be responsible for explosions.

A gentleman pointed out that the inspectors under the Factory Act had power to inspect dangerous machinery, and suggested that they should have authority to call in the aid of a suitable person to inspect the boilers.

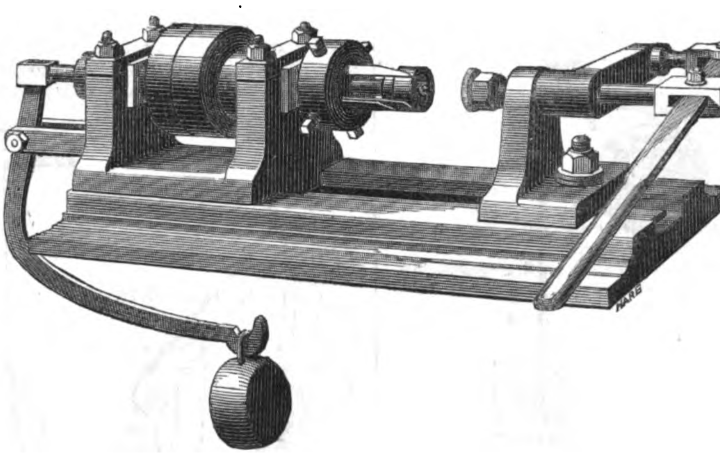
Professor Rankine said he never knew a boiler explode, except from weakness. He preferred to throw the responsibility on the boiler user.

Mr. Fletcher said that for three persons killed by railway accidents, one was killed by boiler explosion. He thought the system of insurance of boilers was wrong, as it led people to try and get their boilers insured rather than inspected.

The President agreed with what seemed to be the general opinion of the Section, that Government interference was undesirable. He also thought that some improvement should be made in the coroner's investigation. A vote of thanks was given Mr. Fletcher for his paper.

SHIVE-CUTTING MACHINE.

BY MESSRS. REDUP AND BRIGGS.



REDUP AND BRIGGS' SHIVE-CUTTING MACHINE.

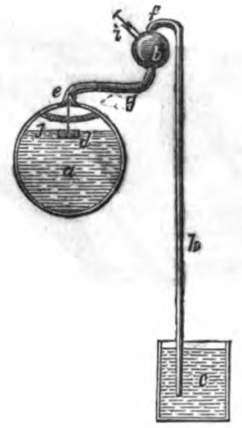
AT the late Manchester Show we came across a very neat and convenient little machine for cutting shives or wooden bungs from solid wood. It was designed and patented by Messrs. Redup and Briggs, and is manufactured by Messrs. Hayward Tyler and Co., of Upper Whitecross-street. Referring to the accompanying engraving, which we find in the "Brewers' Journal," it will be seen that the machine consists of a cast-iron bed-plate similar to that of a lathe-bed, with a fixed headstock having a hollow mandrel revolving freely in gun-metal bearings. Inside this mandrel is a steel rod, which passes through the mandrel for its entire length, and projects at each end. At one end of the hollow mandrel is the gun-metal chuck, in which are fixed, by means of set screws, the four steel cutters by which the cutting of the shive is performed. These cutters are flexible to a certain extent, so that they can be expanded by the brass disc which is carried by the end of the steel spindle, but which is free to revolve with the cutters. The hollow mandrel is fitted with the fast and loose belt pulleys. It will be observed that the outer end of the steel rod is pressed upon by one arm of the bent lever, the other arm being loaded with an iron weight, which tends to force the brass disc already mentioned towards the movable headstock, leaving the cutters free to close to the diameter of the disc, which determines the size of the small end of the shive. The movable headstock on the right can be screwed down at any required distance, and is fitted with a lever handle and sliding bar, having screwed on its end a brass socket, on which is fixed a wood disc, the use of which will presently be seen. The sliding bar is moved longitudinally by the lever handle.

So far the description of the machine; next as to the manner in which it is worked. The piece of wood from which the shive is to be cut is held against the wooden disc fixed on the brass socket by the left hand, and by means of the lever it is then pressed against the revolving cutters. As it is forced towards the fixed head, it comes in contact with the end of the rod, which is pointed, and this rod, being acted upon by the weighted lever, holds the wood steadily against the disc. The cutters, when they first enter the wood, cut out a narrow circular groove, the inner diameter of which is equal to that of the smaller end of the shive. But as the wood is forced towards the fixed headstock the cutters are gradually expanded by the brass disc and they are thus made to give the shive its proper tapered form. After the wood has been cut through, the lever is drawn back, and the finished shive is then forced from between the cutters by the weighted lever operating on the sliding rod within the hollow mandrel. We should mention that one of the cutters has a slight projection on its inner side, which cuts the chamfer on the small end of the shive. By placing packing pieces beneath the tools and changing the disc, shives of any required diameter can be cut, packing pieces and discs of various sizes being supplied with the machine. The shives can be cut from oak staves or any waste pieces of wood, and the machine is easily operated by a boy. We may add that these machines are already in use at Messrs. Bass's, Ratcliffe, and Gretton's establishment at Burton-on-Trent, as well as in other breweries, favourable reports being received of their working.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending September 4 was 5,100. Total number since the opening of the Museum, free daily (May 12, 1858), 1,636,497.

A NEW INJECTOR.

THE apparatus here figured, from "Cosmos," is the invention of M. Delaurier, who names it the "Automatic Alimenter." It is adapted for use at



all pressures, and acts, as will be seen, without the aid of any machinery. The manner in which it functions is as follows:—In the boiler *a* is a float *d* which descends as the level of the water falls and opens a valve *e* communicating with a closed vessel *b* containing water. Steam taking the place of this water forces it down into the boiler, and then the float *d* rises and closes the valve *e*. Almost as soon as the valve is shut, the steam condenses, and a vacuum is made in the closed space *b*; then another valve *f* at the top of the vessel opens, and water ascends from the reservoir *c* to be let out again at *e* as before. In this way, the water in the boiler is always kept at the same level.

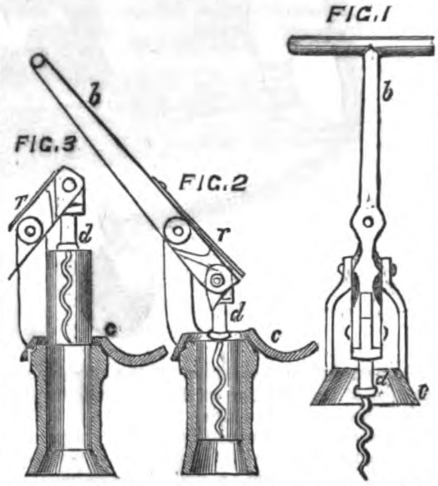
To set the apparatus in action for the first time, it is, of course, necessary to remove air from the space *b*, which is done by means of a small air pump *i*. This is worked until the space is filled with water, after which the apparatus functions of itself, but it is well to give the pump a few strokes occasionally, to be certain that the space is kept clear of air.

To make sure that the valve *e* is either completely opened or closed, there must be some slight friction to retard the movement a little. This is given by the piece of metal *j*, through which the rod of the float slides. The delay gives time for all the water in the space *b* to run out; and then, there being an excess of water in the boiler, the float is kept for some time pressed against the valve *e*. Without this slight modification the apparatus would not act at all or only very imperfectly. The reservoir of cold water *c* may be ten yards below the level of the valve *f*.

A NEW CORKSCREW.

IN spite of the numerous ingenious mechanical devices which have appeared from time to time with the object of substituting the principle of the lever for the muscular exertion of the individual, the latter still remains the favourite and the surest method of drawing a cork. It is also the quickest; for dividing the operation into two parts, that of screwing in the screw and that of extracting the cork, the manner of effecting the former is common to all the methods ever proposed or invented. If we suppose a couple of bottles, into the cork of one of which the screw of an ordinary corkscrew is inserted, and into the other that of any of the patented inventions, and one of the bottles delivered to an expert "waiter," and the other to one equally well practised in the manipulation of the patent screw, there is no question but that the cork will be whipped out by the ordinary screw in less time than it will be extracted by the other. It is quite true that to draw a tight cork with a common corkscrew requires an amount of physical exertion which is beyond the powers of a woman or girl unless she is well practised in the operation and has acquired the "knack," for although occasionally a good pull is indispensable, yet in the main it is the wrist which really does the job. Connoisseurs and old parties who vaunt the merits of the "wine with the green seal" complain, and justly too, of the "shaking" which the bottle suffers by the use of the ordinary screw, but it must be borne in mind that while most of the patents obviate this acknowledged defect, yet it is only when they are properly handled. An inexperienced hand will "shake" a bottle infinitely more by an abortive attempt to use a lever screw than if he understands how to draw a cork adroitly by the common screw.

A new description of screw has lately been patented by Messrs. Jafroy Brothers, of Paris, which is less complicated, has fewer parts, is more effective and cheaper than those already before the public. It is represented in the accompanying cuts, and a brief description will render it per-



fectly intelligible. Owing to the disposition of the levers the cork can be extracted very gently and with great facility. There are five parts in this screw, but they are not detached, as is frequently the case, and consequently there is no chance of the screw being rendered useless by the loss or mislaying of any one piece. Referring to the cuts, *b* is the handle, which may be of wood, horn, ivory, or any other suitable material. The screw is screwed into the socket *d*, which allows of its being replaced when broken or worn out without necessitating the loss of the rest of the apparatus. The spring *v* is mounted in a manner which permits of its ready replacement by any locksmith, and the cap *c* is lined with an internal leather collar. The screw itself presents no feature of particularity, being identical with those in common use. It will be seen that the shape of the handle is the same as that of an ordinary screw, which is certainly the best adapted for getting the screw in quickly. For private houses there is no doubt but that this patent screw will be found exceedingly useful and convenient, but for public-houses and bars it is questionable whether the common plan of drawing corks will ever be departed from.

A STEAM OMNIBUS.

A SHORT time since a steam omnibus, or, to speak more accurately, an omnibus drawn by a road steamer, passed along Princes-street, Edinburgh. This road steamer has been built by Mr. R. V. Thomson for an enterprising omnibus proprietor in one of the largest towns of England, who intends to have his omnibus drawn by steam. The trial, says the "Scotsman," was divided into two stages, the first of them being at Granton. There the engine, with the omnibus attached to it, was run up and down the incline to exhibit its speed and the ease with which it could be controlled. It went up the hill at the rate of seven miles an hour and came down it at the rate of nine. It turned in the road with far greater ease than if drawn by horses, was pulled up instantaneously at the word of command, and even backed up hill. It then proceeded from Granton to Leith, and the second stage of the trial consisted in the journey from Leith to the West-end of Princes-street. The road-steamer, with its omnibus, started from Constitution-street, and ran at best omnibus speed up Leith-walk and Leith-street, making no account whatever of their steepness. The dexterity with which it picked its way between strings of cart-horses, omnibuses, and cabs, and the docility with which it stopped or turned whenever it was required, were marvellous. It ran from one end of Princes-street to the other without stopping, then turned down South Charlotte-street and on through North Charlotte-street to Forrest-street, where at the steepest point, when the descent looked really dangerous, it was brought to a sudden standstill, to show how completely it was under command, and how entirely it could dispense with any kind of brake. This was its final display, and it then went quietly and rapidly back to Leith. The trial was completely successful, and left nothing to be wished for. It was very amusing, as the road-steamer sped along Princes-street, to watch the pleased surprise depicted on every face as it passed. Those who saw it will be perhaps glad to remember that they witnessed the journey of the first steam-engine ever built for omnibus traffic in towns.

FRESH MEAT FROM THE RIVER PLATE.

AN experiment of importance towards solving the question as to the possibility of obtaining supplies of fresh meat from the practically boundless plains of the River Plate has been successfully completed. It was stated in the "Times" in April last that the Government of the Argentine Republic, and also the Government of Uruguay, had granted to an English house the exclusive privilege of shipping live cattle from those States for a period of years, with entire exemption from all port charges and Customs' duties, and that in the first instance a small trial would be made of the effect of the passage. It now appears that the steamer "City of Rio," which arrived recently, brought 19 oxen which had been shipped at Montevideo, and had been 31 days at sea, with, it is said, a short supply of water and scarcely any food but the commonest hay. No casualty had occurred among them, although from exposure and insufficient treatment they had become extremely thin. They were hurriedly shipped without selection on its being found that the vessel could take them, and the price paid at Montevideo was £5 per head, but a contractor at that port offers to supply any quantity at £4 per head, free on board, well prepared, and weighing not less than 800lb. each. It is also stated that the steamer by which these were brought had, on her outward passage, taken 15 English bulls to Montevideo consigned to Mr. Buschenthal, a large landowner, which arrived after a 37 days' passage (the distance being about 6,000 miles) not only all well, but, from careful treatment, in better condition than at the date of their embarkation. Of course these experiences furnish nothing decisive as to the commercial results to be looked for from the trade, but a steamer is now building expressly for carrying it on upon a large scale. This is expected to be ready in about six weeks, and will be followed by others of a similar character.

ELECTRIC BEACONS.

MR. THOMAS STEVENSON, C.E., Edinburgh, recently conducted an experiment at Granton with the view of showing the practicability of illuminating beacons and buoys at sea with the electric light, produced by means of a battery on shore. A submarine cable, fully half a mile in length, was laid between the east breakwater of Granton Harbour and the chain pier at Trinity. The operator occupied a station near the centre of the breakwater, and the light was shown at the point of the pier in front of an ordinary lighthouse reflector, producing a most brilliant flash. The flashes were emitted with great rapidity; as many as 500 can be transmitted in a minute, but the machine can be regulated so as to send one every second, or at any other desired interval. The experiment, which gave entire satisfaction, was conducted in the presence of Mr. Shaw Lefevre and Mr. Farrer, secretaries to the Board of Trade; Captains Fenwick and Nisbet, Elder Brethren of the Trinity House, &c.

TO CORRESPONDENTS.

THROUGH an error in the Printing Office, the headings of Mr. Walker's Coal-Getting Machine and Mr. Brierley's Machinery for Forging Nuts, which appeared in our issue of August 27, pages 154 and 155, were reversed.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—W. J. B.—L. C. M.—J. P. M.—E. T. H.—R. T.—G. W. H.—H. H.—C. P. C.—W. G. F.—J. B. and Co.—H. E. S.—R. S.—J. R. K.—H. E. T.—J. R. B.—J. T. S.—G. B. W.—I. T. C.—D. T.—E. G.—G. S. and Co.—R. E.—E. T. I.—T. C.—C. O. E.—H. T. O.—H. B.—F. H.—J. R. W. H.—W. T. M.

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Naval, Military, and Gunnery Items.

THE Lords Commissioners of the Admiralty have granted to the Bristol Training Ship Association the loan of Her Majesty's ship "Formidable," lately flagship at Sheerness, as a training ship for houseless and destitute boys, and Commander Edward Poulden, R.N., has been appointed captain superintendent. The "Formidable" is expected to arrive at Bristol in the course of next week.

DURING the month of August, 17 vessels, having a total tonnage of 16,599, were built on the Clyde. Of that number nine were built at Glasgow, four at Port-Glasgow, one at Greenock, one at Dumbarton, one at Renfrew, and one at Rutherglen. Nine were iron steamers, seven iron sailing ships, and one a composite. The largest of the 17 was the "Loch Katrine," 1,330 tons, intended for the Glasgow and Melbourne trade.

SOME time ago attention was drawn to the fact that the Shell Foundry Department, Royal Arsenal, Woolwich, was at a standstill for want of work, an order having been received to stop the making of Palliser projectiles, as they were found to break up in the gun when fired. This was supposed to have been caused by the studs being forced in by the explosive force of the powder. Since this the process has been tried of cooling the iron in sand. Several projectiles made in this way have lately been fired at Shoeburyness and found to answer most successfully, and it is to be hoped that the shell foundry will now resume its former activity.

A LETTER from Trieste says that the American frigate "Franklin," carrying the flag of Rear-Admiral Radford, is lying in that port. The Admiral, it is added, will go to Fiume to study the effects of our torpedoes. These engines, it may be said, *en passant*, make a great noise in the maritime world, and lately even the Prussians have convinced themselves of the efficacy of this new invention, originated by M. Lupis, a retired captain in the Austrian navy, and brought to perfection by Mr. Whitehead, an English engineer, proprietor of a machine manufactory at Fiume. The Americans are greatly interested in these torpedoes, and entertain a serious idea of making them the base, so to speak, of naval warfare, not only for defence, but for attack.—"Army and Navy Gazette."

DR. PETERMAN has received a first letter from the German Expedition to the North Pole, containing intelligence to July 29. Contrary winds and storms had detained the expedition until July in the North Sea, and forced it to keep near the coast of Norway. The first ice was encountered on July 12, lat. 74 N., long. 10 W. Up to July 29 the expedition had not reached the coast of Greenland, which was, however, in sight. At 25 German miles from the coast the soundings showed a depth of 7,000ft. Captain Koldeway reports that the position of affairs is very different from that met with in 1868. The temperature is higher, the winds more constant, and the ice looser, but from July 9 to 29 much foggy weather prevailed. The ship is in excellent condition, and the crew in good health.

IT is now confidently asserted that in addition to closing Woolwich and Deptford dockyards, the Government has decided on the abolition of Sheerness as a naval establishment as soon as the requisite arrangements connected with the change can be carried out. The only dockyards and naval establishments which will thus be retained are those at Chatham, Portsmouth, Devonport, and Pembroke. The Government, by the abolition of Woolwich, Deptford, and Sheerness dockyards, only give effect to the recommendation of the Committee which sat some since, in concentrating the whole of the naval resources of the kingdom at some three or four large dockyards. For some years past Sheerness has been allowed to sink into the position of one of the minor dockyards, the large establishment at Chatham, some few miles higher up the Medway, monopolising nearly the whole of the building and fitting of the ships of our ironclad squadrons, while the completion of the vast basins and docks now in course of formation at that port will leave no necessity for the retention of Sheerness as a separate naval establishment. As to the use to which Sheerness dockyard may ultimately be put, nothing definite would appear to be decided; but it seems probable that it will be retained as a place for depositing naval stores. The period for closing the dockyard at Woolwich is fixed for the 1st of October, when the whole of the mechanics and other hands employed at the establishment will be discharged. Already a number of the established workmen have been transferred to Chatham Dockyard, and the remainder will be sent to that and other dockyards as vacancies occur at those establishments.—"Pall Mall Gazette."

THE prevailing belief that iron ships cannot be built in the United States, owing to the dearness of iron and the high rate of wages under the protective system, is stoutly denied by the "Wilmington Commercial" (Delaware), which gives the following information on the subject:—This city, as is well known, is the head quarters of iron shipbuilding in this country. Our construction of wooden ships has declined in importance, as it has everywhere; but since the difficulties alleged to exist are those of foreign trades, for which iron vessels are largely used, we may confine our inquiry to the latter class. In iron ships, then, our builders have recently competed directly with the builders on the Clyde, and, having put in a lower estimate, have received work in preference to those celebrated English artisans. The case in point was the construction of a seagoing iron steamship for the Central American trade, built at the order of the Panama Railway Company. The proposal of the Wilmington firm being less than the Clyde builders, the ship was built there. It is needless to say that the work was as well done in all respects and the material as good as it could have been if constructed in Great Britain; but it is proper to add that new contracts at rates similar will be accepted by our builders. In another case another of our firms has built two steamers, and is now at work on a third for a company who run lines on some of the South American rivers. For various reasons our builders are preferred after a direct comparison of their abilities with those of the English builders, and the company in question gave them the work. So decided, indeed, is the conviction of the leading firms of this city on this question, that on being recently applied to by a proposed ocean steam-ship company for a certificate to be presented to Congress, that on account of the tariffs on ships' materials, it was impossible to furnish vessels at foreign prices, and that, therefore, those duties should be repealed, they conscientiously refused to make any such statement, for the simple reason that they knew it to be incorrect—this, too, notwithstanding that the statement had already been signed by leading firms in New York and Boston. These, we think, are important facts.

Miscellanea.

THE money remitted to the Chancellor of the Exchequer by sundry persons for conscience' sake in the financial year ending March, 1869, amounted to £4,194. In the preceding year the amount was £4,688. We understand the working expenses of the Chancellor of the Exchequer's Office are annually met by the receipt of conscience money.

THE new act (32 and 33 Vic., cap. 17), for the preservation of sea birds, states that the sea birds of the United Kingdom have of late years greatly decreased in number, and that it is expedient to provide for their protection during the breeding season. It is made an offence to kill, wound, or to take or have possession of any sea bird recently killed or taken between April 1 and August 1 in each year, one moiety of the penalty of 20s. to be paid to the informer.

THE number of visitors to the South Kensington Museum during the week ending September 4, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 15,323; Meyrick and other galleries, 2,720; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 2,114; Meyrick and other galleries, 236; total, 20,393. Average of corresponding week in former years, 12,000. Total from opening of Museum, 8,774,006.

HIS ROYAL HIGHNESS the PRINCE of WALES has granted two scholarships to the Royal School of Mines, which is under the directorship of Sir Roderick Murchison, and several others have been established by the Government. In the ensuing session, which commences on the 4th prox., the following courses of lectures and demonstrations will be given:—1, Chemistry, by Professor Frankland, Ph. D., F.R.S.; 2, Metallurgy, by John Percy, M.D., F.R.S.; 3, Natural History, by Professor Huxley, LL.B., F.R.S.; 4 and 5, Mineralogy and Mining, by Mr. Warrington Smyth, M.A., F.R.S.; 6, Geology, by Mr. A. C. Ramsay, LL.D., F.R.S.; 7, Applied Mechanics, by Mr. T. M. Goodeve, M.A.; and 8, Physics, by Mr. F. Guthrie, B.A., Ph. D.

THE return showing the import of gold and silver bullion and specie registered at the Custom-house states an arrival of gold from Australia in the month of July amounting to no less than £1,201,626. Mexico and South America also sent gold and silver of the value of £732,000, and the United States as large an amount. The import of gold and silver into the United kingdom this year, which up to the end of June had only reached £9,375,934, had been raised to £12,522,316 at the end of July. The export of gold and silver from the United Kingdom in the month of July did not reach a million. The whole seven months' export was £9,975,899. £4,525,424 went to France and £2,488,475 to Egypt, the high road to other parts ever athirst for gold and silver.

CONSIDERABLE alterations are now being made in the New Palace of Westminster, within the central hall and the interior approaches to the Houses of Lords and Commons, the object being to afford more natural light. For this purpose, the stained glass windows in the Peers' corridor have already been transformed into plain glass designs. It was intended that the stained glass windows in the central hall should also be discoloured, but this idea has been abandoned for the present. A large number of workmen in the employ of Messrs. Field, of Parliament-street, the contractors, are now busily engaged in removing the moulded archways, which will now be rendered comparatively, if not altogether, useless. In place of them, temporary glass screens will be erected. The whole of this expenditure is undertaken for the purpose of affording more light at the entrances to the interior of both Houses of Parliament.

AN Act of Parliament was passed in the late Session to make provision respecting the use of subways under the management of the Commissioners of Sewers of the city of London. It recites that subways are in the course of construction under the viaduct or raised way and parts of the new street in the city of London, and the same, when completed, will be under the Commissioners of Sewers, and in order to prevent inconvenience to the public and the frequent breaking up of the surface of the viaduct and new streets, the Commissioners should be enabled to require companies, bodies, and persons intending or required to place water, gas, or other pipes, to lay them in the subway, on proper terms and conditions. The Act invests the Commissioners with power to carry out the provisions, and provides remedies against parties violating the terms and conditions annexed to the undertakings. The Commissioners, as far as space will permit, and without favour or preference, are to allow pipes to be laid in any subway under their management. The Commissioners are to exercise supervision, and the subways are to be maintained in an efficient state of ventilation, and in case of difference the Board of Trade is empowered to give directions on the subject. A penalty of £20 may be recovered for an infraction of the provisions, and the Commissioners may remove pipes, &c., improperly laid down, and recover the expenses as a penalty.

ON the 9th ult. an Act to alter and amend the Telegraph Act of 1868 received the Royal assent, and arrangements are being made, and are expected shortly to be perfected, to transfer the telegraphs to the Postmaster-General. By the new Act the Treasury is empowered to raise £7,000,000. The gross revenue received by the Postmaster-General for the transmission of messages by means of electric telegraphs is to be paid into the Exchequer to the account of the Consolidated Fund, and the expenses incurred with the sanction of the Commissioners of her Majesty's Treasury in working, maintaining, or extending telegraphs to be paid out of moneys to be voted by Parliament. By the recited Act (31 and 32 Vict., cap. 110) the Postmaster-General was empowered to purchase the whole or part of the undertaking of any telegraph company except the Atlantic Telegraph Company and the Anglo-American Telegraph Company. The Postmaster-General was required by the former Act to make one uniform charge for the transmission of telegraphic messages throughout the United Kingdom, and it is declared in the present statute that in order to protect the public revenue it is expedient that similar powers to those conferred upon the Postmaster-General with respect to the exclusive privilege of conveying letters should be enacted with reference to the transmission of public telegraphic messages within the United Kingdom. Agreements have been made with certain telegraph companies to pay them £5,715,048 8s. 11d., and it is estimated that the amount which will be required for the other purposes of the recited Act and of the new Act will not exceed £300,000, besides £700,000 with railway companies, and the chief object of the present Act is to give authority to the Commissioners of the Treasury to raise the funds which will be required to enable the Postmaster-General to carry into effect the arrangements. There are a few exceptions mentioned to the exclusive privilege of the Postmaster-General sending telegraphic messages, and he is also empowered to transmit foreign messages. The Treasury may raise sums not exceeding £7,000,000, for the purposes of the Act, either by terminable annuities or by the creation of Exchequer bills or bonds, and the moneys raised are to be placed at the disposal of the Postmaster-General under certain regulations. Annual accounts are to be laid before Parliament, as also the regulations made under the new Act. No deed or instrument executed by, to, or with the Postmaster-General is to be liable to stamp duty. Messages are to be deemed post letters, and the provisions of the Telegraph Acts of last year and the present year to be considered as "Post-office laws."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—402, 422, 476
BUILDINGS AND BUILDING MATERIALS—423, 439, 448, 453, 472
CHEMISTRY AND PHOTOGRAPHY—417
CULTIVATION OF THE SOIL, including agricultural implements and machines—431, 437, 450, 452, 479
ELECTRICAL APPARATUS—None
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—404, 408, 409, 410, 420, 438, 458, 461, 464, 469
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—414, 434
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—412, 415, 427, 430, 433, 436, 363, 467, 474
GENERAL MACHINERY—411, 453, 456, 471, 479
LIGHTING, HEATING, AND VENTILATING—403, 428, 444, 449, 461
METALS, including apparatus for their manufacture—426, 457
MISCELLANEOUS—407, 413, 416, 418, 419, 429, 432, 445, 447, 460, 465, 466, 473, 477
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—406, 424, 425, 435, 441, 454, 457, 459, 475, 478
SHIPS AND BOATS, including their fittings—425, 440
STEAM ENGINES—405, 443
WARFARE—442, 446, 462

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402 B. F. STURTEVANT, Massachusetts, U.S. *Furnace blower.* Dated February 9, 1869.
This consists in a corrugated case or multi-duct surrounding the periphery and one side of the blast-wheel case, and serving both to conduct the air from the peripheral educts of such case to an eduction pipe or conduct, and to prevent it, to a considerable extent if not entirely, from whirling or revolving while passing into the eduction pipe.—Patent abandoned.

403 J. H. JOHNSON, Lincoln's Inn-fields. *Heating and ventilating.* (A communication.) Dated February 9, 1869.
The radiator and ventilator is so constructed that a thin stratum or column of steam is exposed on two sides to the external air intended to be heated, the combined area of the surface of these two sides being much greater than the exposed surface of the radiators now commonly in use. The steam has a direct passage through the radiator, and as it does not follow a tortuous course its movement is rapid and the whole interior is quickly filled, condensation takes place rapidly and induces a swift current of the external air through the heated central tubes.—Patent completed.

404 J. H. JOHNSON, Lincoln's Inn-fields. *Manufacture of paper.* (A communication.) Dated February 9, 1869.
The pulp being contained in the beating engine either the solution of the salts of lime, magnesia, baryta, or strontia, their chlorides, for example, are to be first added, and then the decomposing solution, such as the sulphate or silicate or carbonate of soda in about equivalent proportions, are to be added until the desired precipitation has been effected, or the sulphates, carbonates, or silicates may be first added and then the alkaline earthy solutions. It will be understood that when it is desired to obtain the precipitation of an insoluble sulphate, such, for example, as sulphate of baryta, either sulphuric acid or a soluble sulphate may be employed in conjunction with a soluble salt of barium, such, for example, as the chloride of barium. When an insoluble carbonate such as the carbonate of baryta is used, a soluble carbonate in conjunction with a soluble salt of barium is employed. When an insoluble silicate is used then a soluble silicate in conjunction with a soluble salt of barium is employed, and so in like manner for the formation of the insoluble compounds of the other substances referred to.—Patent abandoned.

405 E. J. A. CAMERE, Nice. *Rotary steam engines.* Dated February 9, 1869.
This engine consists of a perfectly bored cylinder of a diameter and thickness varying with the power of the machine. This cylinder, closed at its two ends by solid plates provided with tightening bolts and stuffing box gland, carries laterally two flanges or rings pierced with longitudinal ports intended to receive in the case of a steam or of a water motor the induction and the eduction pipe, and in the case of pumps and fans the suction and force pipes.—Patent abandoned.

406 K. B. EDWARDS, Claverton-street. *Communicating in trains.* Dated February 10, 1869.
The inventor employs the agency of an explosive compound or other force whereby a ball or other body may be thrown or ejected from one carriage to another as a means of communication between different portions of a train. A shot or explosive apparatus is to be used in conjunction with a chain or cord communicating with each of the several compartments into which any carriage may be divided for the purpose of enabling the occupants in any portion of the train to communicate with the guard or driver by pulling such chain or cord.—Patent abandoned.

407 G. GROS, Bordeaux, France. *Self-closing boxes.* Dated February 10, 1869.
These boxes are formed with two cases or shells of a rectangular shape, but rounded off at each end. The deeper one is the receptacle, and the flatter one the lid. The straight edges of both parts are formed so as to enter and slide in one another. They are tied to each other either by means of a small steel or wire spring, or by a thin strip of india-rubber acting as a spring, and keeping them closed. The box can be opened very easily by sliding the lid with the thumb of the hand in which the box is held. On the pressure of the thumb being removed, the lid instantly slides back and closes the box, this being effected by the action of the small spring lodged inside, but which might equally well be placed outside; and, instead of a single spring, two might be used, one on each side. That part of the top of the lid against which the thumb is to bear slightly, in order to open the box, is clearly indicated by the exergue, or the obligatory inscription of any patented article, the under side of the box being either pointed, cut in the casting, or in any way roughened to give a rubbing surface on which to ignite the matches.—Patent completed.

408 W. HILTON, Bolton. *Looms.* Dated February 10, 1869.
This relates, first, to the picking sticks of what are commonly known as "under pick" looms, and consists in an arrangement of mechanism for returning the picking stick to its normal vertical position after each pick. The invention relates, second, to the "swells" of the shuttle boxes, and consists of an arrangement for controlling the action of the "swells" in such a way that the shuttle is relieved from the pressure thereof immediately before and during each pick, the "swells" coming into action again before the shuttle reaches the opposite box.—Patent completed.

409 J. CROFTS, Leeds. *Combing wool.* Dated February 10, 1869.
This invention is intended to facilitate the removal of the noil produced by the operation of combing. For this purpose, when the noil has lifted up the teeth of the combs by means of the noil lifters, the inventor causes a current of air flowing from the mouth of a tube or other suitable channel, and supplied from a fan or otherwise, to act on the lifted noil and blow it direct, or by a suitable channel, into a can or receiver.—Patent abandoned.

410 J. STUART, Limehouse. *Separating vegetable from animal fibres.* Dated February 10, 1869.
This relates to mixed fabrics or fabrics composed partly of animal and partly of vegetable fibres, and has for its objects—first, the separation of animal fibres (such as, for example, wool, hair, or silk) from the vegetable fibres, such as cotton, flax, jute, or other vegetable fibre; and, second, the effecting of this separation in such manner that the animal fibre is obtained uninjured either in substance or quality, and, in a great measure also, in colour.—Patent completed.

411 S. MELLOR, Park-terrace, Victoria Park. *Pumps.* Dated February 10, 1869.
The inventor forms the barrel of the pump of a tube of any suitable elastic or flexible material. Within a casing, semicircular at the upper part, the inventor adapts a piece of elastic tubing, which passes through holes formed through the rim of the casing, one hole being formed through one side of the rim, a little above the springing of the semicircular part thereof, and the other hole through the opposite side of the rim a little below the springing of the semicircular part thereof, so that when the tube is passed through the holes it follows the curvature of the inside of the curved part of the casing. Through the sides of the casing, and at the centre from which the semicircular part is described, the inventor forms holes and adapts a short horizontal shaft or axle working in suitable bearings, and on the shaft or axle he fixes a piece of metal carrying two rollers mounted therein at opposite sides of the shaft, and in a line with the centre thereof.—Patent abandoned.

412 W. LEVER, Union-street, Borough. *Hats.* Dated February 10, 1869.
This consists in manufacturing the body of a certain combination of materials not hitherto used for the purpose. For this object a sheet, layer, or piece of thin caoutchouc or gutta-percha, or of waterproof material whereof caoutchouc or gutta-percha is an essential or main constituent, is placed or interposed between two pieces, layers, or thicknesses of cotton or other textile, woven, or knitted fabric. The three thicknesses, layers, or pieces are then all cemented or caused to adhere together firmly and substantially by the employment of shellac or other gummy, gum resinous, resinous ordinary, or adhesive substance, which also imparts considerable stiffness to the compound material.—Patent completed.

413 S. W. MULLONEY, Coventry. *Surgical bandages.* Dated February 10, 1869.
This invention consists in making, during the process of weaving the bandage a series of what are known to manufacturers of ornamental goods as continuous "purls" or loops along each edge of the bandage, instead of forming, as heretofore, a rigid or inelastic selvage, and thus giving the edge an elasticity equal to that of the centre of the fabric.—Patent abandoned.

414 C. T. E. LASCELLES, Southwark. *Machine-made casks.* Dated February 10, 1869.
This relates to the manufacture of casks by the aid of machinery, the object being to facilitate the cutting of the staves of casks and to produce joints akin to those which are found only in hand-made casks. This is effected by the use of a machine which contains a pair of rotary cutters set in a vertical plane so that they may be adjusted to suit different widths of stave, and capable of varying the bevel of their cut, as desired.—Patent completed.

415 F. J. KNEWSTUB, St. James's-street, Westminster. *Locks and fastenings for bags.* Dated February 10, 1869.
This consists in making the nozzle and face plate apart from the plate which is secured to the bag, and connecting this plate to the nozzle in such a manner that it is free to be turned or otherwise moved in order to release the hasp, or the nozzle may be connected to or form part of the plate which is secured to the bag, and the face plate which operates the lock may be secured to the first-named plate in any suitable manner; by turning, moving on one side, or otherwise operating this plate the hasp is released.—Patent abandoned.

416 J. F. BENTLEY, Peterborough. *Filters.* Dated February 10, 1869.
This consists in the adaptation to filters of a closed reserve tank or vessel to contain the filtered water after it has passed through a layer or layers of filtering material, so that on the application of a pump or syphon or a tap, by which it is intended to draw the water from this reserve tank or inner cylinder, and on the removal of all or a portion of the water from the tank or cylinder, a partial vacuum will be formed, in consequence of which the process of infiltration will continue with regularity, though the withdrawal of water from the reserve tank may be sudden, intermittent, and irregular.—Patent completed.

417 W. H. FISCHER, Manchester. *Photographic printing process.* Dated February 10, 1869.
The inventor dissolves gelatine and gum arabic in the proportions of about 30 grains of gelatine and 10 grains of gum arabic in 1oz. of water, and adds thereto about five grains of lump sugar. After filtering he adds one drachm of a saturated solution of bichrome of potass or bichrome of ammonia. The mixture is then ready to pour on the glass, slate, or metal which is to form the positive picture. After drying the plate so prepared is placed under the negative so that the film side of the negative shall be in contact with the gelatine film.—Patent abandoned.

418 G. BROADHURST and J. KERSHAW, Manchester. *India-rubber cloths.* Dated February 10, 1869.
The inventors prepare a compound of caoutchouc and golden sulphuret of antimony, commonly called the red or mineralized caoutchouc or india-rubber, and spread layers of it on and between cloths in the usual way, preferring this compound to that which has hitherto been used on account of its extraordinary grease-resisting qualities, while it is well known that the ordinary grey vulcanised india-rubber very soon decomposes when in contact with articles containing even very minute portions of oil or grease, and in addition, double texture cloths thus made are not liable to harden in cold temperatures, as is the case with what is known as the natural rubber card cloth now in use.—Patent completed.

419 P. TAYSEN, Leith. *Manufacture of stearic acid.* (A communication.) Dated February 10, 1869.
When the inventor has completed the decomposition of the fatty acids, which now have a melting point of 48deg. to 50deg. celsius, and which are black or dark, he lets them rest from 12 to 16 hours. During this time a part of the black substances are precipitated into the sulpho-glycerine water, and are driven off along with it by a cock situated at the bottom of the vessel. After this, the fatty acids are removed to another vessel, which vessel is provided with two leaden tubes for steam, one open, and allowing the steam to escape into the material, the other closed. In this vessel the inventor makes the fatty acids boil partly by free steam and partly by the closed steam pipe, and during the boiling and while continuing agitation, he adds an energetic oxidising agent.—Patent completed.

420 J. CLAYTON, Radcliffe. *Fixing paste for prints.* Dated February 10, 1869.
The inventor first boils 4lb. of kid glue in 2½ gallons of water till dissolved, stirring it well all the time. When boiled down to about 2 gallons, he adds thereto 2 gallons of turpentine, and boils again. He then cools down to about 110deg. Fah., and adds 4 gallons of blood albumen at a strength of about 3lb. per gallon, previously dissolved in either water, buttermilk, or blood, mixes well, and stirs for about four hours. To prepare for use he takes 1 gallon of the above preparation and mixes therewith an equal quantity of blood albumen solution (at a strength of about 1½lb. to the gallon), and to this mixture he adds the aniline or other colour as required.—Patent completed.

421 Not allowed. Abstract will appear in a future number.

422 J. A. F. SUTER and T. C. HINDE, Hereford. *Heating boilers.* Dated February 10, 1869.
This consists in producing a gaseous fluid by directing atmospheric air upon or through ignited coal or coke, or other solid fuel, in an oven or chamber, the atmospheric air being forced over or through the ignited fuel by means of a fan or other blowing machine or apparatus. There is thus produced a gaseous fuel consisting essentially of carbonic oxide mixed with nitrogen. This gaseous fuel is conducted to the furnace or fireplace of the boiler and mixed with atmospheric air, and upon being ignited heats the boiler and generates steam in the said boiler. By the use of a blast of air obtained by a fan or other blowing machine or apparatus, complete control is obtained over the production of the gaseous fuel, which cannot be obtained when the draught of a chimney or stack is employed to determine the current of atmospheric air through or over the solid fuel.—Patent completed.

423 J. CARTER, Birmingham. *Waterclosets.* Dated February 10, 1869.
Underneath the ordinary basin, with its movable bottom or pan, the inventor places a second basin having a movable bottom or pan, which is brought into its raised position by a counterbalance weight or spring. The axis of the movable bottom of the second or lower basin is so connected by a chain or otherwise with the axis of the movable bottom of the upper or ordinary basin that the raising of the movable bottom of the upper or ordinary basin causes the depressing of the movable bottom of the lower basin.—Patent completed.

424 J. E. BILLUPS, Cardiff, and W. COOPER, Rotherhithe. *Communicating in trains.* Dated February 10, 1869.
This consists of a friction or cam wheel or other kind of wheel or wheels, either fixed upon the axle or held in contact with the carriage wheel or wheels, or rail, and acting upon a gong, whistle, ratchet and click, or other instrument or apparatus for producing sound, by which means each carriage, when in motion, is provided with a complete method of signalling between the passengers and the guards and engine drivers without necessitating any special connection between the several carriages.—Patent abandoned.

425 W. R. LAKE, Southampton-buildings, Chancery-lane. *Water velocipede.* (A communication.) Dated February 10, 1869.
This apparatus is constructed with two, three, or more insubmergible boats or floating parts which may be formed of any suitable material. These boats are arranged side by side, and at a sufficient distance apart to allow the paddlewheel or wheels to be placed between them, and are connected by crossbars. The paddlewheels are operated by treadles similar to those of land velocipedes, and the desired direction is given to the apparatus by a rudder which is controlled by a chain wheel according to the "Vaucanson" or other system.—Patent completed.

426 G. F. ANSELL, Bernard-street, W.C. *Manufacture of steel, &c.* Dated February 11, 1869.
This relates to the conversion of cast iron into steel or into wrought iron, by the use of bisulphate of potash, or bisulphate of soda, or a mixture of the two to act upon the metal in a molten state, and applied in such a manner as to act throughout the mass of melted metal. For

this purpose, the bisulphate may be placed at the bottom of a vessel lined with fire-clay, which may be called the converting chamber or receiver, and the melted cast iron poured upon it. This converting chamber may also have ridges or ledges ranged round its interior, upon which the bisulphate may also be placed, or it may be placed in layers between thin plates of cast iron or in recesses in the bottom of the converting chamber.—Patent abandoned.

427 P. J. SMITH, F. W. SMITH, H. J. SMITH, and A. PAPPENBERGER, all of Bristol. *Pianofortes.* Dated February 11, 1869.

The inventors employ one or more metal bars or studs which pass underneath the soundboard, and at the ends are cranked or bent up, so as to rise above the surface of the soundboard, and take a direct bearing against a metal bar laid in the wrest plank at the one end and against the bass plate and bent side (or plate covering the same) at the other end. Thus, these bars or studs, while they do not in any way interfere with the strings and action, directly take the strain between the wrest plank and base plate and bent side, thereby preventing any pulling over of these parts and all leverage upon the back (or bracings) of the instrument, and enabling strings of the same weight and tension to be used in upright pianos as have hitherto been used in grand pianos.—Patent completed.

428 G. A. NOWELL, Nuneaton. *Lamps.* Dated February 11, 1869.

When using an argand burner, the following is the arrangement the inventor prefers to employ:—At the lower part of the lamp the reservoir for the hydro-carbon oil is formed (it may be of globular or other convenient form), and the gas pipe (which has a suitable regulating cock upon it) passes up vertically through the reservoir, and ascends nearly to the top of the heated chamber, which is a cylinder closed at its upper end, and at its lower connected with the top of the reservoir; a wick (which it is preferred to make of cotton wool enclosed in wire gauze) surrounds the ascending gas tube, and can be moved up and down on it by turning a milled head on the exterior of the lamp, so as to regulate the amount of wick within the heated chamber, and, consequently, the amount of vapour formed. The gas passing up its pipe to the top of the heated chamber, there enters the chamber and descending mixes with the hydro-carbon vapour, and the compound passes out near the bottom of the chamber to the ring burner, where it is burnt. This burner encircles the chamber, so that when the burner is lighted, the upper part of the chamber will be surrounded by the flame, and will thereby become intensely heated.—Patent completed.

429 J. YOUNG, Limefield. N.B. *Measuring pressure of gases.* Dated February 11, 1869.

To measure the pressure of gases and the force of aeriform or gaseous currents, a U-tube containing water in both limbs is often used. The inventor puts a cistern or overflow on one or both arms of the tube, and uses two liquids of different densities, by which means he increases the sensitiveness of the instrument in proportion as the liquids approach each other in density.—Patent abandoned.

430 H. P. HANSEN, Leith. *Stoves.* Dated February 11, 1869.

The fire-chamber is lined with firebrick, and the unburnt gases and smoke given off by the fuel during combustion ascend through chambers situated above the fire-chamber in a zigzag direction in passing to the smoke pipe or chimney. This is effected by dividing the stove into separate chambers (which may be of any desired number) by horizontal divisions or dampers, openings being left in these alternately at opposite sides of the stove, so that as the unburnt gases and smoke produced during combustion ascend, they enter each chamber at one side and escape into the chamber above at the opposite side.—Patent abandoned.

431 C. THOMAS, Bristol. *Reaping machines.* (A communication). Dated February 11, 1869.

The rake makes its effective sweep across the platform from the grain side of the same toward the main frame. The grain is thus gavelled or bundled at the inner edge of the platform, and is held by the rake, which has an interval of rest for that purpose, against a wire which is supplied from an elevated reel, and held by grasping devices at a point below the gavel. The wire is made to completely encircle the gavel by the descent of a binding arm, and a length is cut off and twisted, so as to firmly and securely bind the grain into a sheaf.—Patent completed.

432 B. P. STOCKMAN, Abingdon-street, Westminster. *Meters for water.* Dated February 11, 1869.

This consists of two cylinders and pistons combined and working with a reciprocating action, viz., one piston up while the other is down. The two cylinders are placed side by side on a base plate common to both. The cylinders are bored out, and the pistons are packed with a cupped leather or with any other suitable packing to ensure their working watertight, or the means of rendering them watertight may be bags of leather or india-rubber attached at one end to the cylinder and at the other to the piston; when this method is adopted it may not be necessary to bore out the cylinders. At the top of the cylinders there is a capping plate, upon which is seated the whole system of gearing comprising the valve apparatus. Each piston has a toothed rack attached to it in place of a piston rod, and the two racks pass through holes provided for the purpose in the capping plate. Between the two racks is a toothed wheel in gear with both, which gives the reciprocating action to the piston. A four-way valve is fixed on the capping plate centrally with the toothed wheel, and from two of the openings in the valve, there is a communication with the bottom of the cylinders by means of pipes or passages cast in the cylinders, while the two other openings in the valve have the supply and discharge pipes attached to them.—Patent completed.

433 A. C. ENGERT, Tabernacle-row. *Mouldings for picture frames.* Dated February 11, 1869.

The inventor causes two suitable pieces of wood fashioned to the general form of the moulding which it is desired to produce to pass under a vessel containing composition, and as the wood passes under the vessel the composition is pressed out through an orifice in a thin sheet which is caused to adhere to the wood by means of size, which is applied to the wood just before the sheet of composition comes in contact with it. Then as the wood is made to travel on in the machine the composition is pressed down upon its surface by a roller with a smooth face and corresponding in form with the moulding; in this way a smooth, or comparatively smooth, surface is obtained. Then the wood with the composition upon it is, if necessary, passed through a die, which completes the smoothing, cutting off, and rubbing down any inequalities that may remain on the surface. To produce a pattern on the moulding it is now passed under a roller on which the pattern is cut, and in this way the pattern is impressed on the composition. Usually the pattern will not extend over the whole width of the moulding, and then the parts which do not receive the pattern remain smooth as they were left by the roller and die.—Patent abandoned.

434 H. EDWARDS, Staple Inn, Holborn. *Preserved food* Dated February 12, 1869.

The inventor takes potatoes, or other vegetable substances, in a natural or cooked state, or other articles of a similar nature, and mixes them with meat or other fleshy substances in a concentrated state. The natural potato or other vegetable, when thus mixed with meat or other fleshy substances, essence, or extract therefrom, becomes impregnated and retains the flavour and the nutriment of the said articles. He then brings it into a granulated or finely divided state, and dries it at a regulated temperature. When in this state it can be packed in tin or other cases, and, if kept dry, presents in any climate a valuable and portable article of diet.—Patent completed.

435 W. J. HORTON, Warrington. *Railway chairs.* Dated February 12, 1869.

This consists in an improved mode of holding the rail in the chair, and it consists in applying a cast-iron wedge between the rail and the chair in place of the usual wooden key or wedge. The inventor employs a wrought-iron key inserted from above between the chair and the cast-iron wedge to hold the latter firmly against the rail. This cast-iron wedge is made of such a form that its lower edge sets against the flange of the rail which is in the chair, and by means of the wrought-iron key the cast-iron wedge is held in contact with the side and also the flange of the rail in the chair.—Patent completed.

436 T. A. COLLINSON, Liverpool. *Boots.* Dated February 12, 1869.

The operator should first provide himself with an ordinary block for stretching and forming to the required shape the upper leather, to which is fitted on the edge or front, from the fore part of the instep up to the top of the leg piece, a movable ridge piece of sufficient width and length to require sufficient extra upper leather to form the flap piece in which the button holes are to be worked. —Patent abandoned.

437 F. J. VANDENVINNE, Brussels. *Working ploughs.* Dated February 12, 1869.

This refers to previous letters patent dated the 28th day of May, 1867 (No. 1573), and the invention consists in an endless railway so attached to the machine that the wheels rest thereon. This railway, by the motion of the machine forward or backward and suitable articulated joints therein, is caused to be laid continuously under the wheels so as to prevent them from being imbedded in the earth by the great weight of the machine or from being impaired by stones or other matter.—Patent completed.

438 W. H. HAYHURST, Blackburn. *Looms.* Dated February 12, 1869.

This relates to means and apparatus for stopping the loom when from any cause one or more threads of warp are broken. This is effected by means of two brackets fixed to the breast-beam of the loom, one being near the weft fork and hammer, the other on the other side of the loom. The brackets are connected by means of a rod along which two or more "warp forks" are caused to pass "to and fro" across the piece by means of a cord attached to the warp forks passing over pulleys on the brackets above mentioned and a weight which is attached to the cord.—Patent completed.

439 H. B. BINKO, Cleveland-road, Islington. *Colouring matters.* Dated February 12, 1869.

The inventor takes indigo of the best quality and after it has been finely ground and sifted he dissolves it in acid in the proportion of 3lb. of acid to 1lb. of indigo, and allows the mixture to stand for three days. After this the inventor adds to every pound of the above indigo 20lb. of water and 5lb. of goat or cow hair, boiling the whole three hours, or until it becomes of a greenish hue; this is then allowed to remain 24 hours standing. The hair is then taken out, and washed in clear cold water until a beautiful blue colour appears. He then puts the hair into 10 gallons of water, and boils it, and whilst boiling adds potash in the proportion of 10lb. of potash to 1lb. of indigo, thus rendering the indigo solution free from acid. The whole is then strained and evaporated to half its bulk, and allowed to remain 36 hours standing.—Patent completed.

440 T. V. TREW, Stratford. *Screw propellers.* Dated February 12, 1869.

This consists in constructing screw propellers in a form which is a combination of a curved face or propelling surface and a spiral leading edge.—Patent completed.

441 G. H. MORGAN, Edgware-road. *Carriages.* Dated February 12, 1869.

The inventor mounts an axle or shaft in suitable bearings carried by the quarter of the carriage, and applies at each end thereof an arm which by a link or connecting rod is attached to a projection from the head pillar. A projection from each of these links or connecting rods is by another link or connecting rod attached to a projection carried by the "cant rail" or by the hinge thereof. To each of the levers the inventor connects one end of a spring the other end of which is connected to the standing pillar or to other suitable part of the carriage body.—Patent completed.

442 W. E. NEWTON, Chancery-lane. *Explosives.* (A communication.) Dated February 12, 1869.

This consists in the combination of nitro-glycerine with any suitable nitrate and carbon so as to form an explosive compound differing in character from ordinary gunpowder. When a powdered nitrate, whether it be a nitrate of potash, soda, baryta, or lead, is intimately mixed with coal or any substance containing carbon or hydrocarbon, such as rosin, sugar, or starch, a combustible mixture is produced, which, unless enclosed or confined under strong resistance, burns too slowly to form what is usually called an explosive mixture. But a slight addition of nitro-glycerine, intimately mixed therewith so as to form a thin coating over every separate grain, admits of effecting the instantaneous combustion of the whole, owing to the intense heat developed by the explosion in immediate contact with every grain of nitre, which it causes to melt.—Patent completed.

443 A. V. NEWTON, Chancery-lane. *Rotary engine.* (A communication.) Dated February 12, 1869.

The case or cylinder (the interior of which is oblong in the transverse direction) is fitted with a rotary piston block, carrying at its periphery hinged leaves or pistons to receive the pressure of the impelling fluid. This piston is keyed fast to the central shaft, which has its bearings in the heads or cover of the case or cylinder. But these covers, besides serving to close the ends of the case, also provide (as will hereafter be fully explained) steam supply passages and exhaust chambers for the engine.—Patent completed.

444 F. C. HILLS, Deptford. *Gas retorts.* Dated February 12, 1869.

This relates to previous letters patent dated April 29, 1864 (No. 1087). The inventor introduces into the closed ashpit of the furnace air heated by the waste heated gaseous products of combustion, but he tempers the heat generated by this air by mixing therewith a portion of the waste heated gaseous products of combustion which escape from the furnace through the flue to the chimney. The carbonic acid and nitrogen contained in these products when mixed with the atmospheric air introduced into the furnace diminish the intense local heat which heated air generates when introduced by itself, and the heat is by this means the better diffused through the bed of retorts, and a saving of fuel is effected.—Patent completed

445 W. SUMMERS, Bristol. *Packing cases.* Dated February 12, 1869.

The inventor makes the exterior of the packing case in the form of an ordinary box with a hinged or jointed lid, except that he leaves openings in one or more of the sides of the box in order to permit of the circulation of air through the case for the purpose of keeping its contents cool, or he makes the side or sides in one entire piece, with no openings. He divides the interior of the box or case into a series of square or rectangular divisions or compartments by means of lattice work of galvanized iron wire, the divisions being made of a size proper to fit the bottles to be packed or stored in the case. Near the bottom of the case, that is, the side towards which the necks of the bottles are turned, on the side opposite the door, the inventor fixes a layer of wood or a series of slips of wood, the layer or slips being perforated with holes of a size proper to receive the necks of the bottles, the holes being so made in the wood that they are respectively situated in the lines of the axes of the lattice work compartments.—Patent completed.

446 C. GORDON, Goswell-road. *Breech-loaders.* Dated February 13, 1869.

The breech block is what may be termed a "compound" breech block, and consists of two parts, the forward portion, which may be termed the breech piece, being next the barrel when the breech chamber is closed, and the rear portion, constituting the breech block proper, filling up the remainder of the chamber. The breech piece and breech block are respectively hinged to a transverse pin, and upon the breech block being elevated towards the barrel by means of a lateral projection at the hinder end thereof, may be caused to traverse backwards and forwards in the breech chamber. A loose striker is placed in the centre of the breech piece, the same being of such a length that upon the cartridge being inserted and the breech piece pushed up to the end of the barrel (which is recessed for the admission of the cartridge head, as well understood) the rear end of the striker will project beyond the back face of the breech piece into the end of the breech block, which is open.—Patent abandoned.

447 A. W. TAYLOR, Holloway. *Ceiling walking.* Dated February 13, 1869.

This consists in strongly attaching to the foot of the performer a plate of iron. The face, under side, or surface of the ceiling should consist of a large sheet of brass or other material, and at the top or reverse side of the sheet there should be connections for causing a contact with a very powerful electro-magnet, which, by strongly attaching the iron plates attached to the foot of the performer, keeps him very firmly in a perpendicular position, and as the connecting points of the electro-magnet are moved so the operator is enabled to walk in both a graceful and very surprising manner without fear or possibility of falling. The inventor claims the sole privilege or right of effecting any performance of this kind by the aid or use of electro-magnetism or galvanism in connection with a human being.—Patent abandoned.

448 J. HOLMES, Northampton. *Sash holder.* Dated February 13, 1869.

The inventor adopts a metal frame of a suitable size with an aperture sufficiently large to take the roller hereafter described, made, or provided thereon. The roller works upon a pin, but, instead of this pin working on a fixed centre, a slot or groove in the side bracket is made and the roller is kept in its proper position by means of a spring, one end of which is affixed to the bottom of the inner part of the frame, the other or free end being shaped to fit or nearly to fit the roller and press against it.—Patent completed.

449 W. E. NEWTON, Chancery-lane. (A communication.) *Heating apparatus.* Dated February 13, 1869.

This consists in the employment of lamps of any convenient and suitable construction, which are placed in a vessel (containing water if desired) of a conical or other suitable form, and provided with vertical tubes or pipes through the centre. To the lower end of these pipes or tubes paraffin or other oil lamps or burners are adapted so as to fit closely, in order to prevent the escape of any of the heat. The heat thus obtained from the combustion of the oil rises into a chamber, into which is fitted loosely, so as to allow a space all round, the vessel or receptacle containing the food or water to be cooked or boiled. Suitable openings are left to allow of the escape of the gaseous products of combustion.—Patent abandoned.

450 D. HANTON, Lunan, N.B. *Ploughs.* Dated February 13, 1869.

This consists in uniting together the beams, frames, or bars to which the plough bodies are fastened by parallel links, so that as in a parallel motion when the beams are moved in directions parallel to each other they approach to or recede from each other; therefore, by so moving the beams, frames, or bars the distance between the furrows is regulated.—Patent abandoned.

451 E. G. BREWER, Chancery-lane. *Metallic joints.* (A communication.) Dated February 13, 1869.

This consists in uniting the edges or other parts of tin or other sheet metal plates, so as to produce a perfect water, oil, or air tight joint or seam by means of heat and

pressure effected by suitable machinery capable of uniformly pressing each part of the same into a solid mass without the application of the soldering iron or any additional solder or amalgam beyond that which is contained upon the metallic plates themselves.—Patent completed.

452 S. W. CAMPAIN, Spalding. *Drills.* Dated February 13, 1869.

The inventor substitutes for the cups on the discs flat surfaces placed at such an angle as to lift the material upon them, and also to admit of being scraped by a scraper suspended over the axis of the disc. The angle of the lifters is such that the surfaces become horizontal a short time after they rise above the level of the axis of the disc. The material, when it falls off these flat lifters, drops into the delivering funnels, which lead it to the coulters as usual. There is a scraper for each lifting disc, and it is a blade which, over the axis of the discs, opposes itself to the flat lifting surfaces as they come round. It is suspended from the top of the box containing the discs, and a weight is applied to it to cause it to bear with sufficient force against the face of the lifters. The scraper acts on the lifters on the two sides of the disc, and a notch is made in it to allow it to overlap the edge of the disc on either side a sufficient distance to operate efficiently on the lifters, and the edge of the disc acts as a stop to prevent its falling too far.—Patent abandoned.

453 W. BASFORD, Burslem. *Bricks and tiles.* Dated February 13, 1869.

The inventor proposes, in some cases, for the purpose of improving the strength of the clay or marl, and also for giving a tint by mixing it with pulverised slate rock. Besides this, he takes the shale or bass or brasses which are thrown away as waste from the coalpit, and, when necessary, calcines them, and then mixes the cinder or calcined shale in proportions with the clay or marl. He also uses silicate of iron to mix with the clay or marl, and for that purpose he takes the slags of blast and puddling furnaces, and having reduced them to powder mixes them in suitable proportions with the clay or marl. He proposes, also, to mix with it pulverised anthracite or stone coal. When ironstone dust is used to aid in giving a blue colour to bricks and tiles, it often produces blisters. To correct this the inventor proposes to add a compound composed chiefly of silicate alumina as a substitute for this. He grinds up the old broken saggers and pitchers, and having mixed them with the ironstone dust, introduces them in suitable proportions into the clay or marl. —Patent completed.

454 W. HAYCOCK and W. CARTER, Manchester. *Horse shoes.* Dated February 15, 1869.

This consists in a novel application of pieces of iron or steel (commonly called caulks or spikes) to the shoes of horses, such caulks or spikes being firmly secured thereto by means of screw bolts, rivets, or wedges.—Patent completed.

455 B. HUNT, Serle-street, Lincoln's Inn. *Saws.* (A communication.) Dated February 15, 1869.

This consists in a detachable saw tooth fitted to a recess in the blade and retained therein by a spring catch, so that the tooth may be easily removed and replaced and retained in its place without the aid of rivetting appliances, which tend to distort the blade. The second part of the invention consists of a planing attachment for circular and other saws, the attachment being either part of a detachable tooth or being on a separate plate attached to the blade, the object of this part of the invention being to render the usual rough surface of boards cut by saws smooth and even.—Patent completed.

456 A. MORTON, Glasgow. *Ejector condenser.* Dated February 15, 1869.

This relates to previous letters patent dated July 18, 1867 (No. 2106). It consists in causing a portion or the whole current of the injection water, after passing the steam nozzle, or the last of them when there is more than one, to circulate or return before passing into or through the throat of the lateral-action-inducing and discharge-expanding tube, back through a passage or passages, or other equivalent arrangement into a water nozzle behind the steam jet or jets, as the case may be (where the injection water enters) during the interval between each discharge of steam from the respective ends of the steam cylinder, cylinders, or engines, which returned water may either enter the injection water in a solid central jet or in an angular jet, through correspondingly shaped conoidal nozzles, so as to stop or partially stop the entrance of the injection jet for the time being, while the return current is in action, or combine and mingle with it its outward motion through the condenser or apparatus, instead of the water only passing right out through it as described and practised under the former invention. An extra water nozzle or nozzles may be employed in and for producing this return current in connection with the return passage or passages.—Patent completed.

457 W. H. TAYLOR, Baldwinsville, U.S.A. *Harness buckle and loop.* Dated February 15, 1869.

The side of the improved buckle frame which forms the outer face is made separate from the body of the frame, and is hinged thereto at one end, the other end of the frame being provided with a travelling catch whereby the hinged side of the frame is readily secured and released. The hinged side carries on its inner face a shed which serves as the tongue of the buckle to hold the strap in the frame or loop. One or more of these studs may be used as desired; opposite to each stud is a crossbar or plate in which is formed a hole to receive the tongue or stud when the buckle is closed.—Patent abandoned.

458 W. R. LAKE, Chancery-lane. *Looms.* (A communication.) Dated February 15, 1869.

The boxes are supported in suitable guides or ways, and attached to a rod or other device which is connected to one arm of an elbow lever turning in a stud in the frame; the other arm of the lever, receiving motion from a rod which is actuated by the faces of a graduated slide, has a motion corresponding to that of the loom changes, or, in other words, if it is desired to change after one thread is laid, then the slide moves for every throw of a shuttle, and when changing only. After two threads the slide need move only on the alternate throws, the faces of the slide being so arranged that each moves the lever a different degree, and so as to bring the corresponding box into place, that is, the first face brings up the second box, the second face the third box, and so on, the graded slide turning so as to present the face wanted. This change of position is effected by a lever turning it more or less on its axis, as the lever is lifted or moved by another lever resting on the chain, both levers being connected, and the chain or pattern chain being made with different sized rolls or similar devices to give the different degrees of motion necessary. A gauge plate attached to the elbow lever supports the boxes when raised by means of a drop lever resting on its surfaces and against its faces, which correspond to those of the slide; and the dropping or lowering of the boxes may be effected by raising this drop lever.—Patent completed.

459 E. J. HILL and R. DAVIS, Craven-street, W.C. *Signalling apparatus.* Dated February 15, 1869.

The inventors make use of the natural means of weight as the acting agent, and it is worked upon the principle of a balance scale, and consists of the signal glasses which are attached to a movable frame working in an almost semicircular manner on pivots, and rods attached to the glasses are passed through small holes to the outside of the lamp, the same rods being prevented from extending beyond the outer case of the lamp by small movable lids or caps or other similar contrivance, the momentary removal of which lids or caps effected by the hand or finger causes the change of signals.—Patent abandoned.

460 A. H. LEWIS, Liverpool. *Refining copper.* (A communication.) Dated February 15, 1869.

For the extraction of copper from its ores by this process it is necessary that it should be in a state of protoxide or suboxide or some compound of one of these oxides. Sulphuretted ores are therefore pulverised and thoroughly roasted or calcined in contact with air in a suitable furnace, as a reverberatory, muffle, or terrace furnace, from which the sulphurous acid produced may be collected to be made use of in the production of sulphuric acid, or for the treatment of oxychloride of iron as hereinafter described. For the native oxidised ores, such as the black and red oxide, the carbonates and oxychlorides of copper, calcination is not necessary, but they must be finely pulverised.—Patent abandoned.

461 T. HATTERSLEY, Leeds. *Spindles and flyers.* Dated February 15, 1869.

This consists in an improved mode of fixing the flyer upon the spindle by means of a clutch or catch made to fit into a corresponding clutch or catch on the top of the spindle instead of by means of a screw as at present used. The form of this clutch or catch is such that the flyer locks itself upon the top of the spindle by a slight turn either to the right or left hand, so that the same spindle and flyer can be used for right hand as well as left hand twist, and therefore this invention does away with the necessity of having spindles with two threads on the top, one a right hand thread and the other a left hand thread, and two flyers to each spindle with threads to correspond, as is frequently the case in silk spinning.—Patent abandoned.

462 C. W. LANCASTER, New Bond-street. *Cartridges.* Dated February 15, 1869.

In order that cartridges for breech-loaders may throw as closely as wire cartridges in muzzle-loaders or nearly so, the inventor employs, over the shot and under the ordinary terminal wad of the cartridge, a hollow cylindrical wad, formed of a short piece of cylinder of paper or other material closed at the end by the insertion of an ordinary cloth or other wadding. This short cylinder he forms to fit inside the cartridge case, and he inserts it after pulling in the shot so that it forms a cap or thimble over the front portion of the charge of shot. This hollow wadding is then secured in its place by the ordinary terminal wad, over which the cartridge case is turned.—Patent completed.

463 S. SHAW, Boston, U.S.A. *Buttoning boots.* (A communication.) Dated February 16, 1869.

The inventor takes a piece of metal of the proper size and turns a rounded head thereon. Below this head he turns a circumferential groove. He then forms a shank or stem of less diameter than the body of the stud, with a shoulder just below the groove, and this stem he makes tubular or hollow and of sufficient length to reach through the leather, so that when the stud is inserted therein its end may be turned over on the inside and riveted in the same manner as an ordinary metallic eyelet. The flange which is formed by thus turning down the inner end of the tubular shank or stem serves to hold the stud securely in place. Instead of being turned, the studs may be formed in dies or by any other suitable means, and they may be made with one or more circular grooves for the lace or cord, and may be either plain or ornamental, as desired.—Patent abandoned.

464 T. BOND, Liverpool. *Making casks.* Dated February 16, 1869.

This consists essentially in the employment of a reciprocating or vibrating knife of any suitable shape, caused to move in slides or guides by a crank, eccentric, or other means. The stave blank or stave to be shaped is placed on a table of the required shape and adjustable, if necessary, and at each double stroke the knife cuts off the superfluous timber from the whole or a portion of one side. Second, in an improvement in the machine for finishing the ends or heads of casks known as the "head lathe."—Patent abandoned.

465 T. WINDER, Liverpool. *Spring coupling.* Dated February 16, 1869.

The inventor constructs a hollow cylinder of metal or other strong material and fits thereto a piston, or its equivalent piston rod. The piston rod passes through a firmly secured cylinder cover. Surrounding the piston rod and between the cylinder cover and piston, or its equivalent, he fits a cylinder of india-rubber or other elastic gum, hereafter called rubber; or rings or cones of the same material, separated by rigid plates if considered desirable, can be employed. At or near the end of the cylinder, and also at or near the end of the piston rod, eyes or other connecting agents are formed to allow the coupling to be connected into or to links or other parts. Any sudden strain or jerk given to the coupling will, as regards its damaging effects, be neutralised in consequence of the yielding of the rubber. When fitted in tiller chains, in steering apparatus, and for other purposes on board ship, and in other places where slackness of the chains or other parts is objectionable, the inventor combines with the above described cylinder, piston, and rubber tightening screws of any ordinary or convenient construction.—Patent completed.

466 H. POSEN, Offenbach. *New fastening.* (A communication.) Dated February 16, 1869.

One portion or member of the fastening consists of a fixed plate, block, or piece, in which is a recess or notch, and on or over this plate is another but movable plate, which is free to work by sliding action or otherwise in such manner as to cover and uncover the recess or notch, according to the direction in which the plate is worked. The other member or portion of the fastening consists of a stud, tongue, knob, or projection, called the "projection." It is of such form as to correspond with and fit in the recess, and is so arranged and situated as to be capable of being placed in and taken out of the recess with facility when required.—Patent abandoned.

467 T. BILLYEALD, Nottingham. *Ladies' nets.* Dated February 16, 1869.

The object of this invention is to give greater finish and neatness to the appearance of nets for ladies' hair. The inventor forms the fabric in breadths corresponding with the width of the desired nets, the respective breadths being united during manufacture by lacing or connecting threads. Transverse lines may also be applied to define the size in that direction.—Patent completed.

468 W. SMARTT, Buckhurst-hill. *Utilising waste heat.* Dated February 16, 1869.

The inventor uses the heat under sitting-room, office, and other similar fires, for heating, cooking, warming, and drying purposes, and with this object he adopts a portable apparatus or oven, which is specially constructed and adapted for being suspended, supported, or placed for use under fires. Things or articles intended to be heated, cooked, or warmed, or dried, are according to the circumstance in each case, either placed in vessels in the ovens or simply in the ovens. The ovens with contents are then moved into the spaces under the fires when the said spaces do not contain too large a quantity of ashes; or the ovens may be under the fires before recovering the said things or articles.—Patent completed.

469 L. N. LEGRAS, Wardour-street. *Preserving animal substances.* Dated February 16, 1869.

This apparatus consists of three chambers or reservoirs of iron or other suitable metal or material and of any convenient form placed one inside another. The outer chamber may be made of wood, and is supported upon feet to raise it from the ground. It is to be filled with any good non-conductor of heat, such as felt, powdered charcoal, or carbonised sawdust. The next inner compartment is to be filled or partially filled with ice or other refrigerating substance or substances, whilst the third compartment or chamber serves to contain the meat or other substance to be preserved, such, for example, as butchers' meat, game, poultry, or fish, or, if desired, the third compartment may be employed for the preservation of raw hides, thereby keeping them perfectly sweet and fresh.—Patent completed.

470 Abstract will appear in a future number.

471 G. W. R. PIGOTT, Halifax. *Tension and compression apparatus.* Dated February 16, 1869.

The form of material, whether metallic or not, preferred to be operated upon by this apparatus is a continuous one, such as a band, plate, ribbon, rod, tube, or wire capable of being drawn or thrust through drawing plates or rollers to give any required sectional form. The apparatus consists of certain vices, nippers, or holders, capable of travelling to and fro or remaining at rest, and certain compressing tools in frames capable of sliding or rocking backwards and forwards either in the direction of the line of travel of the vice or holder, or laterally thereto, such vices, holders, or compressing frames, or some of them, being furnished with suitable tools for shaping, moving, or holding the material to be consecutively operated upon, such as dies, punches, cutters, drills, or polishers actuated by suitable mechanical power applied by the usual means of communicating motion, such as levers, cams, cranks, or eccentrics.—Patent completed.

472 B. J. B. MILLS, Southampton-buildings. *Brick making.* (A communication.) Dated February 16, 1869.

This consists, first, in an arrangement of paired mould wheels, the peripheries of which contain a series of equidistant radial compartments or moulds, with intervening spaces on each periphery, the wheels being so geared together that the moulds of one revolve in close juxta-position with the periphery of the other. The moulds of each wheel contain plungers operated by a fixed cam attached to the frame of the machine and operating inside of the wheel with a loose journal at its centre, around which each respective wheel with its series of plungers revolves. Second, in an arrangement of devices whereby the moulds are completely and continuously charged with the clay in proper quality and quantity. Third, in providing apparatus, such as tongue scrapers and rollers, for ensuring a smooth and dense finish to the bottom of the brick.—Patent completed.

473 C. E. BROOMAN, Fleet-street, E.C. *Treating animal waste.* (A communication.) Dated February 16, 1869.

This consists in treating the waste of wool, silk, horn, hides, feathers, and other animal substances with a mixture of sulphuric and nitric acids, whereby products are furnished which will act upon phosphates and coprolithes, and form nitrated super-phosphates of great value for manure.—Patent abandoned.

474 H. TYLOR, Queen-street, E.C. *Spring bedsteads.* Dated February 16, 1869.

The object of this invention is to construct spring bedsteads, as distinguished from spring mattresses, by fixing a number of springs between two sets of laths or bars, as hereafter described. The side rails or angles of the bedstead are pierced with a series of holes; into these holes pins are dropped, the pins depend from the ends of stout bars which stretch across from one side rail or angle to the other. These bars have eyes or their equivalents fixed on them to hold the lower coils of the springs, and the upper coils of the springs are connected in a similar manner to the under side of the upper set of laths or bars. These upper laths are attached to studs fitted on an additional side bar or rail fixed parallel to and above the side rails or angles first mentioned. There may be a number of straps on the under side of the upper cross laths through which the long laths may be passed, their ends being secured to other cross bars fixed parallel to and above the head and foot angles or rails.—Patent completed.

475 A. M'NEILE and J. SLATER, Pentonville. *Carriage wheels.* Dated February 16, 1869.

This relates, first, to certain improved modes of constructing the felloes of wheels and securing the ends of the spokes thereto. Second, to improvements in the construction of the naves and axle boxes of wheels, and relates more particularly to cast or wrought-iron axle boxes or naves.—Patent abandoned.

476 J. FLETCHER, Bow. *Begass furnaces.* (A communication.) Dated February 11, 1869.

This consists, first, in applying an arrangement of mechanism, or apparatus, to the begass furnace, whereby it is fed in a more continuous, regular, and economical manner than by manual labour. This mechanism or apparatus consists of a hollow trunk or chamber of a square or rectangular form inside (having its four inner sides planed) fixed in a horizontal position in front of the begass furnace, and having one end connected thereto and communicating with it. The upper side of the trunk is fitted with a hopper to receive the begass having a hole in its bottom communicating with the inside of the trunk through a corresponding hole in the top of the trunk.—Patent completed.

477 F. WALTON, Staines. *Artificial leather.* Dated February 16, 1869.

In making artificial leather, the inventor cements together two or more thicknesses of calico or other fabric by means of oxidized oil cement, as described in a patent granted the 4th August, 1869 (No. 1801), and having so obtained the required thicknesses, he japans the surface as is now practised in the manufacture of what is generally known as patent leather.—Patent completed.

478 H. MULLINER, Leamington Priors. *Hanging broughams.* Dated February 16, 1869.

The inventor constructs a perch of steel, iron, or other suitable material with which he connects the ordinary beds and springs of an under spring carriage, and suspends the body upon the under carriage so constructed by means of frame work of iron, steel, or other material on the bed or beds carrying a cross spring with which he connects the body by means of elbow springs, or he employs a cross spring of elliptic shape and connects the body with the same by means of ironwork.—Patent abandoned.

479 J. W. YATES, Birmingham. *Spades, shovels, &c.* Dated February 16, 1869.

This relates to those parts of spades, shovels, forks, and other similar articles called the straps or langets, by which the tree or cylindrical part of the handle is connected with the blade, plate, or fork of the articles. The straps or langets, as ordinarily constructed, consist of pieces of iron or steel situated in planes parallel or nearly parallel to the blade, plate, or fork. When the tree or cylindrical part of the handle is placed and fastened between these straps or langets one of the straps or langets is situated at the front and the other strap or langet at the back of the tree or cylindrical part of the handle. By this arrangement of the straps or langets they are liable to break at their junction with the blade, plate, or fork in consequence of the great strain which takes place at those parts, and the object of this invention is to remedy this defect.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated August 31, 1869.

2572 F. W. Potter, Barbican, City. A new or improved construction of wirework, applicable for sieves, screens, and various other articles in which wirework is used.

2573 F. Durand and C. Beslay, Paris. Applying the incompressibility of liquids for imparting the required stiffness to suitable supple bodies for allowing them to be made use of as armatures for building tunnels or other submarine constructions, or for divers other useful purposes.

2574 A. P. Tronchon, Rue Ste. Appoline, Paris. Improvements in the construction of elastic seats.

2575 A. M'Netie, John-street, Pentonville, Middlesex. Improvements in brakes for retarding the progress of wheeled carriages.

2576 W. Glover, Prestwich, Lancashire. Improvements in looms for weaving.

2577 W. E. Newton, Chancery-lane. Improvements in washing machines.

2578 T. Coles, Fort-place, Sandy Hill, Woolwich, Kent. Improvements in the construction of the running wheels of carriages and other vehicles mounted on wheels, and wheels and riggers used in machinery.

2579 T. Wardlaw, Toughmill, Dunfermline, North Britain. Improvements in reaping machines.

Dated September 1, 1869.

2580 T. Wilson, Birmingham. Improvements in screw and ratchet wrenches, part of which improvements is also applicable to pipe cutters.

2581 J. Grice and J. G. Harrison, Birmingham. Improvements in axles for carriages.

2582 J. Shand, Upper Ground-street, Blackfriars, Surrey. Improvements in direct-acting steam pumping engines and steam fire engines.

2583 S. Schiff, Great Alie-street, Goodman's-fields, Middlesex. Certain improvements in the mode of filling or charging pipes for smoking tobacco, and the apparatus or box for containing such pipe, priming, or charges, and lights in combination therewith, called the Premier pipe cigar.

2584 W. S. Laycock, Portobello-place, Sheffield. Improvements in weaving certain kinds of fabrics.

2585 G. H. Nussey and W. B. Leachman, Leeds. Improvements in machinery or apparatus for pressing woollen and other woven or felted fabrics.

2586 T. Greenwood and J. Bapty, Leeds. Improved machinery for combing silk and other fibrous materials.

2587 B. Isangk, Ile Lacroix, Rouen, France. Improvements in apparatus for indicating and registering the pressure of steam or other gases or liquids, called Manograph or self-registering steam gauge.

2588 R. Scott and W. M'Ivor, Addiewell, North Britain. Improvements in the treatment of hydrocarbon oils.

2589 A. M. Davis, Bexley Villas, Bromley, Kent. Improved aerated alcoholic drinks.

Dated September 2, 1869.

2590 S. Willis, Swannington, Leicestershire. Improvements in railway chairs.

2591 R. Pitcairn, Trafalgar-square, Middlesex. A new or improved rest for supporting the arms, feet, or body of a person, or books and other small objects.

2592 J. Day, Manchester. Improvements in the means of raising or closing the glasses or shutters of carriage doors and windows.

2593 P. M'Gough, Halifax. Improvements in sash frames and sashes, particularly applicable to the windows of railway and other carriages.

2594 F. Prestage, Gresham-street, City. An improved arrangement of apparatus to be adapted to railroad carriages for the purpose of assisting in retarding their progress when desired, and also for assisting in starting a train after a stoppage.

Dated September 3, 1869.

2595 E. D. Temple, Circus-place, Finsbury-circus, City. Improvements in the construction of telegraph railway signal, scaffold, and other posts.

2596 S. H. Greaves, Sheffield. Improvements in the manufacture of knives and forks, spear points, daggers, and such like instruments, and in the means or apparatus employed therein.

2597 T. Slater, Euston-road, St. Pancras, Middlesex. Improvements in the construction of electro-magnetic machines as motors, and in the construction and mode of exciting batteries, and in the application of such motors and batteries to various useful purposes.

2598 A. M. Clark, Chancery-lane. Improvements in steam boilers.

2599 H. Bridgewater, Watford, Herts. Improvements in railway chairs, and in the means of securing bridge and flanged rails to their sleepers.

2600 R. Spear, New Haven, Connecticut, U.S.A. Transmitting power for operating marine signals, and for other purposes, by means of air or fluid.

2601 A. Ogg, Kynaston-street, Lambeth, Surrey. Improvements in printing machines.

2602 W. H. Burnett, Great Coram-street, Brunswick-square, Middlesex. Improved modes of signalling on railways by means of sound, and apparatus to effect the same.

2603 G. Henley, Essex-street, Islington, Middlesex. Improvements in dial or needle and alphabetical telegraphs and relays.

Dated September 4, 1869.

2604 J. G. Lynde, Manchester. A diaphragm indicator especially adapted for water and other meters.

2605 J. Webster, Birmingham. A new or improved nozzle for blowing air, steam, water, or other liquids and gases, and blowing, drawing, mixing, and forcing fluids and vapours.

2606 H. Defries, Houndsditch, City. A novel application of glass to decorative or ornamental purposes.

2607 J. Juckes, Wigan, Lancashire, and E. Wood, Bolton, Lancashire. Improvements in the construction of furnaces.

2608 P. Spence, Newton Heath, Manchester. Improvements in the separation of copper from ores.

2609 W. Ambler and B. Jowett, Bradford, Yorkshire. A new or improved method of advertising, and the application of automatic means or apparatus to be employed for that purpose.

2610 J. Hargreaves, Fylde-road, Preston, Lancashire. Improvements in extracting phosphoric acid and phosphorus from the tap cinder of puddling furnaces and iron refineries, and from other compounds of iron and phosphorus.

2611 W. H. Reade, Great Sutton-street, Clerkenwell, Middlesex. Improvements in machinery for clipping and cleansing the hair of animals.

2612 J. Porteous, Edinburgh, and H. Gibson, Musselburgh, Midlothian. Improvements in the manufacture of tobacco, and in the machinery or apparatus employed therefor.

2613 W. Wright, Mostyn, Flintshire. Improvements in the treatment of burnt cupreous pyrites for the extraction of the metals contained therein.

2614 F. H. W. Heuer, South-place, Finsbury, Middlesex. Improvements in velocipedes.

2615 W. S. Clark, Street, Somersetshire. Improvements in the manufacture of boots and shoes, and in machinery and apparatus employed therein.

Dated September 6, 1869.

2616 C. F. Claus, Middleborough-on-Tees. Improvements in the manufacture of carbonate of soda, and in the recovery of waste products resulting therefrom, and in the construction of apparatus to be employed for such purposes.

2617 T. S. Webb, Norton Ironworks, near Stockton-on-Tees. Improvements in the manufacture of iron and steel.

2618 J. Edwards, Richmond-road, Hackney, Middlesex. Improvements in railway carriages, and in means for communicating from one to another of the same.

2619 C. D. Escoffier, Finsbury-circus, Middlesex. Improvements in the construction of castors or rollers for furniture, and applicable where castors or rollers are or may be employed.

2620 E. T. Hughes, Chancery-lane. Improvements in the construction of doors and similar articles.

2621 T. H. Blamires, Huddersfield. Improvements in rubbers for condensing and piecing machines.

2622 W. E. Newton, Chancery-lane. Improvements in reaping and mowing machines.

2623 F. Wicke, Bockenheim, Prussia, J. Bronner, T. Petersen, and J. G. Zehfuss, Frankfort-on-the-Maine, Prussia. Certain improvements in the treatment of human excrements, whereby they are converted into an inodorous, dry, and easily portable manure.

2624 W. E. Gedge, Wellington-street, Strand. Improvements in apparatus for rectifying alcohols.

2625 S. F. and A. B. Ibbotson, Sheffield. Improvements in joints for uniting and securing the ends of railway rails.

2626 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in velocipedes.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1219	2345	2427	2447	2476	2486	2495	2505
1683	2353	2429	2449	2477	2487	2496	2507
1749	2402	2431	2451	2478	2488	2497	2508
1983	2411	2437	2455	2479	2490	2498	2509
2039	2413	2439	2457	2481	2491	2499	2510
2229	2415	2440	2459	2482	2492	2500	2512
2253	2417	2441	2461	2484	2493	2503	2514
2296	2418	2443	2467	2485	2494	2504	2516
2328	2419	2445	2473				

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2467 W. A. Richards
2476 A. J. Alderman
2491 G. Ritchie

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2246 J. Owens
2266 C. E. Brooman
2277 W. T. Sugg
2287 W. P. Bardell and W. Powell
2294 T. Barney
2297 J. and J. W. Asquith
[illegible] C. E. Brooman
[illegible] C. Catlow
[illegible] W. Clark
[illegible] C. P. Stewart and H. Chapman

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," September 7, 1869.

1219 P. R. Hodge
1270 P. Jensen
1274 J. Cudbird
1293 W. R. Lake
1298 J. H. Sams
1302 T. Aspden and E. H. Lambert
1304 O. Moseley
1308 G. Heyes and E. Barlow
1313 E. Cooper
1318 D. Greig, R. Burton, J. Gozney, and T. Atkinson
1322 M. Wilkin and J. Clark
1324 O. Rose
1327 R. Eladon
1332 F. Bajeaud
1337 R. Craig
1338 R. Ward
1339 E. Tutte
1349 W. Broughton and T. Steven
1350 J. Conway
1361 P. Southern
1373 A. V. Newton
1374 W. E. Newton
1377 D. Adamson
1382 A. Cocks
1395 W. Galloway
1407 F. Leonard and H. Hewitt
1428 W. B. Smith
1448 A. Henry
1469 C. H. Gardner and J. Bickerton
1531 F. Walton
1571 E. H. Pullbrook
1664 J. Smith
1688 H. Holdsworth
1686 C. H. Gardner
1749 J. and S. W. Varley
1825 P. Jensen
1853 W. Woods
2001 W. Fraser
2058 W. [illegible]
2266 A. B. [illegible]
2297 H. Bessemer
2349 J. Lawson and E. G. Pitton
2477 W. Crampton
2536 W. R. Lake

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed September 3, 1869.

654 A. A. L. P. Cochrane
667 C. Tighe
669 F. Windhausen
674 W. B. Waterlow
677 R. Badger
[illegible] J. A. [illegible]
[illegible] W. T. [illegible]
[illegible] T. [illegible] and G. [illegible]
[illegible] W. Powell

Sealed September 7, 1869.

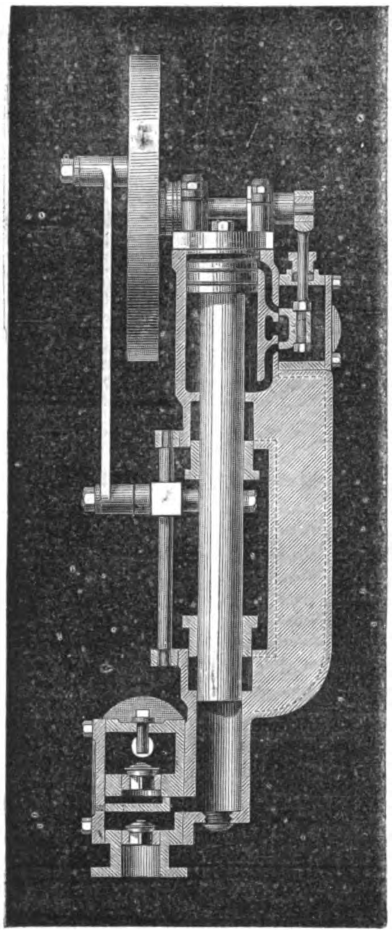
694 L. M. Ruiz
695 H. Tylor
723 R. M. Caffall and D. Miller
724 J. Henderson
729 W. Walker
731 B. Britten
733 J. Sax
740 D. Johnson
744 G. Glover
748 C. H. Cooper
769 C. E. Brooman
770 L. Labadie
773 H. C. Bartlett and A. G. Southby
819 C. F. Claus
827 A. de Pindray
828 W. R. Lake
844 W. R. Lake
871 M. Sigler
906 F. Hurd
913 J. T. Calow
933 B. J. B. Mills
996 H. A. Fletcher
1243 A. Borgnet
1312 L. Isaac
1400 G. T. Bousfield
1508 S. W. Clark and W. R. Sykes
1900 W. R. Lake
1905 W. Clarke and E. Walker
2092 J. Dewar
2149 J. W. Ormiston

LIST OF SPECIFICATIONS PUBLISHED

For the week ending September 4, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
8981	1 2	91	0 10	186	0 6	256	0 4	288	0 4	301	0 4
8986	0 8	95	0 8	194	1 4	263	0 4	290	0 4	303	0 4
2	3 10	100	0 10	236	1 4	265	0 4	291	0 4	304	0 4
46	0 8	110	0 10	240	0 4	267	0 4	292	0 4	306	0 4
48	1 4	112	1 4	247	0 4	268	0 4	293	0 4	309	0 4
59	0 8	116	1 2	248	0 8	269	0 4	294	0 4	318	0 4
60	0 10	131	1 2	250	0 4	271	0 4	296	0 4	319	0 4
61	1 4	132	0 8	251	0 4	273	0 4	297	0 4	355	0 4
67	1 2	150	0 6	252	0 4	279	0 4	298	0 4	374	0 4
71	0 6	182	0 6	254	0 4	286	0 4	300	0 4	419	0 4
88	1 4										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.



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IMPROVED DONKEY PUMPS, INJECTORS, SAFETY VALVES, STOP VALVES, AND BOILER MOUNTINGS OF EVERY DESCRIPTION.

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N.B—They are proportioned to draw 15ft. and force into the boiler supplying steam to them; when they draw more than 15ft. the rams have to be made smaller. In pumping water they will throw it 2ft. high for every pound pressure of steam in the boiler.

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5	1¼	3	230	15	8	10	0
6	1⅝	4	460	30	11	0	0
7	2¼	4	600	40	13	0	0
*8	2¼	4	900	60	15	10	0
9	2½	6	1,200	75	17	0	0
*10	2½	6	1,300	120	19	0	0
11	2¾	6	1,500	100	22	0	0
*12	2¾	6	2,250	150	25	0	0
*14	3	9	3,750	250	35	0	0
*16	4	12	7,500	500	45	0	0

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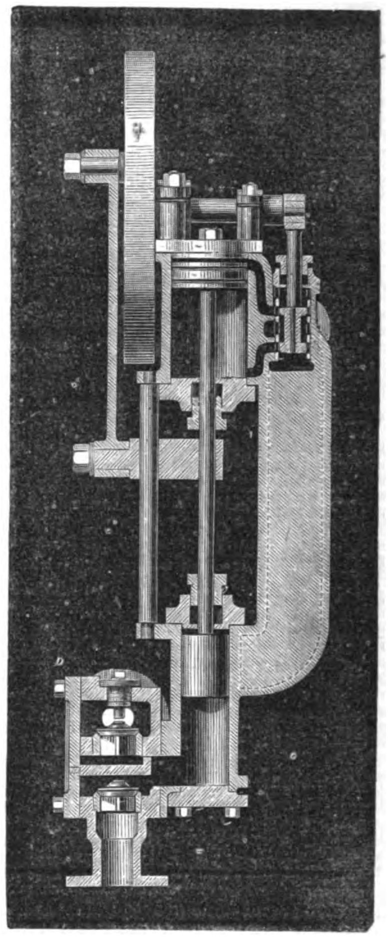
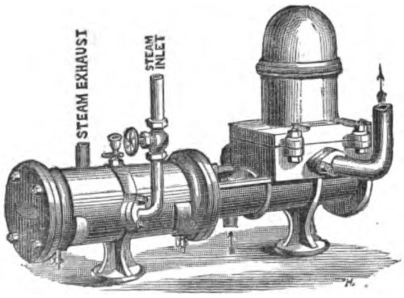


PATENT

UNIVERSAL STEAM PUMPS,

VERTICAL AND HORIZONTAL.



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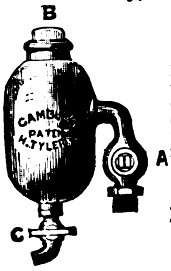

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(Half-size drawing of Chesterman's Patent Steel Measuring Tape, 66 feet.)

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SINGLE & DOUBLE-ACTING DOOR SPRINGS,

ENGINEERS' TOOLS, &c., &c.

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A 27

Prize Medal, International Exhibition, 1862.

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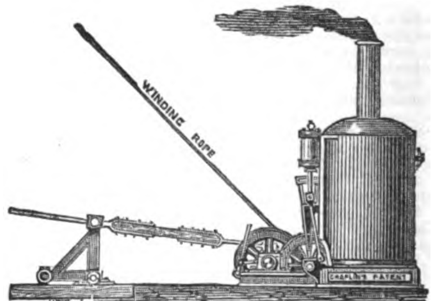
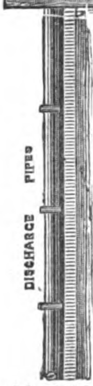
PATENT PORTABLE

STEAM ENGINES,

FOR PUMPING AND WINDING.





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Stationary Engines, 1 to 30-horse power, with or without gearing.
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THE
MECHANICS' MAGAZINE.

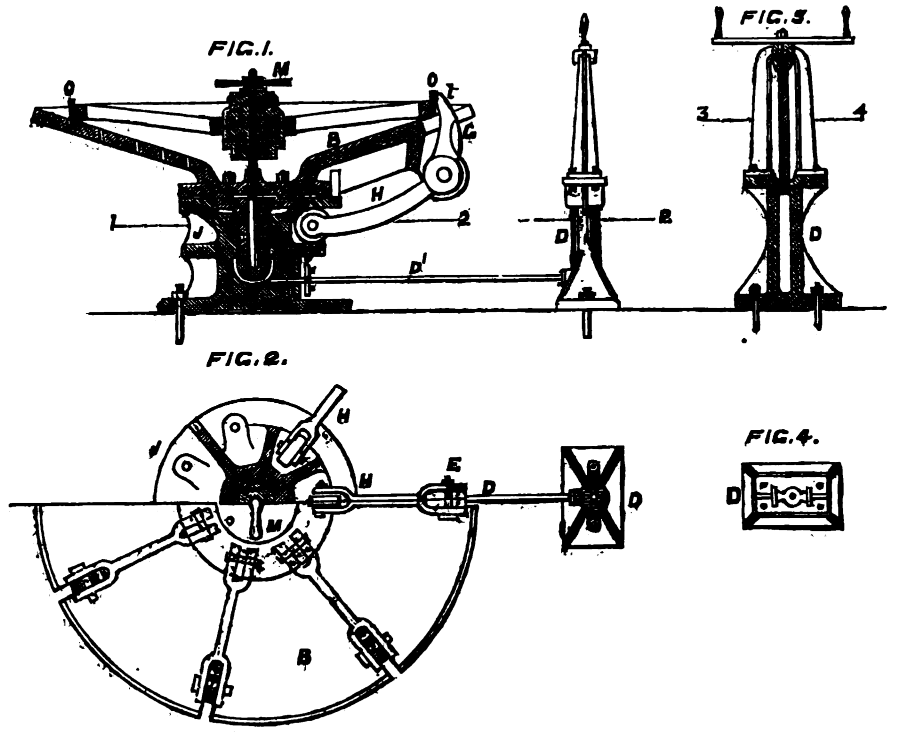
LONDON: FRIDAY, SEPTEMBER 17, 1869.

MACHINE FOR COMPRESSING WHEELS.

OUR readers are familiar with the ordinary method of attaching a tyre to a wheel, in which the object is effected by heating the metallic rim and permitting it to compress the wheel after cooling. Recently a patent has been taken out by M. A. Colas which reverses these conditions, and also materially facilitates the putting together of the various parts of the wheel. The two principal advantages claimed by the inventor are, that by attaching the tyre when cold, all chance of burning the felloes is obviated, which frequently takes place with the hot tyres, and that there is no danger of injuring the elasticity and homogeneity of the metal by a violent and sudden alteration of temperature. According to the new principle, the metallic tyre is made and applied in its normal dimensions and conditions, but the wheel itself is maintained in a state of strong compression throughout the whole of its circumference while the operation of fixing the tyre is accomplished. So soon as this is completed, the artificial force of compression is removed, and the wheel recovers the elasticity of which it had been temporarily deprived. It is evident that the whole operation designed by M. Colas is exactly the inverse of that in ordinary practice among wheelwrights and manufacturers. In addition to the difference in the two systems the means of carrying into practical execution the one under consideration are sufficiently novel and ingenious to deserve a detailed description.

The present apparatus employed by the inventor, which has had many improvements added to it suggested by experience and the deficiencies of its predecessors, is illustrated in the accompanying cuts. A vertical section is represented in fig. 1, a plan with two views in fig. 2, and the two remaining figs. show a vertical and horizontal section of the pump which injects water into the machine. The wheel A is placed upon the frame B, which has its external surface of a conical shape and is capable of being raised by the piston C, attached to the hydraulic pump D. The tube D' conducts the water under the piston. When the frame B is raised, it carries with it the axes E. Upon these latter are placed the compressing levers G and the connecting rods H, which turn freely upon the pivots I attached to the frame J. It results from the upward motion of the platform B that the levers G bear against the small arms *t*, and press them against the felloe of the wheel A. In consequence of this compression, the diameter of the wheel is reduced, and it descends, or settles down a little lower in the conically shaped frame B, under the action of the hand screw M, which passes through the centre of the frame. The manner in which the introduction of the tyre is accomplished now remains to be described. In its present stage the wheel is compressed by the arms *t*, and also held firmly in its place by the screw M and the conical shape of the platform B, so that the pressure of the levers G may be relaxed, and the tyre inserted in its place. Directly this is effected the operation is finished. The pressure of the screw M is removed, and the wheel, restored to its normal condition of elasticity, presses against the tyre with sufficient force to become firmly fixed to it without the aid of heat, but by a simple and rapid mechanical operation. Within certain limits there would not appear to be any difficulty in adapting the machine to wheels of different diameters, as the levers of compression G have a certain amount of play, and the conical form of the platform B could receive circumferences of different size. Obviously it would never do for a manufacturer to purchase a machine for every sized wheel that he might be called upon to supply. As a rule, there are certain sizes usually recognised for the different descriptions of vehicles, so that it must not be imagined that their manufacture is altogether a matter of chance. The simplicity of the method proposed by M. Colas needs no comment. So far as the motive power is concerned, any other suitable means might be employed instead of hydraulic agency wherever the latter was not available.

MACHINERY FOR COMPRESSING WHEELS.



CONCRETE STONE IN INDIA.

ALL who are acquainted with Bombay are well aware how badly it is off for good building stone. The materials in ordinary use are trap and Porebunder stone, the former of which gives a heavy ponderous appearance to the buildings, whilst the latter is of a very perishable nature. The Coorla stone is much more durable, but it is so hard as to be almost unworkable. The stone from Hemnuggur answers well, but the cost of transit is so great as to preclude its use in all but very special cases. Hence the want of a good and cheap building material has been long and seriously felt in Bombay. That want, we are glad to find, is now supplied by the introduction of Mr. Ransome's siliceous stone. The value of this invention having become known to the Secretary of State, the manufacture of the Ransome stone was forthwith directed to be carried out at the Government works in Bombay. An establishment was organized by Mr. A. Pye-Smith, a gentleman from the inventor's works at East Greenwich, and is now in full work, producing stone on Mr. Ransome's beautiful principle. The new stone appears to afford much satisfaction, and the prospect of a material at once pleasant in colour, enduring in texture and moderate in price, is especially cheering where such serious drawbacks as those to which we have referred exist. The introduction of the stone, too, is singularly opportune, inasmuch as the Government is just commencing a series of large buildings, which it was wished to make as permanent as possible. The Ransome stone—as our readers are for the most part aware—is produced by dissolving flints in caustic soda and mixing the resulting silicate of soda with dry siliceous sand and limestone powder. The paste thus formed is moulded to any desired shape, and then hardened by immersion in a solution of chloride of calcium. A shower bath of cold water drives off the chloride of sodium, and the stone, after being dried, is ready for use.

Our readers will doubtless remember, from our description of the Ransome's Stone Works at East Greenwich, that the process of saturation with the solution of chloride of calcium is accomplished by hose playing on the blocks, as well as by immersion. Mr. Ransome has, however, improved this part of the process, and in connection with his son, Mr. Ernest Ransome, and the well-known Mr. Bessemer, has recently obtained another patent, in which is claimed the "saturating, washing, and drying blocks or moulded pieces of artificial stone by means of a vacuum or pressure, or by both vacuum and pressure combined." And the works have now been fitted up with air pumps and other apparatus for this purpose with the most satisfactory result. In the Government Works at Bombay Mr. Pye-Smith has introduced another very ingenious arrangement for carrying out this part of this process, consisting of an airtight iron chest, into the upper side of which a pipe is carried from a tank placed at a considerable height above the building. The chest has a movable bottom, which is lowered by a winch and placed on a traveller. When the plate has been loaded with moulded material—the pieces being placed over vents made in the movable bottom—it is placed beneath the saturator, which somewhat resembles a diving bell. It is then screwed up in its place and well packed, the cock of the down pipe is then opened, and the chloride of calcium admitted under the pressure of a good head. It rapidly permeates the soft masses exposed to its action and converts them into durable stone, after which they are treated with water in the usual way. The only drawback the manufacture at first experienced was the difficulty of obtaining sand of the proper quality. There is no siliceous sand in or near

Bombay, but, after several journeys, Mr. Smith found a supply at Kutch Mandive. The limestone powder is readily obtained by pounding Porebunder stone to a sufficient degree of fineness. The natural materials being thus formed the manufactured ingredients, such as the silicate of soda and chloride of calcium, are readily obtainable, and thus enable this important manufacture to be developed where it will prove of the greatest value. It supplies a want created by the absence of natural stone of the proper quality for building purposes, and bears striking testimony to the special merit of Mr. Ransome's invention.

MANUFACTURE OF CAPS AND CARTRIDGES.

No. X.

It has been already stated that the brass ends or sockets into which the cartridge case fits are manufactured and annealed at the premises in the "Rue Notre Dame des Victoires," and in this condition are forwarded to the branch of the establishment situated at Moulineaux. As a preliminary preparation for the future modifications they are destined to undergo they are cleaned and polished by the united action of an acid, sawdust, and the revolving barrel, from the last of which they emerge "bright." The other component parts, namely the case, the "piece" with the chamber, and the "renfort," have been brought to a similar advanced stage, and they are all despatched together to the workshop, where the operation of uniting them is effected. This is accomplished altogether by women, and is one of the most interesting and curious of the many processes connected with the manufacture. Hand labour is ingeniously aided and supplementalised by the employment of mechanical agency. The workwoman stands in front of an iron table, which supports upon her left a small frame carrying a mandrel moving horizontally from front to back. Opposite to it is placed an anvil separated from the extremity of its stroke by a distance about equal to the length of a cartridge. In the centre of the table is an opening or slit, in which is fixed a copper wheel revolving in a small reservoir containing paste, while in an oblique direction to the same aperture is situated a bracket furnished with a groove which serves as a guide for the introduction of the cartridge. On the right of the workwoman the various component parts of the cartridge are arranged, and she holds ready in her hand a short mandrel, a trifle longer than the cartridge itself. Taking the case in her right hand, she inserts the "piece," passes the mandrel inside the case, and presses the end of it against the anvil on her left, and upon which descends the punch having a conical section. The slight pressure bestowed upon the end of the case depresses it a little and enables it better to receive the brass end piece. Previous, however, to the case undergoing this pressure, it is brought for a moment into contact with the small copper wheel already alluded to, which gives it a thin coating of paste, and causes the brass end to adhere firmly to it. The operation is terminated by presenting the end of the cartridge to the flat part of the anvil and permitting the punch to descend upon the mandrel inside the case. The pressure drives the "piece" well down and fixes it in its place. So quickly is the whole process performed that without close attention, the unpractised eye can scarcely follow the various motions. Some of the best hands can turn out as many as six thousand of these cases in one day's work.

Similarly to their warlike brethren, the sporting cartridges have to be "struck," but a rather gentler and more delicate kind of machine is employed in their case. The motion moreover is vertical instead of horizontal, and the apparatus strongly resembles a rivet-head making machine, as will be at once perceived by the description. In front of the workwoman is placed a disc carrying at the circumference twenty hollow sockets, into which the cartridge cases are inserted with the brass ends uppermost. Exactly as in the rivet machine, the rotation of the disc brings each case in turn under a punch, which drives the brass end up to its proper place, and also compresses the "piece" into half its original thickness. At the same time the chamber is enlarged, and one of its sides bevelled off so that the priming may be easily introduced, and the passage prepared for the needle. By the same stroke the number indicating the gauge of the cartridge is stamped upon the metallic end, together with the trade mark of the establishment, and the rim, serving to retain the case in the gun, also formed. The next step is to prime the cases, which is a twofold operation, the first part consisting in the boring of the hole through which the needle passes, and the second in the introduction and fixing of the needle and priming. A drill worked by a lathe at a very high velocity effects the piercing of the necessary aperture. The priming is placed in a little kind of stirrup and introduced into the cartridge, while a horizontal rod holds the needle, which is inserted to the proper depth by means of a small lever. There are some objections to this description of priming. According to the degree of acuteness of the drill, the diameter of the hole is subject to variation, which is a very undesirable result. At the moment of firing, the metallic end undergoes a considerable dilatation, due to the pressure produced by the gas, and the aperture for the needle permits of the passage of gas in a high state of inflammability, carrying with it particles of metal and paper. Moreover, the aperture itself being enlarged, the needle is liable to be blown out by the pressure. In fig. 1 is shown a longitudinal section of a

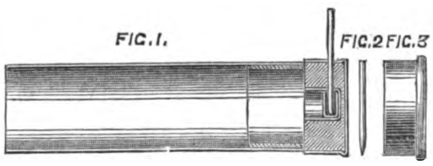


FIG. I. FIG. 2 FIG. 3

cartridge after being primed and the needle inserted. Figs. 2 and 3 show respectively the needle and the metallic end piece.

To remedy the serious defect in the method of priming already described, M. Gevelot has substituted for the action of the drill that of a steel punch. This latter acts like a nail when driven into a piece of wood, and penetrates through the breech of the cartridge, at the same time that it compresses together all the material in the neighbourhood of the aperture, which is thus rendered exactly equal in diameter to that of the needle intended to fill it. At the moment of expansion of the gases by the firing of the arm, their action forces the ring of compressed metal and paper resulting from the pressure of the steel punch closely all round the needle in a manner similar to that in which the leather collar acts in a hydraulic press, and effectually prevents all escape of gas. A very simple machine suffices to perform this operation. The priming is introduced into the cartridge as in the former method, and a frame is employed, working backwards and forwards between two guides, and carrying a wheel furnished with two piercers of unequal length and the needle. Three blows are imparted by means of a lever. At the first, a slight depression is made in the metal and the upper layers of the paper in immediate proximity to it; at the second, the other piercer follows in the path of its predecessor, but penetrates deeper, as far as the chamber. The third blow brings the needle itself in front of the aperture into which it is inserted, driving before it in its passage the loosened and broken particles of paper and metal. This system of priming, by its great simplicity and facility of execution, has considerably increased the manufacture of cartridges for breechloaders. The cartridges have yet to be filled and charged, and they are then ready for exportation.

PHOTOGRAPHY.

THE PHOTOGRAPHING OF MACHINERY—REMOVAL OF NITRATE OF SILVER STAINS—THE PHOTOGRAPHING OF SPIRITS—A NEW POLARISING PRISM—ALKALINE WET PLATES.

A NOTICE has appeared in the "Scientific American" to the effect that M. Bourbouze has succeeded in representing by photography machinery in motion. The statement is that he constructs his photographs in movable parts as transparencies upon glass; each movable organ is photographed on a separate glass, and the fixed parts upon another glass plate. The fixed parts and the movable glasses are arranged in a frame, and motion is given to the latter glasses by means of a winch so as to represent the actual motion of the machinery. The whole is then in all probability illuminated by the lime light and projected on a screen, but the published notice is so brief as to give too little information. A plan by which moving figures have been successfully represented is to take several small transparencies of the moving object in its different positions, and to arrange these pictures in a circle near the rim of a large flat wooden disc. This disc is made to spin round in front of a magic lantern, so that all the pictures are brought in succession into the focus of the object glass, and thereby thrown upon the screen one after the other. By the law of the retention of vision, the object then appears to be in motion, supposing the wheel to be driven at the proper speed, and each picture to be rendered stationary for the instant that, by suitable appliances, it is flashed upon the screen.

In order to remove the dark stains of nitrate of silver from linen without destroying the fabric, Herr Grimm recommends that the stain be first treated with chloride of copper, to produce chloride ot silver by double decomposition, and that then the spot be treated with hyposulphite of soda. When the silver has been thereby dissolved, the linen should be well washed. Another plan is to treat the stain with a weak solution of permanganate of potash to which some hydrochloric acid has been added, and then to finish with hyposulphite of soda and washing, as before. A solution of iodine in iodide of potassium also answers the purpose for the first washing.

A very great deal has been published in all the photographic journals for many weeks past about the Mumler spirit photographs. It will be remembered from the notices which appeared in the newspapers, that a photographer named Mumler has been for many years taking photographs in New York wherein shadowy human forms accompany the sitters, which forms have usually been alleged by the sitters to represent deceased relatives of their own. Nothing is easier than to produce good ghost pictures with the connivance of the sitter, but nothing of this kind took place in producing the Mumler photographs. Mumler was prosecuted as an impostor by the photographers of New York, but many respectable witnesses came forward and swore that the pictures produced in their presence were actually those of their deceased relatives, and one of these witnesses was Mr. Livermore, the New York banker. The result of the trial was that Mumler was acquitted, as imposture was not proved against him. Faint ghost-like pictures may be produced upon imperfectly cleaned glass plates treated in a peculiar way known to scientific photographers, so a favourite explanation of the case in the photographic

journals when the trial was over was that ghost-like smudges were thus produced, and imagined to be likenesses of departed friends by weak-minded purchasers. But when the photographs themselves reached England, it was seen that the phantom faces were well-defined absolute likenesses, presenting marked features. To still further complicate the matter, some witnesses testified that these pictures came out in Mumler's presence in the operating rooms of other photographers where Mumler was not allowed to touch the glasses, chemicals, or sitters. Up to this point the case was puzzling enough, but very recently the "British Journal of Photography" published a part of a letter from Mr. S. C. Hall, F.S.A., Barrister-at-Law, which had been written about the Mumler case to Judge Edmonds, an eminent man who defended Mumler and believed in his innocence. In this letter Mr. Hall said that he and eight witnesses all at the same time saw the spirit of his sister at a circle, Mr. Daniel D. Home being the medium. Among the eight witnesses was the Hon. Mr. Lindsay. The spirit, he said, was visible for about two minutes, and stood out palpably and distinctly enough to be photographed had any photographer been present with his apparatus. So stands the evidence at the present time respecting the Mumler case, whilst that remarkable photographer himself is now at large producing his spirit pictures and loudly offering to submit to any reasonable investigation of his powers. Can he not come to England?

M. Jamin, of Paris, has invented a new polarising prism, but no specimen, so far as we know, has as yet reached England. It consists of a glass box filled with bisulphide of carbon, and a slice of Iceland spar is placed diagonally in the centre of the box.

After reading the correspondence called forth by the publication of Mr. Sutton's new process, it seems to us that a new principle in photographic science has been discovered, without any of the writers having noticed the fact. Major Russell says that Mr. Sutton's prepared plates contain a large amount of soluble bromide. Now with any ordinary preservative this bromide would have to be for the most part removed, or the plates would be very insensitive. But Mr. Sutton does not so completely remove it, yet on pouring a weak alkaline solution containing traces of organic matter over the plate, great sensitiveness of the film is said to be the result. If so, we have the new discovery that alkalinity of the organifier will give sensitiveness to a film containing a large amount of soluble bromide. As yet no evidence has been published supporting Mr. Sutton's opinion that his new process is far more sensitive than the wet one, and upon this point all its value depends. It is to be hoped he will soon send to London pictures of street scenes, giving abundance of half-tone and sharpness in moving figures. When practical photographers see that he can produce much better instantaneous pictures than they themselves can by the wet process, Mr. Sutton's fame will be established.

NOTICES OF BOOKS.

THE proceedings of the British Association have occupied so much of our attention and space for the last few weeks as to prevent our noticing some very useful books which have come to hand since our last notice. They have therefore accumulated to the number of a round dozen, and are now about to receive the attention they demand. We will first notice a valuable addition to engineering literature, which has been made by Professor Rankine. This is a manual of machinery and millwork,* and which forms the fifth of a series of practical manuals on civil engineering and mechanics by the same author. The volume before us is divided into three main sections, the first of which treats of the geometry of machinery. In this section are given elementary rules in descriptive geometry, after which the motions of the primary moving parts of machines are described. The motions of secondary moving pieces are then considered, and the elementary and aggregate combinations in mechanism are fully and lucidly explained. The second part of the work is devoted to the dynamics of machinery, and includes a notice of the performances of work by machines, dynamometers, regulating apparatus, &c., being here considered. The third division is occupied by particulars relating to the materials used in machinery—general tables of strength of materials being given—to the construction of machinery, and to the principles relating to strength and stiffness of machines, the principle of the action of cutting tools being also explained. The author solves several problems in mechanism by methods which have not hitherto been published, but which are notable for ease and accuracy. We may specially refer to the drawing of rolling curves and of some kinds of cams, the construction of the figures of teeth of skew bevel wheels and of threads of gearing screws by the help of the normal section. There are also some improvements in the details of processes for designing intermittent gear, link motions and parallel motions. The text is interspersed with numerous diagrams, and the whole forms a volume in no way behind those of the series which have preceded it. It fully sustains the reputation of its talented author, and will take its place as a high class text book of mechanics.

* "A Manual of Machinery and Millwork." By WILLIAM JOHN MACQUORN RANKINE, C.E., LL.D., F.R.S., &c., &c. London: CHARLES GRIFFIN and Co., Stationers' Hall-court. 1869.

We next come to a new edition of Mr. Bourne's recent improvements in the steam engine,* which was first issued as a supplement to the Catechism of the Steam Engine, by the same author. This useful book gives a clear and concise idea of the various improvements which have been made of late in the steam engine in its various applications to mines, mills, ocean navigation, railways and agriculture. In the present edition several examples which appeared in former editions have been omitted, and they have been judiciously replaced by many new examples. Amongst these will be found some of the most remarkable engines collected in Paris at the Exhibition of 1867. The volume has been much enlarged upon its predecessors, and contains descriptions and illustrations of every class of engine, as well as some useful remarks upon superheated steam, boilers, furnaces, the injector, slide valves, pumps, &c. A variety of examples of locomotive engines are given, but we miss one which we think ought to have found a place in such a work as the present. This is Mr. Fairlie's system, which, as is well known to our readers, has been brought to a practical issue by the inventor. But if this has been overlooked, our author has taken care to supply examples of the most recent practice in steam fire engines, as well as in hot air engines. This renders the book very complete, and will make it most useful for reference for some time to come—that is, until the changes brought about by the rapid progress of mechanical engineering render another edition necessary.

A work which will find favour with students, and will prove very useful to general readers, has just been given to the public by Dr. Nuttall.† It is a dictionary of scientific terms, and it makes its appearance at a very opportune moment, when the question of technical education is taking such a practical turn. The language of practical science is here elucidated and rendered familiar to the general student. By the aid of this useful volume, both he and the general reader may readily ascertain the derivation, meaning, and general application of the numerous words which are being brought into daily use by the progress of scientific knowledge.

* "Recent Improvements in the Steam Engine." By JOHN BOURNE, C.E., new edition. London: LONGMANS, GREEN, and Co. 1869.

† Dictionary of Scientific Terms. By P. AUSTIN NUTTALL, LL.D. STRACHAN and Co., 56, Ludgate-hill. 1869.

The recent proposition to abolish the Patent Laws called forth observations and indignant protests from many quarters. Amongst others, Mr. Henry Dircks has addressed a letter to Lord Stanley, and which has been published in pamphlet form by Messrs. E. and F. N. Spon, 48, Charing Cross. In this letter, Mr. Dircks ably shows up the fallacies of Mr. Macfie's statements in the House of Commons. Mr. Dircks very properly contends that the whole question in dispute affecting the abolition of the Patent Laws concerns only manufacturers, and not the nation at large—the public, the million. The people, says Mr. Dircks, never will move in it, simply because they are the gainers, even although some few manufacturers, with old works conducted on old systems, may happen to suffer ever so much during some great reform; such as, for example, the substituting of steam engines for atmospheric machines, doing away with spinning jennies, introducing steam propulsion on land and water, or whatever interferes with supposed vested rights. And, after all, when thus limited to manufacturers, how few are ever affected to their serious injury, and how many owe their elevation to their early enterprise in the encouragement they have given to some patented novelty. Those who argue against Patent Law never keep to one argument, never prove anything. They assert abundantly that it is a national calamity by which trade is hampered and the progress of manufactures impeded. These are their public grounds of groundless complaint. Then they shift to the poor inventor: he has only an idea, he can have "no property in ideas," his law expenses are enormous, patents ruin him, the true inventor gets no benefit, and so forth, to prove that patenting of inventions is a delusion and a snare! Then come their comparisons. Mr. Macfie stated that "an invention differed altogether from the literary work of an author, which he would continue to protect." So that, logically stated—a book not being an idea, a man may legally claim a property in his book! Such, says Mr. Dircks, is the miserable reasoning of the opponents of equal protective right in works of genius and talent.

Another tunnel scheme for crossing the Channel, and thus placing England and France in direct communication, has been worked out by Mr. E. W. Young, C.E. (Messrs. Spon). Mr. Young proposes to construct between Dover and Cape Gris Nez a wrought-iron tunnel, in short sections of (say) 200ft. to 300ft. in length. These are to be floated into position and lowered into place at a certain depth below the surface of the water, where, the joints being made good by divers, they would form one continuous tube across the Channel. The tube being buoyant, would be held down to the required depth by mooring cables of iron, attached to blocks of bêton of sufficient weight. The tube would be fixed at such a depth below the surface as to be practically unaffected by the waves. It could not be raised vertically without lifting the anchors or breaking the mooring cables, nor depressed without overcoming its buoyancy. It could not mov laterally without breaking away from the inclined mooring cables, and, therefore, it would be stable under all circumstances Ventilation would be secured by means o lighthouses placed half a mile apart along the tube. These lighthouses would be supported from the bottom of the sea by piers formed of clusters of cylinders filled with concrete. Mr. Young gives drawings and details of his proposition in the pamphlet before us.

Four useful little volumes are to hand from Messrs. Cassell, Petter, and Galpin, of La

Belle Sauvage-yard, London. The first is Tyndall's Natural Philosophy, which has been brought down to the level of the most ordinary understanding, and is produced in the form of easy lessons. These lessons will be found an acquisition to schools as well as to the student who is setting out on the path of scientific inquiry and research. The second volume is an elementary treatise on building construction, by Mr. Ellis A. Davidson, and forms the third of the series of Messrs. Cassell's technical manuals. This book gives a general knowledge of the principles of building construction, and at the same time affords elementary practice in architectural drawing. It is illustrated by 133 wood engravings, and, as an elementary work, will be found exceedingly useful. The two remaining books received from this enterprising firm are "Æsop's Fables" and "Evenings at Home." They are both reading books for beginners, and have been written in words of one syllable—the "Fables" by Mary Godolphin, and the "Evenings" by Uncle John.

Some interesting "Notes on the Geology of North Shropshire," by Charlotte Eyton, have been published by Mr. Hardwicke, 192, Piccadilly. The authoress puts forth her "Notes" with much modesty, but she may rest assured that they will be appreciated by all who take a geological interest in the district, as well as by beginners in the study of geology. The book is simply a collection of notes of geological work in the neighbourhood of the Wrekin and part of the plain of North Shropshire. Each chapter interests whilst it teaches, and this little *brochure* will afford pleasant reading to all who feel sufficiently interested in geology to give it a perusal.

Those who think will find much good food for thought in "Lacon," which was addressed to them some years since by the Rev. C. C. Colton, M.A. A new edition of this work has been published by Mr. Trounce, of 9, Cursitor-street, Chancery-lane. This book deals with a variety of subjects of a moral and religious character, but hitherto it has had one drawback to its utility. This was the absence of a means of ready reference to any particular anecdote, maxim, or position, an abundance of all of which it contains. In the present edition, however, this defect has been remedied, the editor having prepared a brief, but expressive, title for each article, which is prefixed to it. An index also has been added, which is a further great improvement in a volume containing about a thousand distinct subjects. Thus the most popular of the rev. author's works has been made increasingly useful to those who can snatch half an hour now and then from busy life for thought and reflection.

A fellow of the Meteorological Society has written a pamphlet on the aneroid barometer, with instructions for its purchase and use (Houlston and Wright, 65, Paternoster-row. 1869). It describes the construction of the aneroid, and points out its usefulness. The author gives the new altitude tables by the Astronomer Royal, and illustrates his subject by engravings of aneroids of various kinds and suitable for various purposes. The pamphlet, of course, is written in a popular style, and will be found useful for its intended purpose.

Messrs. Longmans and Co. have issued a second edition of their "Monarchs of England since the Conquest." It is arranged in a compact tabular form, about 11in. square, and shows at a glance many particulars relating to each sovereign. Advantage is taken of the principle of association of ideas to enable the main facts to be retained in the memory for any length of time.

ELECTRICITY AND TELEGRAPHY.

PROFESSOR FLEEMING JENKIN has recently patented some improvements in obtaining electric light. His invention is especially applicable to beacons and buoys, which by its use may be lighted by a voltaic battery placed on shore and communicating with the beacon by a submarine cable. The light is produced by a rapid succession of sparks due to successive charges and discharges of a condenser charged directly from a voltaic battery without the intervention of any induction coil. When the system is used for this purpose, the condenser is on the beacon, and the battery on shore is connected with a terminal on the beacon by a submarine cable or aerial wire. The condenser is charged and discharged by a tongue or contact maker moving backwards and forwards between the battery terminal and an earth terminal. A somewhat similar plan has been adopted with a Rhumkorff induction coil, but the new apparatus dispensing with the induction coil is less likely to get out of order, and converts a considerably larger proportion of the energy of the battery into light. The motion of the tongue is produced by clockwork driven by a spring, which, says the Professor, may be wound up in some cases by the motion of the buoy or beacon, as self-winding watches are wound. The motion of the tongue may also be produced by currents sent from shore through a second wire, which would move the tongue by an electro-magnet, as the tongue of a relay is moved in the usual Morse instruments. The tongue might also be moved by the motion of the buoy in some cases; it might also be worked in a manner analogous to the trembleur of the ordinary bells. To prevent the contacts where the sparks pass from wearing away too rapidly, the contact pieces are made to revolve slowly, so as to distribute the action over a large surface.

In the prospectus of the proposed "Land and Sea Telegraph Construction Company (Limited)," it is stated that "Mr. Rowett is the patentee of the only deep sea hemp-covered cables now in use, the Atlantic cables being made on his principle," and that "Mr. Rowett has agreed to grant to the new company an exclusive licence for manufacturing cables according to his patent on moderate terms." These observations, which, it will be remembered, formed the subject of discussion in the MECHANICS' MAGAZINE a few months since, have called forth the following remarks from the solicitors for the Telegraph Construction and Maintenance Company (Limited), who manufactured and laid the three existing Atlantic cables. They protest against the first of these statements. With the second they say they have no concern further than to state, for the information of the public, the following facts respecting the alleged invention:—Mr. Rowett's patent is dated April 10, 1858, and his specification lodged on that day states that the invention principally consists in a method of regulating the specific gravity of electric telegraph cables, so that they shall possess a semifloating quality, and that this is to be effected by making the cables of Indian grass fibre, New Zealand and Manilla hemp cotton or cotton fibre, &c., and not theretofore employed in the construction of electric cables, and to pass the yarn or strands of the cable through a solution of turpentine, tar, &c., and in the centre of the cable thus made the necessary insulated wire is to be placed. In 1852 (six years before Mr. Rowett's patent) a light hempen cable, saturated with a solution of some of the materials described by him, and covering two insulated metal telegraph wires, was laid between Port Patrick and Donaghadee. In 1855 and 1856, at least six different specimens of telegraph cable, having an outer covering of hemp and iron on precisely the same principle as the three Atlantic lines, were made by the Gutta-percha Company, and publicly tested in September, 1856, at Messrs. Brown, Lennox, and Co.'s works, for the scientific committee appointed to decide the best form of cable for the Atlantic Telegraph Company. The committee chose the former, which was actually adopted, and which has proved so signally successful, but which, nevertheless, Mr. Rowett has on many occasions declared to be altogether wrong in principle. A piece of the hempen cable of 1852, and several of the specimens of 1855-6, are now in our possession. Mr. Rowett has frequently been informed of these facts. It is of importance to the Telegraph Construction and Maintenance Company that their shareholders and the public should understand that this company can still make and lay cables of the Atlantic pattern, notwithstanding the "exclusive licence" granted by Mr. Rowett to their new rivals.

The telegraph cable between Caithness and Orkney was successfully laid in the Pentland Firth on Monday last. The distance across the Firth is eight miles, and the time occupied was only two hours and a half.

The number of messages which passed over the French Atlantic cable for the week ending September 11 was 478, the cable charge on the messages amounting to £1,068.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

A MERCURIAL DYE—A NEW WAY OF WATERPROOFING FABRICS—TO MAKE INDIARUBBER TUBING IMPERMEABLE TO GAS—GAS FROM SEWAGE—AN EXTRACT OF VEGETABLES.

M. BRETONNIERE has brought into use a new grey dye, in one particular a novelty. In this country we have employed a solution of a salt of lead to saturate a fabric or yarns, and havethen either exposed the material to an atmosphere of sulphuretted hydrogen or immersed it in a solution of a sulphuret, and so obtained a solid lustrous grey. The colour, however, was never a favourite. M. Bretonniere, in place of a salt of lead, uses a salt of mercury, the nitrate, for example, and so will obtain just about the same colour. The dye is not so expensive as might be thought, for very dilute solutions may be used unless deep shades are required. It might be thought dangerous to go about with a dress saturated with a compound of mercury, but we are told that no evil effects have been known to follow. We would not recommend the dye for stockings, for, although sulphide of mercury is insoluble, by long contact with the skin soluble compounds may be formed, and the effects of mercurial poisoning might be produced.

M. Neuman has discovered a new way of waterproofing—or rather of making fabrics impermeable to water. The operation is simple, but it must be carried on with care, or the fabric will be ruined. It consists in submitting the tissue it is wished to make impermeable to the action of moderately strong sulphuric acid (57deg. Beaume) for a space of time varying from a second or two to two minutes according to the nature of the fabric. By the action of the acid the fibres, whether of wool or cotton, are superficially decomposed into a glutinous material. As soon as this has happened (the time required must be found by experiment) the fabric is passed rapidly through water, and well rinsed and finally dried, first in the air and then over cylinders. The glutinous matter will of course fill up all spaces between the threads, and no doubt the fabric will be made impermeable. Another way of effecting the same object is to completely dissolve cotton or linen in sulphuric acid and spread the solution over the fabric either by means of cylinders or a brush. Calendering seems to be advisable in both cases.

Indiarubber tubing is slightly permeable to gas. As a fact, the amount which escapes through the walls of the tube is very small, but there are places in which it may be advisable to render any escape impossible. This can be done by giving the tubing a thin coating of a varnish made by dissolving one part and a half of treacle and two parts of gum arabic in seven parts of white wine and three and a half parts of strong alcohol. That is the receipt of M. Jouanne, but we have no doubt that beer may be substituted for white wine without harm. The treacle and gum must first be dissolved in the beer or wine, and the alcohol must be added very slowly, constantly stirring the mixture, or the gum will be thrown down.

It is not a recent discovery in science that gas can be obtained from sewage, but the fact has lately been published as a novelty just discovered in India. The wonderful news comes too that it is proposed to light some of the larger Indian cities with gas from this source. As a matter of course, it is suggested that we should do the same, and the sewage difficulty is solved. What was darkness is now light. Waste is turned into profit. It is too bad, as we have said before, to delude the unfortunate metropolitan ratepayer in this way. Everybody who knows anything about sewage is well aware of the fact that it undergoes a sort of fer-

mentation, during which a good deal of marsh gas is given off. By precise experiments, it has indeed been determined that four cubic feet of ordinary sewage will, every twenty-four hours for about a week, give off a cubic foot of gas, more than three-fourths of which will be marsh gas. It is mixed with nitrogen, carbonic acid, and sulphuretted hydrogen. The mixture will burn, but it is unnecessary to say with a very faint light. For illuminating purposes, such gas would be worthless; but it is simply the discovery of this gas, we imagine, that has excited the bright dreams of a sanguine writer in the "Pall Mall Gazette." As regards the extent and nature of the works which would be required, we need only say that to furnish London with gas sufficient for one night's consumption it would be necessary to store in close vessels a week's sewage, estimated at 28 millions of tons.

That an extract of vegetables should follow an extract of meat is very natural, but we are somewhat astonished at the form in which we are told it is obtained. It is said to be a limpid colourless liquid, which contains the flavour and aroma of all the more commonly used vegetables. The process by which the extract is made is not yet made public.

PROCEEDINGS OF THE BRITISH ASSOCIATION.

SECTION B.—CHEMICAL SCIENCE.

ON A SPECIMEN OF OBSIDIAN FROM JAVA, WITH A MICROSCOPICAL EXAMINATION.

BY MR. W. C. ROBERTS.

MICROSCOPISTS have lately urged the necessity and importance of examining rock sections with the microscope. Little, however, appears to have been done in the accurate identification of the constituent minerals of the rock mass. The present paper was a statement of the result of the examination of a substance that, from the indefinite character of its composition, partakes of the nature of a rock rather than that of a mineral. It consists of a specimen of obsidian from Java, originally in the cabinet of Bernard Woodward, Esq., but the label does not give the exact locality. It appears to differ much from that, also from Java, now in the British Museum. The specific gravity of the specimen now produced is 2·35; in thin sections it is perfectly transparent. The lecturer gave a complete analysis of its composition, which he said may be easily cut into thin sections, and by the aid of a low power, say 200 diameters, at least three distinct minerals (beautifully crystallised) may be distinguished, diagrams of which were produced with the specimen. These, with the optical properties, were admirably described, some doubt being expressed as to the nature of the second mineral; but the third was undoubtedly composed of magnetic iron.

ON THE ACTION OF HYDRIC-SULPHATE ON PHOSPHORIC-CHLORIDE.

BY MR. STEPHEN WILLIAMS.

THE action of hydric-sulphate on phosphoric-chloride holds an important place in the history of chemical theory since Professor Williamson, by interpreting it aright, fully established the debasic character of hydric-sulphate. About fourteen years ago, Professor Williamson discovered that the first product of the action of phosphoric-chloride on hydric-sulphate was a body which he termed chlor-hydrated sulphuric acid, and that the second step of the reaction was the formation of chlorosulphuric acid. Gerhardt had performed this same experiment, but had misinterpreted the results. Having obtained a fuming liquid, he seems to have concluded that it could only be sulphuric acid, and he explained the reaction as though the first step was the removal of the elements of water from the hydric-sulphate by the phosphoric-chloride, and then the decomposition of the sulphuric acid. It was afterwards attempted by diffusion to separate the hydric-chloride and sulphuric acid, and many forms of apparatus were used, but unsuccessfully. One reaction of this chlor-hydrate is worthy of notice. It was found that when added to hydric-sulphate, it breaks up hydric-chloride, being expelled with great violence. From this we see that the attraction between hydric-sulphate and sulphuric acid is greater than that between the hydric-chloride and sulphuric acid in the chlor-hydrate.

SECTION C.—GEOLOGY.

ON SCHEELITE.

BY MR. C. LE NEVE FOSTER.

THIS was a paper on the occurrence of the mineral *Scheelite* (tungstate of lime) at Val Toppa Gold Mine, near Domodossola, Piedmont. In this paper the author stated that *Scheelite*, or tungstate of lime, is now occurring at the Val Toppa gold mine. It is associated with quartz, iron pyrites, zinc blende, calcspar, brown spar, and native gold; whilst wolfram, tinstone, molybdenite, fluor-spar, apatite, topaz, and tourmaline, which usually accompany *Scheelite*, are entirely absent. The *Scheelite* is called "marmor rosso" by the Piedmontese miners, and is looked upon as a good indication for gold. Professor Warrington Smyth said this rare mineral might be found in the neighbourhood of Tavistock, in Devonshire.

ON CERTAIN PHENOMENA IN THE DRIFT, NEAR NORWICH.

BY MR. J. E. TAYLOR.

IN this communication, Mr. Taylor said that, although there was the finest series of the Drift beds in Norfolk to be found in Great Britain, still in the Upper Boulder clay certain anomalies occur which frequently puzzle the geologist. The paper was an attempt to explain these by referring them to the agency of icebergs. Sometimes there were found beds of Upper Boulder clay lying at lower levels than the Middle Drift beds. In fact, such phenomena occurred through icebergs having ploughed up the sands and deposited beds of clay in the furrows. This accounted for the out-of-the-way character of what had been termed "Third, or Valley Boulder clay." The sand beds on each side these linear extensions of clay were frequently dragged out of their place and contorted. The chalk also was disturbed and the flint bands thrown into almost perpendicular positions in the neighbourhood of such phenomena. Mr. Taylor also mentioned the exceeding narrow track of these abnormal beds of clay, and concluded by showing that their occurrence only the more fully bore out the glacial hypothesis.

The President, Professor Harkness, said Mr. Taylor distinguished himself by working on the Cray and Drift beds of Norfolk, and that his paper was very valuable and interesting. He then traced the general relationship of the Lower and Upper Boulder clays, and of the Middle Drift beds. The first and last, he said, always showed strong evidences of ice action and arctic climature, the Middle Drift sands being marked by having numbers of non-arctic shells and flint pebbles. Professor Harkness reviewed the various localities where this was the case, both in England, Ireland, and Scotland.

Mr. S. Pattison, F.G.S., said similar phenomena to those mentioned by Mr. Taylor could be seen in the neighbourhood of Whitby. He had no doubt they were due to iceberg groovings.

FRESH-WATER DEPOSITS OF THE VALLEY OF THE RIVER LEA, IN ESSEX.

BY MR. HENRY WOODWARD, F.G.S.

CERTAIN excavations made by the East London Waterworks Company had revealed the presence of shell marl on the Walthamstow Marshes. The marl was accompanied by vegetable remains and bog iron ore. All the shells are recent, and the most notable fact connected with the bed was the presence of bronze spear-heads, arrow-heads, knives, &c. These were accompanied by bones of man, wolf, fox, beaver, wild boar, red deer, roebuck, fallow deer, reindeer, &c., as well as of the sea eagle, and fishes. As late as the year 1700, the entire tract was forest land. In 1154, the same country is described as abounding in wolves, wild boar, wild bulls, &c. Mr. Woodward thought that the maintenance of a Royal Forest had been the means of preserving this bed. In the deep cutting of the bed, remains of the mammoth were met with. The author thought much of the deposit might fairly be ascribed to the beaver working and making dams in the old valley of the Lea.

Mr. Pattison said the implements were found in the upper or historical portions of the beds mentioned.

Mr. Woodward, in reply, said the discovery of the beaver, red deer, and reindeer within seven miles of London was something astonishing.

THE SOURCE OF THE QUARTZOSE CONGLOMERATES OF THE NEW RED SANDSTONE OF CENTRAL ENGLAND.

BY MR. EDWARD HULL, F.G.S.

THE author referred to a supposed statement of Dr. Buckland that the quartzite pebbles of the New Red Sandstone had come from the rocks of the Lickey, in Worcestershire. That geologist, however, only said they were very similar to them. Mr. Hull then proceeded to trace the probable origin of these pebbles. In South Lancashire and Cheshire, these conglomerates attained a thickness of 600ft. and 700ft. They were thicker as we proceeded northerly, and the author therefore thought we ought to look in the latter direction for their source. He produced pebbles from various counties, all of them liver-coloured quartzites. One peculiarity about them was their well-rounded, water-worn form, never sub-angular. The author thought that these pebbles had gone through at least two periods of trituration, and he had some time ago come to the conclusion that all were originally derived from the Old Red Sandstone formation. This idea was verified when he went to study the old red conglomerates near Loch Lomond; and he thought the question of the origin of the new red conglomerates of Central England might now be regarded as settled.

Mr. Maw, Mr. Pengelly, Mr. Godwin-Austen, and Professor Huxley then continued the discussion of the subject, Mr. Austen objecting to the idea that a great amount of time is required to produce well-rounded shingle.

Professor Huxley objected to the idea that a shingle bed could thicken seawards.

NOTES ON THE BRACHIOPODA, HITHERTO OBTAINED FROM THE "PEBBLE-BED" OF BUDLEIGH SALTERTON.

BY MR. T. DAVIDSON, F.G.S.

THE author had examined the specimens forwarded to him by Mr. Vicary and others. None of the rocks known to occur in England presented such a fauna, although in Normandy we have a bed of Silurian rock extant containing the same. Mr. Davidson could not account for the extraordinary mixture of Devonian and Silurian forms, except by supposing that some old land had been broken up. There were ten Silurian, ten Devonian, and fifteen undescribed species of brachiopoda.

Mr. Winwood, Mr. Vicary, and Mr. Godwin-Austen afterwards spoke on the subject, the latter gentleman entering into a popular detail of the occurrence of these fossils.

Mr. Salter was of opinion that when these "pebble-beds" were formed there was no break between England and Normandy. The fossils were derived from rocks which occur nowhere else than in Normandy.

Mr. Davidson thought that at least one half of the fossils found in the pebbles had been derived from local sources.

Mr. Austen said that Lower Silurian fossils were found on the south coast of Cornwall.

Mr. Pattison thought that the remarks which had been made only bore out the theory of Mr. Godwin-Austen, that a reef of palæozoic rocks had formerly stretched across what is now the English Channel.

Mr. Etheridge pointed out that the Budleigh pebble-bed lay on the triassa of Teignmouth, and thought that the pebbles had come from Normandy.

SECOND REPORT ON BRITISH FOSSIL CORALS.

BY DR. P. M. DUNCAN.

AFTER describing many new species, and noticing the 140 kinds already published, the author stated that 251 species of corals had been found in British Secondary and Tertiary strata. The presence of certain kinds of corals in strata was shown to indicate peculiar conditions of sea water. The report concluded with a statement concerning the periods when the area of England was occupied by an ocean with coral reefs, or by moderately deep seas and shallows. The condition of this area was then compared with that of the continent during the Secondary and Tertiary periods, and it was shown that coral reefs fringed the old coast line.

REPORT OF COMMITTEE ON PHOTOGRAPHS OF CORALS.

BY MR. J. THOMSON.

THE author of the above paper has devoted considerable time to cutting very thin sections of fossil corals, and afterwards photographing them. This method has afforded palæontologists a natural means of studying the structure of these interesting fossils. When mounted on glass these sections can be magnified to any extent by the oxy-hydrogen lantern, and thus these old world forms, which are of great beauty, can be made to illustrate their own history.

THE GRANITE OF THE NORTHERNLY AND EASTERNLY SIDES OF DARTMOOR.

BY MR. G. W. ORMEROD, F.G.S.

THIS short paper was intended to serve as a guide

to geologists visiting Dartmoor. Scheel and tourmaline are of frequent occurrence in the granites. South of Torquay are rock basins of various shapes and sizes. Throughout the whole of Dartmoor the granite is much jointed, and sudden changes in the joints and stratification frequently occur. On the north of Dartmoor, near Belston, the granite bends under schistose rocks, and the present contour of the country may be attributed to this phenomenon. It was an uncertain point whether the Dartmoor granite was all of one age, but the "elvans," or veins crossing the mass, were of undoubtedly later age. A vein of fine porphyry may be seen on the road from Okehampton to Exeter.

Mr. Ormerod said geologists visiting Dartmoor could not help asking what had become of the overlying rock masses, and what had been the agents which had cut it down to its present form. Mr. Pengelly had stated that some of the beds in the Isle of Wight had been formed out of the wear and tear of the granites of Dartmoor. The author had not found any glacial scratchings, but last year Professor Otto Jorell had visited with him the gravels near Hunt's Tor, and that geologist had declared it as his firm opinion that these were remains of *moraines*.

THE DEVONIAN GROUP CONSIDERED GEOLOGICALLY AND GEOGRAPHICALLY.

BY MR. GODWIN-AUSTEN.

THIS paper dealt with the probable distri bution of land and water during the Devonian period, its fossil zoology and botany, and the physical changes which have taken place subsequently.

Mr. Austen briefly and popularly sketched the order of successive sea-beds, and showed that these represented geological time. Of these the Devonian group were amongst the earlier. Our rocks, sandstone, or otherwise were simply sea bottoms, and the geologist only referred them to their original condition in order that he might deduce their physical and zoological history. The Devonian rocks had a wide geographical extent, in Europe, Asia, and America. In the latter country there was a broad band of old Silurian rocks, which existed as dry land during the Devonian epoch. In Great Britain the Devonian rocks had a general direction from north-east to south-west. From the nature of the fossil fishes of these rocks, Mr. Austen came to the conclusion that the Old Red Sandstone was of fresh water origin, as of all the existing fishes, only six genera were related to the Ganoid family, and all of these were of essentially fresh water habits. The dry land was covered with a series of great fresh water lakes, like those of North America. Besides the strata deposited along the bottoms of these lakes, there was a series of vast marine deposits, which are termed Devonian. The Old Red Sandstone group was a very perplexing one, and passed down into the Silurians at its base, and into the carboniferous towards its upper portion. The most northern portion of this county, where rocks containing true Devonian fossils came up, was Linton. The author then traced the easterly direction of the Devonian group, showing how they cropped up beyond the chalk of Boulogne, and thence across Belgium and Prussia, into Bohemia and Russia.

Professor Phillips said the division of Old Red Sandstone as fresh water, and Devonian as marine, made by Mr. Godwin-Austen, was very distinct. The former extended towards the north, and the latter towards the south. He expressed himself, however, as opposed to the fresh water origin of red sandstones, simply because few fossils were found in them.

Mr. Pengelly said he had found 300 specimens of Pteraspidian fishes in the Devonian rocks, as well as cephalopoda.

Mr. Edward Hull, F.R.S., expressed his hope that geologists would withhold their decision on Mr. Godwin-Austen's separation of the Old Red Sandstone and Devonian, and pointed out the three sub-divisions of these formations in various places. He thought the evidence of fossil fish was not sufficient to establish the fresh water origin of Old Red Sandstone.

SECTION D.—BIOLOGY.

DEEP SEA DREDGING.

BY PROFESSOR WYVILLE THOMPSON.

THIS was a communication from the learned Professor which was read by the Rev. A. M. Norman, F.L.S., on the successful dredging of H.M.S. "Porcupine," in from 2,435 fathoms. The Rev. A. M. Norman prefaced the letter by a statement of what had been done recently in deep-sea dredging, observing that the work of prosecuting deep-sea researches must be carried on by Government on a very large vessel and the highest skill in navigation on the part of the officers and very costly apparatus. The late Government had taken up the matter, and dredging expeditions were organised in the Atlantic Ocean, which had been attended with the most important results. The remarkable extension of knowledge in this direction had removed the idea which, started by the late Professor Forbes, had prevailed till very recently, that marine life did not exist at depths beyond 300 fathoms. That was a most remarkable illustration of the necessity for caution in coming to conclusions. If Professor Forbes, the greatest marine zoologist of his time, could fall into such an error, how careful need everyone be in coming to conclusions. Some interesting results had been obtained by Professor Percival Wright off the coast of Spain; and at the instance of the Royal Society, H.M.S. "Lightning" had been sent out to dredge in the sea between the Hebrides and the Faroe Islands, and one result was to find that there were two distinct sets of temperatures and two sets of fauna within 50 miles; that difference of temperature was probably caused by the return of the waters of the Gulf Stream after being cooled at the Pole. The investigations of the "Lightning" had only been carried to the depth of 650 fathoms, and found no life at that depth. Professor Thomson had, however, dredged in the Bay of Biscay to the depth of 2,800 fathoms, and the letter gave an interesting account of the casting of the dredge at such depth. About 1½cwt. to 2cwt. of ooze was the general result of a cast of the dredge, and the thermometric instruments employed showed the temperature to be about 36·4, and life was distributed over the whole area which had been examined before the specimens were of a dwarfed character, owing, probably, to the low temperature.

In the course of the discussion which ensued, Professor Huxley said he hoped it would not be at once assumed that naturalists had assumed Professor Forbes's inference as to the depth at which life might be expected to exist. No revolution had taken place in science on account of the recent dredgings. Men of science, and even Professor Forbes himself, were too well aware of the unsatisfactory nature of the merely negative evidence, of which they were always distrustful. The fact was, that such statements as that referred to by Mr. Freeman concerning Professor Forbes's theory got into the text-books of science, and were spoken of as scientific conclusions, when, in fact, nine-tenths of the writers of text-books were a sort of chiffoniers who picked up any kind of rag which they found lying about. They had often called that the conclusion of men of science when men of science had not, perhaps, ever thought of adopting it. He had recently had the opportunity of examining a quantity of soundings sent him by the Admiralty, which had been dredged in all parts of the world; and it appeared from these that there was a gigantic band of life encircling the globe at the bottom of the sea. It was, too, extremely interesting to reflect that the sea bottom in which these creatures were found was of the same geological formation as that which was millions of years old, and the forms of life found there also resembled those found in the geological formations, called the Cretacean period. It was almost impossible to realise their wonderful antiquity of origin. If the land of Prester John could be found and a colony of ancient Egyptians, identical in race, dress, and manners, as those whose pictures were to be found on the Pyramids, that colony would not be one-tenth as wonderful in point of antiquity as were the forms of life found at these great depths of the sea.

Dr. Hooker also pointed out that Professor Forbes's theory had never been accepted as deductions, and alluded to the dredgings of Sir James Ross in 1842-3 at 400 fathoms deep.

The Rev. A. M. Norman, in reply, disclaimed all intention of putting forward the supposition of Professor Forbes as a scientific deduction, and called the attention of the associate members at least to the necessity for observing the distinction between soundings and dredgings, as it was the latter which had been of the greatest importance, as they had furnished the materials which had illustrated so many interesting facts of modern science.

THE PRIMITIVE CONDITION OF MAN.

BY SIR JOHN LUBBOCK.

THIS was a long and interesting paper, which, the author observed, was in reply to certain remarks made by the Duke of Argyll upon a paper read by him (Sir John Lubbock) at the Dundee Meeting of the Association, on the civilisation of the primitive condition of man. The hon. baronet said that the Duke of Argyll, whose speculations on the primitive condition of man first appeared in "Good Words," and were afterwards republished, had also attacked Professor Huxley for proposing to place man and the quadrumana in one order of mammalia, considering that, though this course would be justified if we considered the merely anatomical characters, it is precluded by the immense difference in intellectual power. This was, however, a dangerous argument, since, if man is to form an order by himself on account of his mental superiority, it will be impossible any longer to maintain the unity of the human species, since we must allow a proportionate weight to the immense differences existing between different races of men. The Duke of Argyll, although maintaining Whately's theory as to the primitive condition of man, abandoned the arguments by which, in the opinion of that eminent theologian, that theory mainly rested. Sir John defended himself from the criticism of the Duke of Argyll as to his looking upon all brutal customs as primeval, and showed that his grace had misunderstood his meaning and argument, which was, that a definite sequence of habits and ideas might be traced, and that certain customs still lingering in civilised communities were attributable to a state of former barbarism, rather, however, on account of their simplicity than of their brutality. The theory of the Duke of Argyll, that savages are "mere outcasts" of the human race, was then examined by the hon. baronet at considerable length, and the principal argument adduced against it was, the immense area which was till lately occupied by tribes in a state of barbarism, and it was shown that the Brazilians, occupying a rich fertile country, were lower than the Esquimaux tribes on the shores of the icy sea. In old times, the settlers of new countries, were not, in Sir John's opinion, "mere outcasts," but men of energy and enterprise. The Duke of Argyll had maintained that the Tasmanians, who had no boats when discovered, must have originally possessed them, because they could not have walked over the sea. But the same argument would apply to the kangaroo, the echidna, and other animals, which inhabit both Australia and Tasmania, and whose presence proves a former land connection between these two countries. The Duke of Argyll had maintained that the character of the religion of the lower races of man offered no support to Sir John Lubbock's views, but the latter in his paper traced the course of religious thought, and showed that as man rises in civilisation he acquires a higher and truer conception of the Deity. Sir John also pointed to the remarkable similarity between savages and children. The history of the individual was the history of the race, and we might trace the gradual progress of civilisation in our homes. A clearer perception of this truth might have saved many a national misfortune, from the death of Captain Cook down to the Abyssinian war. In Sir John Lubbock's opinion this similarity between savages and children has so important a bearing on the question of man's primitive condition as to be almost conclusive. Sir John's illustrations were many of them very interesting, especially in regard to the comparison of the habits of children with those of savages, the savage's fetish taking a place between the baby and the child's doll, and the childish custom of tossing halfpence being found in existence amongst some of the primitive tribes in use as oracles.

SO-CALLED "PETRIFIED HUMAN EYES" FROM PERU.

BY THE REV. DR. A. HUME.

DR. SPENCER COBBOLD, for the author, read a paper on the discovery of what had been supposed to be petrified human eyes at Arica, in Peru. The region is exceedingly arid, and animal remains are not decayed, but dried, when put into the earth; and the communication stated that the corpses of Indians who had been buried before the Spaniards had landed were frequently to be found. In one part of Arica, near to where large numbers of people were known to be buried, a large number of eyes had been found. Some of these had been found near the corpses, and some, it was said, in the eye-holes of the skulls. A belief had prevailed that they were human eyes petrified; but on a collection of them being sent to Professor Owen, he pronounced them to be eyes of cuttle-fishes. Several were exhibited by Dr. Cobbold, and examined with much interest by those in the room.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

RAILWAYS AND THE PUBLIC.

BY MR. RAPHAEL BRANDON.

MR. BRANDON in his paper contended that railway companies would prosper better than they do if they studied more the real wants and convenience of the public. The whole railways of the country ought to be under one general management, and railway facilities should be given as far as possible to any place requiring the accommodation. At the present moment the railways of the kingdom might be purchased at a large discount upon the capital expended upon them, showing that as an investment the railway speculation had been a failure. More than half the capital paid less than 5 per cent., and a considerable proportion paid nothing. Had the public obtained such advantage as to compensate for this great loss to the shareholders? He referred to the disadvantages arising out of competition and rivalry between companies, to the bad accommodation afforded to second-class passengers, and the studied annoyance and inconvenience placed in the way of third-class traffic, while statistics proved that the total receipts from third-class passengers were nearly as much as those from second and first class passengers together. He advocated the taking up of the railways by the Government. Then came the leading point in his scheme. He would charge three fixed sums, first, second, and third, for a journey, irrespective of the length of the journey, just as a letter is carried for a penny to the next village or to the most remote station. For example, a first-class passenger should pay 1s., second-class 6d., third-class 3d., for any journey. Mr. Brandon estimated that travelling would, in a short time, be increased to six times the present extent by such a change, and he entered elaborately into figures to show that his scheme would pay. He would allow certain fast trains—trains without third-class carriages, and trains making few stoppages—for those willing to make an extra payment for the privilege, and he would make an extra charge for luggage requiring the assistance of a porter and a separate carriage in a van. In enlarging upon the advantages that would accrue from his scheme, he made a great point of the fact that such increased facilities for travelling would regulate the supply and demand of labour, and immensely diminish pauperism by sending people out of employment to the localities where there was work to do.

Captain Galton said there was a fallacy in the calculations. As an example, if a train from London to Edinburgh carried 20 passengers at 3d., that would be a rather large number, and yet the 20 three-pences would nothing like pay the cost of the journey.

Sir John Bowring was an advocate of the proposal for placing the railways of the country under the management of the Government, and he not only went the whole way with Mr. Brandon, but he even thought it possible that the minimum fare might ultimately be less than that mentioned by Mr. Brandon.

Mr. F. Purdy expressed strong objections to the suggestion for placing railways under the management of the Government. As a rule Government work was done neither well nor economically. As a statistician, however, he thought Mr. Brandon's figures were correct, and not fallacious, as Captain Galton supposed.

Mr. James Brewin spoke in support of Mr. Brandon's scheme, and especially defended his statistics. Taking all the journeys made in Great Britain in a year the average distance of a journey was 21 miles, and the average fare 11½d.

Dr. Farr (who occupied the chair in the President's absence) thanked Mr. Brandon for his paper, which commended itself to his (Dr. Farr's) mind as a proposal likely to be of vast benefit to the nation, and at the same time it appeared to him to be practical. It was an important matter, demanding much consideration.

PROFESSOR GRAHAM, F.R.S., Master of the Mint, is, we are sorry to say, lying dangerously ill at his town residence in Gordon-square. The unfortunate gentleman was, about a fortnight since, attacked with inflammation of the lungs. This, however, was overcome by the remedial measures of his medical attendants, and exhaustion constitutes the dangerous element in his case at present. The answer to inquiries yesterday was to the effect that Mr. Graham was rapidly "sinking."

DAMP WALLS.

OUR attention has of late been called to the question of rendering the walls of buildings impervious to moisture. We have received letters upon the subject from correspondents who ask us to point out a remedy for the evil. We, therefore, gladly take the opportunity of making known to our readers that there is a remedy, at once simple and efficacious. This is a process invented by Mr. Frederick Ransome, and which is being successfully carried out in practice by the Patent Stone Company, East Greenwich. It consists in the employment of colourless mineral solutions which possess the property of forming an insoluble and indestructible mineral precipitate when applied to buildings. The deposit takes place not only on the surface of the material to which it is applied, but enters the body of the substance. The application of the solution in no way alters the colour of the material, a perfectly natural appearance being preserved in the building. The effect is permanent, neither atmospheric nor saline influences in the least degree affecting the indurating material. It not only renders the building waterproof, but it further most effectually indurates and preserves from decay the stone or bricks treated with it. This process has recently been applied to several buildings which are stated to have been untenantable, previously to the application, on account of exposure to a wind-driven rain. Paper now hangs well on the walls from which it formerly drooped in festoons and tatters, whilst dryness and a cleanly appearance have taken the place of dampness and mildew. This process of rendering buildings impervious to wet is comparatively inexpensive, therefore no one need longer to suffer from that source of discomfort and danger to health—damp walls.

WHITWORTH SCHOLARSHIPS.

THE following is a list of the successful candidates, with their ages, occupations, and the number of marks they obtained, who have been reported to the Science and Art Department as entitled to the ten Whitworth Scholarships of £100 a year each:—William H. Greenwood, aged 23, engineer student at the Mechanics' Institution, Manchester, 143 marks; Thomas A. Hearson, aged 23, engineer student, Royal School of Naval Architecture, 137 marks; John, B.Sc., Hopkinson, aged 19, student at Cambridge University, 134 marks; Thomas S. Elgood, aged 24, mechanical engineer, Leicester, and Owen's College, Manchester, 127 marks; George A. Greenhill, aged 21, student at Christ's Hospital School and Cambridge University, 116 marks; John R. Brittle, aged 23, engineer student at Sir Walter St. John's School, Battersea, 113 marks; Thomas W. Phillips, aged 23, student at British School, Millwall, and Royal College of Science, Dublin, 100 marks; Richard Sennett, aged 21, engineer student at the Royal School of Naval Architecture, 98 marks; Robert B. Buckley, aged 21, engineer student at Merchant Taylor's School, 97 marks; Charles E. Leeds, aged 23, B.A., (Oxon), student at Oxford University, 96 marks.

PRODUCING COLOURS FROM NAPHTHALINE.

SOME improvements in the production of colour from naphthaline have been made by Drs. Darmstadter and Wichelhan, of Berlin. The invention, which has been patented in England, consists in acting upon naphthaline with concentrated sulphuric acid, so as to obtain sulpho-naphthalic acid. Sulpho-naphthalic acid or salts of the same is then to be subjected to the action of an alkali, such as caustic soda or potash, at a high temperature, and from the resulting product, by the addition of an acid, such as sulphuric acid, naphthylic alcohol is obtained. The naphthylic alcohol obtained either by this or by other methods is submitted to the action of sulphuric and nitric acids, so as to transform it into dinitro-naphthylic alcohol, which product may be employed for the purposes of dyeing and printing.

About one part by weight of naphthaline is taken, and about one part by weight of concentrated sulphuric acid, and they are heated together at a temperature of about 100deg. Centigrade, until the greater proportion of the naphthaline has been converted into sulpho-naphthalic acid. This product is then to be dissolved in water, and the solution saturated with an alkali. The salts of sulpho-naphthalic acid thus obtained are evaporated to dryness, and are fused with an alkali, such as caustic potash or soda, or with mixtures of the same, so as to obtain compounds of naphthalic alcohol, which upon the addition of dilute acid to the aqueous solution the naphthylic alcohol or naphthol is precipitated and may be obtained in a crystalline form. The before-mentioned naphthylic alcohol or naphthol so prepared, or obtained from any other source, is to be dissolved in about an equal weight of strong sulphuric acid, and the solution is then gradually added to nitric acid diluted with water, the temperature of which mixture has been previously slightly elevated. The solution passes through different tints, but finally assumes a yellow colour, and the yellow colouring matter crystallises out of the solution on cooling. This substance has been called dinitro-naphthylic alcohol or dinitro-naphthol. The colouring matter thus obtained is to be freed from any adhering solution, and is then ready for use. Should it be necessary to subject the colouring matter to a process of purification it may be purified by solution in an alkali, ammonia for example, and be precipitated therefrom by means of muriate of ammonia or otherwise. When this colouring matter is to be employed for the purposes of dyeing or printing it may first be dissolved in a solvent, such as alcohol, or it may be dissolved in an alkaline solution. The pure substance, or its soluble salts, may either be employed alone or in conjunction with other colouring matters for the purposes of dyeing and printing.

PURIFYING AND BLEACHING OILS.

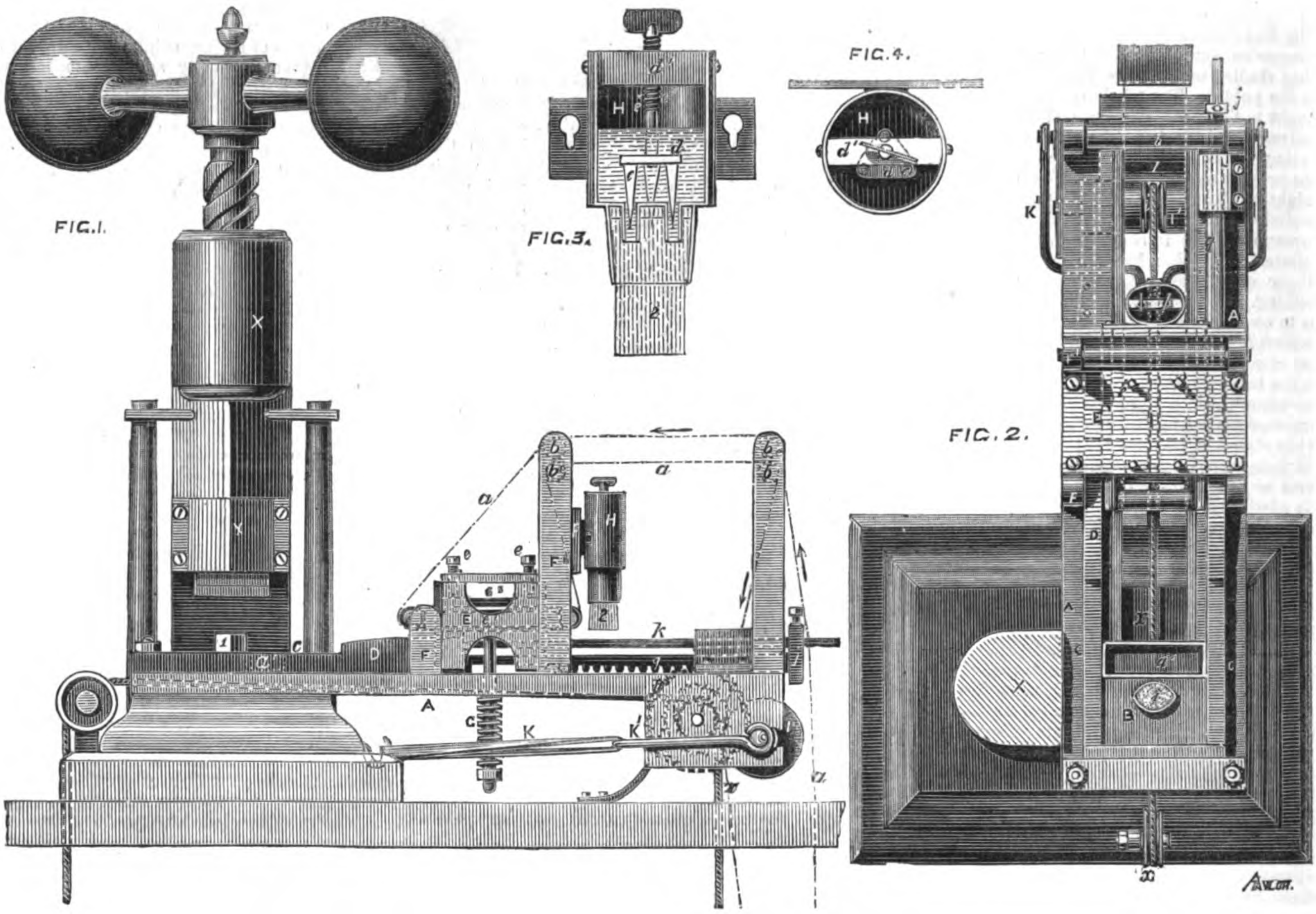
AN invention has been patented by Mr. W. Prosser, of Lancaster, Lecturer on Chemistry, and which consists in the purification, bleaching and saturation of animal and vegetable oils, also of gums and resins, as well as of such liquids as oi of turpentine, spirits of turpentine, and methylated spirits, by means of ozone, whereby much time is saved and greater purity obtained than by the methods at present in use. The substance to be acted upon, if liquid, as in the case of oils and spirits in their usual state, as well as the gums and resins in the melted state, is placed in a suitable vessel, and streams of ozonized atmospheric air or ozonized oxygen are forced through the substance. It is advisable to keep the liquid in motion so as to bring its particles in contact with the ozonized air or ozonized oxygen and thus expedite the process of ozonization, or the liquid substance may flow through a vessel possessing a large superficial area, and into which ozonized air or ozonized oxygen is passed. The great extent of surface permits the ozonized air to act readily upon the liquid and ozonize it. Or animal or vegetable charcoal in fine powder is saturated with ozonized air or ozonized oxygen, and the oils are exposed to the action of the ozonized charcoal. In the case of the gums or resins in their usual solid or unmelted state, Mr. Prosser exposes them in fine powder to the action of ozonized air or ozonized oxygen. By the continued action of ozonized air upon oil or spirits of turpentine, the latter becomes so saturated with ozone as to become vehicles for the conveyance of ozone to other substances. By ozonized air or ozonized oxygen is meant atmospheric air or oxygen ozonized by any artificial means.

VAULTS OF THE HOLBORN VIADUCT.

THE first occupation of vaults under the Holborn Viaduct has been made by Messrs. Fearon and Son, wine merchants, who have an extensive run of cellarage, as well as a large new building, adjoining their old premises in Holborn. The vaults open out of Shoe-lane, and run some 230ft. towards Hatton Garden, and are to have a tramway laid along them. They afford unusual facilities for loading and unloading, a wide passage running along the entrance, and affording sufficient room for waggons to draw up to the edge of each vault and unload without interfering with the ordinary traffic. The new establishment is very extensive and well constructed, with a view of being strong and fire-proof. The floors are supported on heavy girders carried on massive cast-iron columns. These premises are now being fitted up, and when completed, there will be four vats holding 1,100 gallons each, two of 4,000 gallons, about thirty of 800 gallons, and others of smaller holding capacity, to the total number of 140. In the basement will be a steam engine and boiler for pumping purposes and for working a lift, which communicates with every floor from the basement to the top rooms. The details are well carried out, and the arrangements will prove very perfect, every facility being afforded for carrying out the extensive business of this firm.

MACHINE FOR STAMPING AND EMBOSSING.

BY MR. J. PARKINS.



APPARATUS FOR STAMPING, EMBOSSING, OR PRINTING IN COLOURS.

THE object of the invention illustrated in the annexed engraving is to facilitate the operation of stamping, embossing, or printing in colours writing paper or envelopes. It has been patented by Mr. J. Parkins, of Brewer-street, Golden-square. Fig. 1 is an elevation, and fig. 2 a plan view of the machine; fig. 3 is a sectional elevation, and fig. 4 a plan view of the inking or colouring apparatus detached. A is an oblong metal frame fixed at one end to an ordinary stamping machine X and bevelled off on its inner edges so as to form V-guides on which the die bed B slides. This die bed consists of a steel or other metal block having a hole in it for the reception of the die 1. A small trough a^1 is attached to the inner side of the die bed to catch the superfluous ink that will be caused to flow round and down the die by the sharp edge of the die coming in contact with the brush 2 of the inking apparatus. Sliding on this oblong frame A is another and smaller metal frame C that receives a reciprocating or forward and backward motion from the die bed B, which is actuated by means of the cords *x z*, which are acted upon by a treadle and weight. On the sides of this second frame C are formed two vertical wedge-shaped cams D, which, as the frame C and die bed B are moved to the right in order to bring the die 1 under the inking brush 2, will support the cushion or impression frame E out of the way, so that the die 1 may pass forward without touching it. This frame E consists of two side pieces connected together at top by a cross plate, and sliding in upright standards F F^1, and carrying an india-rubber cushion.

The cushion e^1, which is shown by dots in fig. 1, consists of a small block of wood covered with india-rubber and fastened to a metal plate e^2. A band of paper *a* (shown in fig. 1) passes under the cushion, and when the die 1 returns to the press, the cushion presses down the paper *a* on to the die and thereby cleans it from the superfluous ink. The block of wood is formed with a corrugated surface in order that the edges of the die may be properly cleaned. The requisite amount of pressure is given to this cushion frame by means of rods G tapped at their lower ends and projecting from its under side through the oblong frame A, and descending a sufficient depth to allow of a helical spring being adapted to them, the tension of which is regulated by a screw nut. The elastic cushion is made adjustable, so that when a larger or smaller die is used, the cushion may be raised or lowered. This will be done by means of screws *e e* working through the top plate of the cushion frame E, and fastened to the metal plate e^2 of the cushion. The inking apparatus is attached to an adjustable cross piece *f* fixed to the upright guides F^1 of the cushion frame. These uprights F^1 also carry rollers *b* b^1 to facilitate the onward intermittent motion of the die-cleaning paper band *a*.

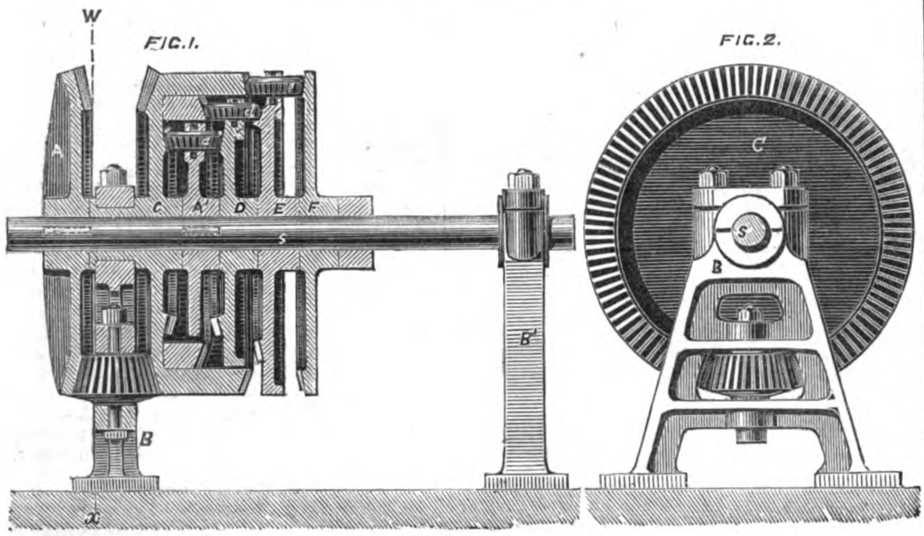
The inking apparatus, which is shown detached and drawn upon an enlarged scale at figs. 3 and 4, consists of a reservoir or cylinder H for holding the ink. To the lower end of this cylinder a brush 2 is attached; in the bottom of this reservoir or cylinder H are holes, the number varying according to the dimensions of the brush. Or a slot may be cut across the bottom of the cylinder or reservoir H, and, by means of short tubes, the ink will flow down into the brush. In order to regulate the flow of ink into the brush, small conical pins or V pieces *c c* fixed to a plate *d* are inserted into the mouth of these holes, and are raised or lowered therein by means of a vertical screw e^* connected to the plate *d*, and working through a cross piece d^1 fitted to the upper end of the reservoir or cylinder, so that by merely turning the screw e^* a larger or smaller quantity of ink may be allowed to pass into the brush as required.

In order to properly actuate the die-cleaning paper band *a*, and impart an intermittent progressive motion thereto, so that the die should not press against it twice in the same place, two nipping rollers I I^1 are employed, between which the band *a* passes in the direction of the arrows. These rollers are covered with vulcanised india-rubber, and are actuated by a rack *g* and pinion *h*, the latter being mounted on the shaft *i* of the nipping roller I^1. A click and ratchet is adapted to the axle or shaft *i*, the whole being actuated by the reciprocating sliding frame C. The length of stroke of this rack and pinion is regulated by means of an adjustable tappet or block *j* on a rod *k* attached to and extending from the sliding frame C. The nipping roller I^1 is composed of two small rollers mounted on the same shaft *i* and working together and having between them a small pulley *l*, fig. 2, running loosely on the shaft to act as a guide for the treadle cord X. In order to keep the nipping rollers I I^1 at proper tension and in position, there is an elastic band K and stretcher K^1 provided with hooked ends, whereby it is attached to the ends of the shaft of the roller I. Scrapers or doctors are adapted to some of the rollers to keep them clean and prevent the inked paper from sticking to them. In order to prevent the nipping rollers from rotating in the wrong direction, there are on the shaft *i*, and at the opposite end of the roller I^1, a ratchet wheel and spring.

The mode of operating the machine is as follows:—Upon pressure being applied from the treadle to the cord *x*, the bed plate B is drawn forward or to the right until it strikes against the rear end of the sliding frame C; it then continues its forward motion with the sliding frame C until it is clear of the inking or colour brush 2. At the same time that the die passes under the cushion frame E, the elastic cushion e^1 will be held up by the wedge-shaped cams D, but as the frame C will be moved forward with the die bed B it will be evident that as soon as the die 1 arrives under the brush 2, the cushion frame e^1 will fall. On the pressure being removed from the treadle cord *x*, the die bed B will be drawn back, that is, to the left, to the front end of the frame C by the weighted cord *z*, to and will thus pass under the elastic cushion e^1 to the stamping press. But as the elastic cushion e^1 will not then be held up by the cams D, the die 1 will press against the paper band *a*, and the superfluous ink will be thereby wiped off therefrom. The sliding frame C will continue to be drawn back by the die bed B until the cams D again come into operation and raise the cushion frame E out of the way of the die ready for the next inking operation. The paper band *a* (which is wound on a drum fixed under the table) passes over the rollers *b* in the direction of the arrows and under the elastic cushion E, as shown in dotted lines, and from thence over the rollers b^1 to the nipping rollers I I^1. The clean die with its proper supply of ink having been brought under the stamping press, the paper is placed thereon and the impression given in the ordinary way.

MULTIPLYING GEARING.

BY MR. L. S. FITHIAN.



GEARING FOR MULTIPLYING MOTION ON A SINGLE SHAFT.

THE invention we are about to describe relates to a new and useful combination and arrangement of cog wheels on a single horizontal shaft, whereby motion may be increased, and thereby greatly simplifying the methods in common use for that purpose. It is the invention of Mr. L. S. Fithian of Brooklyn, U.S. In our engraving fig. 1 is a longitudinal vertical section of the arrangement; fig. 2 is a sectional elevation taken in the line W X, fig. 1. The shaft S S is supported on the standards B B [1], and carries the bevel wheel or disc A, which is keyed thereto. The standard B has a slot to receive the pinion *b* to connect the wheels A and C. The wheel or disc C is cogged on both sides and revolves loosely on the shaft. A lever or disc A [1] is made fast on the shaft S and carries a pinion *a*, which gears into the wheel C and also into a similar wheel D, which also drives two similar wheels E and F. All these wheels or discs are provided with slotted lugs to receive pinions for transmitting motion from one to the other. The wheels E and F are allowed to revolve on the shaft S S.

The manner of working this arrangement of parts is as follows:—The revolution of the wheel A will, through the pinion *b*, act upon the wheel C, giving the latter a corresponding motion in the reverse direction, and the bevel wheel A being fast on the shaft will at the same time revolve the shaft and the lever A [1] with it, and by means of the pinion *a* will receive motion from the wheel C and transmit the motion to the wheel D, which, also carrying a pinion *d*, acts on the wheel or disc E, which thus receives motion from C. The wheel or disc E carries a pinion *e*, which also receives motion from the wheel or disc C and transmits it to F, and so on indefinitely as wheels are added. The number of revolutions each wheel will make will be as follows:—The wheel D three, the wheel E seven, and the wheel F fifteen revolutions in the same time that the wheel A makes one. If it be desired to multiply the reverse motion it may be done by means of multiplying wheels in the slot B, or the inertia motion may be increased by multiplying wheels in the slots in the wheels A [1] D E. In place of the wheel C an increased series of bevelled cogs, or the section of a sphere with a series of cogs upon it, or a cylinder or shaft cogged upon the outer side, may be employed with corresponding levers and discs taking motion from the bevels, spheres, or cylinder shaft, and continue the same motion or increasing leverage and decreasing motion as communication is made with pinions placed horizontally to the shaft, or with an increasing angle up to the vertical and thus passing on to a longer lever instead of a shorter.

PROFESSOR AGASSIZ says that fish is a kind of food which refreshes the system, especially after intellectual fatigue. There is no other article that supplies the waste of the head so thoroughly as fish diet. Fish contains phosphorus to a large extent—a chemical element which the brain requires for growth and health.

METEOROLOGICAL EXPERIMENTS IN THE CAPTIVE BALLOON.*

BY MR. J. GLAISHER.

THE report of the results of the meteorological experiments made with the Captive balloon by Mr. Glaisher is a most important contribution to science, helping to fill, as it does, a long-felt hiatus in his most valuable and instructive series of meteorological observations. The main points of his report may be thus stated:—The necessity which existed in all his previous balloon ascents of leaving the earth with a great ascending power to avoid striking adjacent buildings, caused the first few hundred feet to be passed through too quickly to determine satisfactorily the states of temperature and humidity of the air at the low elevations; at the higher they could be repeated at will, descending by opening the valve, and ascending by the discharge of gas; but this could not be done near the surface of the earth, and, consequently, a certain amount of doubt has rested upon all the observations thus taken, and our knowledge of the distribution of heat and humidity up to 1,000ft. high has, therefore, been very limited indeed. The theory of a decline of 1deg. of temperature in the increase of every 300 of elevation was evidently erroneous, such not being confirmed in a single experiment. In some of the ascents, a decline as large as 2¼deg. was observed in the first 100ft., and there is every probability that, if on these days the balloon could have been kept stationary for some time so as to have made certain that the true temperature at the 100ft. had been attained, it would have been as large as 3deg., while, on other occasions, no change of temperature has been experienced while passing through several hundred feet of elevation. Thus, on some occasions, at 1,000ft. high, a temperature 10deg. less than on the ground has been recorded, whilst, in others, no difference was found within the distance of 1,000ft. from the earth. Thus, the observations near the earth made by means of a free balloon proved that the decline of temperature with increase of elevation varied greatly. It was distinctly found to be different, depending on the clear or cloudy state of the sky, but there were indications that it was different at the different times of the day. This indication was partly confirmed by an accidental descending of the balloon at about sunset, when scarcely any change of temperature was experienced within half a mile of the earth, and, consequently, it seemed possible that, if balloon ascents could be made at night, then the temperature might increase and not decrease from the earth to some distance from the earth, and this inference was proved to be correct so far as ascertained by the only two night ascents made by Mr. Glaisher, for, in both of them, a higher temperature was met with on leaving the earth. Thus, the results of the several balloon ascents were to unsettle our previous views and to cause a suspicion to rest on the laws of refraction, but the appointments were too few in number, and particularly at night, to speak with any confidence.

The great Captive balloon, with its powerful and beautiful machinery, recently located at Ashburnham Park, was well adapted to settle all these points, and Mr. Giffard, its proprietor, placed it at Mr. Glaisher's disposal for any series of experiments to which he could apply it. This balloon could ascend on a calm day to the height of 2,000ft., and he had made about thirty sets of experiments. Each set consisted of readings of Fahrenheit for the determining of the temperature and humidity of the atmosphere at every 100ft. of elevation, with full power of being stationary at any point. Usually, the ascent and descent were slow and regular, remaining always at the extreme point a sufficient length of time to ensure the true states at the elevation, and then the descent was made, slowly and regularly as the ascent; the mean of the readings at the different elevations, ascending and descending, and the mean, on the ground before and after the ascent, have been considered.

Without entering into many details, Mr. Glaisher briefly stated the general results, which are—that with a clear sky, the decline of temperature with elevation is the greatest during the mid-day hours, amounting to 5·10deg. in the 1,000ft., and becomes less and less as the day advances till, at about the time of sunset, there is little or no difference, and that the decline is greatest nearest to the earth, amounting in the first 100ft. to more than 1deg., and from 900ft. to 1,000ft. to about half a degree less. In the cloudy state of the sky, the decline in the day hours is a little smaller than with a clear sky, the larger decrease being nearer, but, as the day advances, the decrease at or about the time of sunset is about 0·5deg. for every 100ft. up to 1,000ft. high. These results prove that the rate of decrease of temperature with elevation varies with the time of the day, confirming that which the free balloon ascents indicated, and giving to them an increased value.

It is to be regretted that, both for the want of time and arrangements, he had made no ascent after sunset, which is now the most important inquiry we have, to determine, if possible, the laws appertaining to the night hours, and bearing directly upon the law of refraction, during the period when the greatest number of astronomical observations were made; and he hoped, if this great balloon were used again, it would be in a more convenient locality, and that each set of observations would not exact so much time. As examples of the variations of temperature at the lower levels, we may give the following, taken under a clear sky:—At three o'clock, temperature at ground, 76·2deg.; at seven o'clock, 70·9deg. At 1,000ft., at three o'clock, 68·9deg.; at seven o'clock, 67·9deg. Thus, while there was a decrease of temperature on the earth of 5·3deg. from three to seven o'clock on the ground, the decrease at the height of 1,000ft. was 0·9deg. only; and, at half-past seven, the following variations were observed:—At the ground, 70·9deg.; at 100ft., 70·9deg.; at 200ft., 70·8deg.; at 300ft., 70·5deg.; at 100ft., 70·2deg.; and at 400ft., 69·8deg.

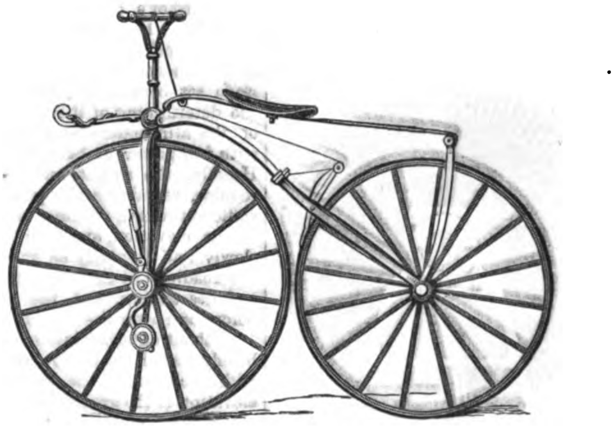
A NEW VELOCIPEDE ACTION.

WHEN it is considered that one-fourth only of the revolution of a crank is available for exercising useful pressure for producing rotation, it is somewhat surprising that velocipedes have until now, been constructed so as to cause a great waste of power to the rider. The feet have to travel completely round the axle in following the cranks; hence an enormous sacrifice of time and useful power. With the object of saving this great waste, and providing an efficient substitute for the ordinary cranks, the invention we illustrate has been designed and patented by Mr. J. G. Wilson, engineer, of Market-place, Manchester. It was exhibited for the first time in public at the recent meeting of the Royal Agricultural Show at Manchester, where it excited the interest of all who were puzzled to know how a revolving motion could be produced by simpfy oscillating the feet and without the assistance ol toothed or ratchet wheel-work. The principal feature of difference between this arrangement and the crank is that when the necessary speed is attained the feet may rest upon the treadles without working or even moving a muscle, whereas with the crank they must either be removed altogether or go round the axle.

Our engraving represents the motion applied to an ordinary bicycle, and the details are illustrated on an enlarged scale in figs. 1 and 2, the former showing a front view, and the latter a side view of the new driving mechanism. A is the axle or driving-shaft of the velocipede, upon which

* British Association.

A NEW VELOCIPEDE ACTION.



is keyed a disc-wheel B, which has a perfectly smooth periphery. Two radial arms or links C C work upon the axle A, on either side of the disc-wheel B, one of such arms or links being extended downwards, and there having a counterbalancing weight D affixed. E is the actuating lever mounted upon a pin between the upper extremities of the radial arms or links C C, the shorter arm of which lever impinges upon the periphery of the disc-wheel B immediately upon pressure being applied to the foot-plate F, which is situated at the extremity of its longer arm.

The action of this driving mechanism may be thus described:—When the actuating lever E is in a vertical position, the foot is placed upon the foot-plate F, and pressure being applied to it, the short arm of the actuating lever E binds upon the disc-wheel B, and as it cannot pass the axle A is thereby caused to turn in its bearings in the same direction as the pressure is applied. The foot having advanced through a quarter of a circle or revolution, viz., from a vertical to a horizontal position, is now drawn back again to the starting point, assisted by the action of the weight D, leaving the axle meanwhile free to revolve, when by re-applying pressure in the same direction another grip of the disc-wheel may be taken whilst it is still revolving, and thus, by oscillating the actuating lever E backwards and forwards a continuous

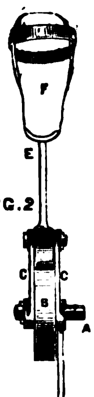


FIG.2

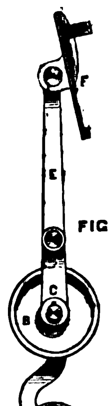


FIG.1

revolving motion may be communicated to the driving wheel in the same manner as drilling with a ratchet brace, with this difference, that in this arrangement there are no teeth nor serrations formed on the disc-wheel, and, instead of being intermittent, the motion is continuous, and any desired speed may be attained.

With Mr. Wilson's invention it becomes practicable for a rider of ordinary stature to use any size of driving wheels, an advantage which cannot be over estimated when viewed in the light of competing in velocipede contests. The same speed can be obtained by this driving mechanism as with the ordinary cranks, whilst at the same time the motion is considerably easier and less fatiguing in consequence of the actuating foot levers or treadles being much longer than any crank that could be applied to the purpose. For rough roads or for hilly country this motion is peculiarly applicable, as the power which can be brought continuously to bear is sufficient to overcome any impediment, or to ascend any gradient.

FETTLING OR LINING PUDDLING FURNACES.

In the ordinary method of fettling or lining the beds and sides of puddling furnaces oxide of iron or a compound consisting mainly of oxide of iron is employed for that purpose. An invention patented by Mr. W. M. Williams, of Sheffield, consists in lining puddling furnaces with crude or prepared oxide of manganese or manganese ore either as the chief ingredient of the fettling or as an addition to the oxide of iron or other material, which is employed. In using crude or native oxide of manganese or manganese ore without admixture with other solid, an ore is used which when pulverised and moistened will form a plastic or pasty mass, and which when heated will harden and adhere firmly to the sides and bottom of the puddling furnace. For this purpose the cheap oxides containing a considerable proportion of iron are best suited, provided they do not also contain other impurities, such as sulphur and phosphorus, which would injure the iron in the furnace. When an ore or prepared oxide is used which does not harden sufficiently, after being rendered plastic by water alone, it is mixed with a sufficient quantity of finely powdered and moistened hæmatite or other suitable material to give it the property of hardening and adhering when heated in the furnace.

The proportions in which oxide of manganese and oxide of iron should be mixed in order to make the fettling according to this invention vary with the nature of the cast or pig iron to be puddled. With pig iron of ordinary quality about half a hundredweight of oxide of manganese mixed with the requisite quantity of oxide of iron for the fettling of the furnace is sufficient for a charge of four to five hundredweight of pig iron. When the pig iron itself is rich in manganese a less proportion is necessary in the fettling. When the pig iron contains a large quantity of silicon and little manganese more oxid of manganese is required in the fettling than is required with pig iron containing much oxide of manganese and little silicon. Where practicable the inventor prefers to introduce the pig iron into the puddling furnace in a melted state; when this is done and the fettling containing oxide of manganese is laid on the bottom and lower part of the sides of the furnace the charge gets the full benefit of the evolution of oxygen, which takes place when the oxide of manganese is heated. By the use of oxide of manganese, as described, the puddling process is expedited, and the quality of the iron or steel produced is improved. The heated iron or steel during the puddling process decomposes the oxide of manganese, causing an evolution of oxygen, which rising through the molten iron or steel rapidly oxidizes the oxidizable materials contained in the metal. A portion of the reduced manganese enters into alloy with the iron or steel and effects the improvement in the quality of the metal which is well known to result from the use of manganese in the manufacture of iron or steel.

When oxide of manganese is mixed directly with the charge for fluxing, as has been proposed, a portion is liable to become mechanically distributed through the mass of iron or steel in the state of an infusible powder, consisting of manganese in a low state of oxidation, and injures the mechanical properties of the metal. But when oxide of manganese is used in the fettling of the puddling furnace according to this invention it is gradually decomposed as the carbon and silicon of the pig iron or steel are presented to it by the stirring of the puddler, and the manganese enters the charge in a fused state either as reduced metal or as silicate.

Very little of the manganese which enters the iron or steel during the puddling process remains in the finished metal, most of the manganese separating during the finishing of the metal in the form of silicate of manganese, carrying with it other impurities, such as phosphorus and sulphur. The silicate of manganese separates from the metal more readily than silicate of iron, and is found in considerable quantity in the cinder and hammer slag. The cinder and hammer slag are therefore more valuable than ordinary cinder or hammer slag for the making of cinder iron in consequence of their richness in manganese. Although the fluxing property of oxide of manganese, either alone or mixed with oxide of iron, renders the addition of any other material to the fettling unnecessary when pig iron or steel of the ordinary qualities are puddled, yet when pig iron or steel of such quality as renders the use of alkaline fluxes desirable is about to be puddled, common salt or carbonate or nitrate of soda may be added to the oxide of manganese. A quantity of the soda salt equal to about one-fourth the weight of the oxide of manganese is generally sufficient.

OVERHEATING OF FURNACE CROWNS AND OTHER BOILER PLATES WHEN COVERED WITH WATER.

By Mr. L. E. Fletcher.

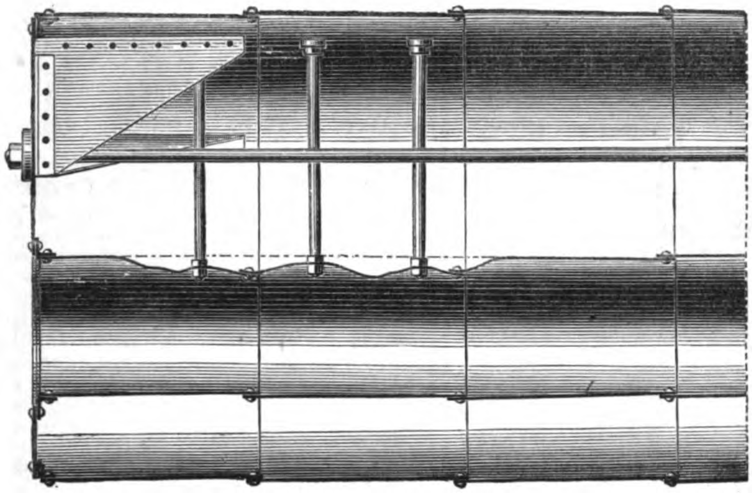
Everyone at all conversant with the working of boilers is aware that when they are allowed to run short of water the furnace crowns are apt to become overheated, the plates to be bulged downwards or otherwise distorted by the pressure of the steam, and in many cases to be rent, from which cause explosions frequently arise. This is admitted on all hands, and the rationale is so simple that the whole must be at once apparent. It is not however by any means so generally known that furnace crowns may be overheated and bulged out of shape—sufficiently so in some cases to cause an explosion—even when they are covered with an ample supply of water. Such, however, is unquestionably the fact, and I wish specially to call attention to this subject on the present occasion.

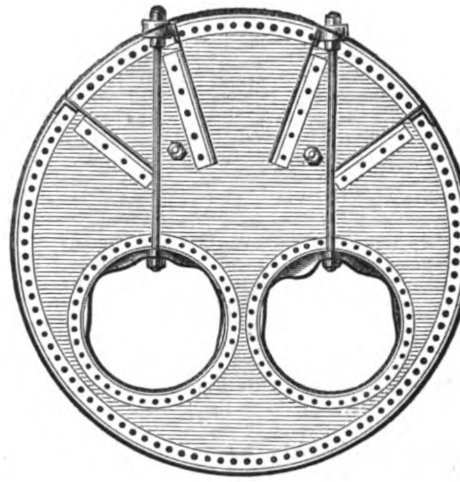
Overheating of boiler plates when covered with water has been found to arise from two causes, one, the too local action of an intense fire, the other the character of the feed water. Injury from intense firing sometimes occurs to boilers heated by the flames passing off from separate furnaces constructed of firebrick, as in the case of puddling furnaces at ironworks, when the flames are too frequently allowed to impinge directly upon the boiler, in consequence of which steam is generated so rapidly that the water is driven off from the plates, and overheating ensues. This is more especially the case where the heating surface is a vertical one, so that the steam on rising forms a separating film between it and the water. Two explosions resulting from this cause may be referred to. One of these occurred at an ironworks on February 9, 1865, to an externally-fired boiler, of the upright furnace class, heated by the flames passing off from two puddling furnaces, as well as from a large firegrate. Another explosion of a similar character occurred on February 7, 1866, to a plain cylindrical egg-ended boiler, heated by the flames passing off from a mill furnace at a works employed in the manufacture of angle iron.

It is desired, however, on the present occasion to call attention more especially to those cases in which overheating of the plates, whether in externally or internally-fired boilers, has occurred simply through the character of the feed water, and not from any peculiarity in the mode of firing. The feed water, which is found to be more particularly productive of overheating, is highly impregnated with carbonate of lime. It forms but little scale, and that seldom thicker than an egg shell, though perhaps in some cases it may be nearly equal to one-eighth of an inch. It deposits, however, a good deal of fine flour or dust, which is generally of a lightish colour. As this dust is quite loose, a good deal of it is floated away with the water when the boiler is emptied, while the remainder is readily washed out, so that on account of the ease with which it is removed, and the light character of the scale, it frequently escapes attention. If grease be introduced into boilers in which this deposit is formed, the furnace crowns are found to give way, the plates to bulge downwards, and leakage to take place at the seams of rivets. The distortion of the furnace plates, however, does not, as a rule, take place suddenly; on the contrary, the crowns come down very gradually, progressing little by little day after day, though hard firing in many cases has an immediate influence. Grease is introduced into boilers in various ways. The feed water is frequently heated by blowing the exhaust steam from the engines upon it, so that the grease in the cylinders is carried with

OVERHEATING OF FURNACE CROWNS AND BOILER PLATES.

BY. MR. L. E. FLETCHER.





the feed water into the boiler, while in addition, the discharge taps from the cylinders sometimes blow into the cistern from which the feed pump draws, so that the boiler gets all the engine sewage. Blowing the exhaust steam upon the feed water has another effect beside the introduction of grease. It is sometimes lost sight of how much of the deposit formed within boilers is lifted out of the water by the steam and carried through to the engines, and thus disposed of either through the exhaust pipe in high-pressure engines or in the hot well in low-pressure ones. When therefore the exhaust is blown upon the feed water this deposit is returned to the boilers, and a constant accumulation takes place, more especially if blowing out be neglected. That the steam lifts the deposit and carries it along with it is clear from the fact that it is frequently manifested at the glands and other parts of the engines, and also is heaped up in the steam dome when there is a shelf on which it can accumulate. These shelves are formed when the shell plate at the base of the dome is not cut away to its full size. This forms an eddy in the current of the steam, and leads to the deposit being dropped on the shelf plate as just stated.

With regard to the manner in which this floury deposit affects the plates over the fire, and leads to their injury, it does not appear to be necessary to suppose that this deposit becomes heaped upon the plates in order to lead to their overheating. It is doubtful whether it settles at all as long as the boiler remains in active work; while, were it to do so, it would settle where the ebullition was the least violent, and thus not on the furnace crowns of internally-fired boilers. Possibly, this fine floury deposit, by thickening the water, interferes with the due escape of the globules of steam, so that they are kept longer in contact with the plates over the fire than they should be, and thus the intimate contact of the water with the plates becomes interrupted and overheating is produced. This may, perhaps, be illustrated in the following way:—Clear water placed in a clean saucepan may be briskly boiled over a fire without foaming over, but if a little meal be dropped into it, or the water exchanged for milk, the globules of steam are no longer able to escape freely, and in their struggle they upheave the whole mass, and vomit a portion of it into the fire. Such is thought to be somewhat the action that takes place within a boiler charged with this fine floury deposit. The globules of steam, imprisoned in the water, lift it from the plates in their struggle to escape, and thus gradual overheating takes place in proportion to the character of the water and the intensity of the fire.

I am not desirous, however, of entering too minutely upon the precise manner in which this floury deposit leads to the overheating of the plates: suffice it to say, that the results are indisputable, that numbers of boilers have been injured by it, and whatever may be the precise *modus operandi*, it appears to have the power of preventing that intimate contact of the water with the plates which is essential for carrying off the heat with sufficient rapidity, so that, although they may not be made red hot, yet they become sufficiently overheated to lose a portion of their tenacity, when bulging under pressure ensues. Numerous instances of this have come before my notice, the particulars of some of which may now be given.

The first of the cases that may be referred to was met with about the close of 1862, and occurred to a boiler fed from a well sunk near the river Mersey, in the neighbourhood of Birkenhead. The boiler was of the ordinary Lancashire class, having two furnace tubes in which the fires were placed, while its length was about 20ft., its diameter 6ft. 6in. in the shell, 1ft. 10½in. in the furnace tubes, and the load upon the safety-valve 40lb. per square inch. This boiler had been found to give way again and again at the furnace crowns, the plates bulging down out of shape, and repeated repairs had taken place in consequence. The plates over the fires had been taken out and renewed with those of Low Moor iron, which had every appearance of being of first-rate quality. Also each of the furnace crowns had been lashed to the top of the shell by three vertical stay rods, but the plates persisted in bulging downwards notwithstanding, and came down between, and all round, the points of support, as will be seen on consulting the accompanying cuts.

Under these circumstances I was requested to examine the boiler and advise the owners as to what had better be done. Immediately on drawing off a little water from the glass water gauge I attributed the injury that had occurred to the furnace crowns to the fine deposit contained in the feed water, and recommended a scum trough for blowing out from the surface of the water, in order to rid the boiler of this deposit. In answer to inquiries the owners did not think they were admitting any grease to the boiler, and had such confidence in the feed water, which appeared so clear before it was pumped into the boiler, that I was unable to persuade them to adopt the simple expedient of a surface blow-out apparatus. One cause after another was assigned for the injury, and it was supposed that, as the boiler was worked night and day, the water supply had been allowed to run short at night time, and that the deflection of the plates was due to a series of minor neglects of this character. On one occasion the owners felt sure they had at last detected the source of the mischief. They discovered that the fireman, anxious to get away quickly on the Saturday evening, had started to blow off his boiler before he raked out the fires, in consequence of which the furnace crowns were laid bare with the fires still in, and thus became overheated. In confirmation of this it was stated that it had been frequently observed on setting to work on Monday mornings that these deflections had been increased, so that the chain of evidence was supposed to be complete. It was soon found, however, that the bulging was too persistent to be accounted for in this way, and the owners, rather than adopt the simple expedient of putting in a scum trough for blowing out the deposit, which there is little doubt would have remedied the evil, resolved on condemning the boiler altogether and on putting in a new one.

The new boiler was of larger dimensions than the old one, the diameter being 7ft. in the shell, instead of 6ft. 6in., and 2ft. 7½in. in the furnace tubes, instead of 1ft. 10½in., while the tubes were strengthened at the ring seams of rivets with encircling hoops, which had not been the case in the old boiler. With this new boiler, though not fitted with a surface blow-out apparatus, the same difficulty was not experienced as with the old one, which arose from the fact that the superior size of the new boiler enabled it to do its work more easily than the others, and thus with more gentle firing. As long, however, as the feed is of the same character as it was in the other boiler, the same tendency remains, and it will only be necessary to make the new boiler do as much work for its size as the old one did to lead to the furnace crowns being again disturbed, though doubtless they would derive considerable assistance from the encircling hoops, so that but little bulging of the plates might take place, though leakage would occur at the seams of rivets. In this case the water was not analysed, as it was on subsequent occasions, but it may be stated that it left a fine floury deposit of a very similar character to other cases mentioned, and which were found to consist of from 70 to 80 per cent. of carbonate of lime.

(To be continued.)

Correspondence.

THE ROYAL AGRICULTURAL SHOW AND THE PLOUGH: ITS HISTORY AND ACTION UPON THE SOIL BOTH IN ANCIENT AND MODERN TIMES, AND THE MODIFICATIONS IT HAS UNDERGONE.

LETTER No. I.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Some of our most useful agricultural implements are lost to the farmer by the want of a better mechanical education among our farm labourers, and we hail with satisfaction the interest and large space devoted to the Royal Agricultural Show in a high-class scientific paper like the MECHANICS' MAGAZINE. It is almost the only means which can mould the minds of the farmer and his men to the ready and willing adoption of those changes which from time to time must come if the British farmer is to hold his own against the rapidly-increasing foreign competition under free trade. Indeed, a greater interchange of ideas must take place between the minds of scientific men and our artisans and labourers if England is to maintain its high position among nations.

Civilisation advances in proportion to the rapid and constant communication one section of society holds with another. In the early history of England, the dwellers on the sea coast, from this cause, were more intelligent than those living in the interior; but now this difference no longer exists, for, whilst the seashore boasts of its shipping, our inlands are justly proud of their hives of intelligent industry, which, together with railways, penny post, and newspapers sent to the most remote hamlets, give the dwellers of the country as broad a path for the attainment of high-class knowledge as the denizens of the city. And in this state it might be supposed man could be left. But the pioneers of human progress think otherwise, and wish for the nations of the earth to bring to one centre their handiworks, that men might compare the works of genius of other lands by the side of their own. And how completely has this been borne out by the late Royal Agricultural Show at Manchester, which has drawn thousands of people together daily for fourteen days to inspect the grand array of the mechanical sciences: and who could go there and not come away a wiser and a better person? The proud and haughty would see that there were greater souls than their own in existence. To the doubting and sorrowful, there was something hopeful.

It is not with the general mass of things which were exhibited at the Royal Show that we are about to treat, but with one article only, and that article is the plough. The word is not very imposing, nor is it very winning in its appearance, yet

this little implement plays one of the most important parts in the political economy of nations. Mankind at large are not aware of the silent yet all-important part that agriculture plays in this modern world of £ s. d. We read of the great manufacturing interests, of our mighty shipping interests, of the £30,000,000 worth of cotton that annually comes from America, of the iron, mine, and coal interests; and we forget, or we do not know, what comes every year from our green pastures and the rich valleys teeming with fat oxen, and the yellow patches and the long lines of red which tell of the rich and golden harvest we are now reaping for our winter's store—a store of which the wheat alone is worth upwards of £60,000,000 sterling. And then add to this the value of the beans, oats, barley, turnips, and we shall have a sum total that far exceeds any other interest in the world; and, when we consider that all this value is produced by the plough, we shall see at once the importance of the implement.

The plough was never shown to more advantage or greater contrast at any previous Royal Show. The steam plough is one of the grand epochs in modern civilisation. It is to find more food for man. It is to give man the land—the broad acres that are now wanted to feed the horses that are required in farming. A more noble idea could not be started; yet it is, like many others of its class, a long way off its completion. But this difficulty will give way to more useful and better implements in steam tillage. Up to this time, steam has done no more than bring the old horse implements, made larger, to bear upon the soil, and worked, not by the force of any new intelligence, but by the more than brute strength of the steam boiler. The steam plough ought to do for the land what the spinning jenny has done for cotton. The number of operations now required for high-class cultivation by the implements in use make farming expensive and tedious. The implement that cultivates the soil, whether by horse or steam, should, upon all clean land, make a good seed bed at one operation, and then we might say that we have an intelligence as great on the farm as makes the arts and the sciences.

The first labour imposed upon man was to till ground. Thus, agriculture is the first institution on the face of the earth, and it must last when all others have passed away, for it is the only means of sustaining existence. The whole animal and vegetable creation die, rocks moulder away, and seas may be swallowed up, but the fertility of the soil is as perfect now as it was when man was first sent forth to till it.

What the first implement was that man tilled the ground with we may never know, but the first implement we find in his hand is the hoe, and that almost in the same form as the one now in use, and from this hoe the plough springs. But many hundreds of years may have rolled on before this change took place. The Egyptians were the first great fathers of agriculture, and their plough had the same form in its cutting edge as the one now in use, except that the share was on the left side, which is not to be found on any other plough in the world. So much did the Pharaohs reverence the plough above all other things that it was the only ornament in the crown of the "mighty Pharaohs," kings of Egypt, and the Egyptians in those days held the granaries of the known world. Rude as the Pharaoh plough was, it was the first grand attempt at that implement, and it was capable of breaking up every part of a field as perfectly as any of our best ploughs with the turn-furrow off. All other ploughs of this period, and for centuries after, acted equally on each side of the beam, which would prevent them from breaking up a field regularly and with facility. As the side broken up would be softer than the land not acted upon, the plough would be forced from the hard soil to the soft, and miss the land.

It is wonderful how little we have altered the share of our ploughs and cultivators for many thousands of years. It is the body and handles of the implement that have undergone the greatest change, and not the cutting line of the share. It is an old saying that there is nothing new under the sun, for the supposed model Woolstontine is just in the form of the earliest ploughs, a chisel-shaped edge about 4in. broad, with a long and gentle incline rising up to the frame. If the chisel-shaped share be objected to, the Chinese, many thousand years ago, had a duck's foot or diamond-shaped share to their plough, and a long incline for the earth to rise up after it is cut that it might be well broken before it left the plough. The present Kent turn-rise plough is just in the form of the old Chinese plough if the turn-furrow was taken off. All who visited the Royal Show at Canterbury must have been struck with the truly antediluvian appearance of the turn-rise plough. Old as this implement is—for it dates from the earliest period,—the "men of Kent" will not give it up; yet it takes a horse more draught than the fashionable iron plough, for there is a raging fashion in ploughs as well as in ladies' bonnets from time to time, which has long stood in the way of real progress. The Kent plough leaves no hollow in the furrow, and breaks the slice up much more than the solid cut of the common plough.

The ancient Romans worked one of the most awkward-looking ploughs, the handle perpendicular to the cutting edge, and the draught beam forming the hypothenuse line. The ancient Greeks are supposed to be the first to have used a share all solid iron. Russia was the first to use iron coulters, but they were round, and evidently used for rising and falling, the cutting edge of the share being attached to it, as they were the first to alter the pitch of the share. This was a great stride. The Circassians or Georgians were the first to use iron coulters detached from the share, which, strange to say, is in the most approved form of those in use at the present day. Switzerland comes next with not quite so perfect a plough. In all the ploughs of the ancients there were no turn-furrows, but the next period following that there were some attempts. The rudest attempt at the turn-furrow is by the Spaniards, consisting of two short bits of wood at right angles at the back of the plough. The Chinese plough, which is the best of all the ancients'—except the Pharaoh,—had two bits of wood placed at an angle of 45 to the cut, which, as a matter of course, must move the earth more or less at one side, but acted on each side alike. Austria, France, and Italy had the same sort of bars on each side, but their ploughs were not such useful implements. The Normans had two iron wings, one on each side, but their ends were bent completely forward, which would act more as breakers than turners. Yet it is the first use of iron for the turn-furrow. Then follows France with an iron wing on each side of the plough that bears some remote resemblance to a modern turn-furrow, which very soon after this period became somewhat perfect. Germany followed close in the wake of France, and by some writers has been supposed foremost in maturing the iron turn-furrow. They certainly were the first to use the skin coulter in front of the plough.

It is a race between England, France, and Germany for the authorship of wheels to ploughs, but to England is due the honour of using them to greater perfection, and also for making the whole of the agricultural implements lighter and handier, and freeing them from the whole of those barbarous lines which mark them in their early production, and which still cling to the French and German ploughs.

Thus, bit by bit, the plough has attained its present perfection, but we use the word perfection in reference only to cutting a solid even furrow, for we believe that this solid slice is one of the disadvantageous features of the modern plough, and it does much more harm than good. Hence arises the dispute between so many of the great agriculturists of the day between the solid and the broken furrow.

We purpose pursuing this subject further in another communication, in which we shall institute a comparison between English and foreign ploughs.—We are, Sir, yours, &c.,

F. and C. HANCOCK, Engineers.

Plough and Screw Propeller Works, Dudley, August 28.

ELECTRIC SEA CABLES AND LAND WIRES.

SIR,—I wish to point out to your readers the superior conductivity of aluminium wire over copper, and, therefore, its efficiency for telegraphs. It does not, I believe, solder; but the joinings of the copper wires do not appear to be made by solder, but by splicing closely sealed. As to the endurance of aluminium under electric action I cannot speak, and I do not think it has ever been tested; but it, of course, can be easily subjected to continuous powerful currents so as to test its durability and point of fusion and the effect produced on coatings by gutta-percha.—I am, Sir, yours, &c.,

VERITAS.

Ayr, September 11.

WINDOWS OF CHURCHES AND CATHEDRALS.

SIR,—There has of late years been a considerable advance in ornamental architecture by introducing tinted and painted glass windows into churches and cathedrals. It has struck me that effects singularly beautiful and grand would be obtained by filling special windows with crystal. Windows with a southern aspect would perhaps suit best, particularly the Gothic rose and Pointed arch windows. No kind of painting could exceed in beauty and effect a window throwing prismatic colours; and although it would necessarily be somewhat expensive, it would be less so than painting or enamelling, and would have the quality of rare effect and uniqueness.—I am, Sir, yours, &c.,

VERITAS.

Ayr, September 11.

EFFECT OF STEAM ON GASES.

SIR,—I wish to draw the attention of your readers to the power of steam in absorbing gases. This property might be used as a means of purification, and also of freeing mines from fire and choke-damp. It is easily generated, easily applied, and very diffusible. The action naturally takes place in the atmosphere, the vapour in which absorbs carbonic acid, ammonia, and other gases, and sends them down in solution in rains. Rain water collected pure (as in the midst of sand-hills) is frequently distinctly acid in taste from the presence of carbonic acid. In confined places, where carbonic acid has been generated, steam immediately relieves its effects. This property seems to arise from the vesicles of the vapour or steam getting filled with the gas and retaining it until condensation takes place, after which a solution is formed. Water itself has a powerful effect in absorbing and retaining gas; and I think the application of the property of steam to mines, cellars, vats, ships' holds, and all places where foul gases exist makes the discovery one of considerable moment.—I am, Sir, yours, &c.,

VERITAS.

Ayr, September 11.

THE ATOMIC THEORY.

SIR,—I have observed that at the meeting of the British Association at Exeter, the President of the Department of Chemical Science declared the return of modern science to the atomic theory of the ancients. After a lapse of twenty centuries, with our superior knowledge and scientific acquirements, we accept in an indirect manner the ideas of those great minds that propounded so important a theory with the imperfect knowledge they possessed. To establish the above we require a knowledge superior to that of the laboratory. The recent solar observations have opened to us a wide field for philosophic inquiry. It is, then, not in the partial decomposition of an element that we must seek the establishment of a theory so ancient and so philosophical. The question of heat has always been the stumbling block of science, and until the nature of both cold and heat have been scientifically explained we may seek in vain to extricate ourselves from the difficulties in which we are involved. It was in the solution of this question that the actual condition of our central body (since verified by recent discoveries) was foretold in the columns of the MECHANICS' MAGAZINE. The iteration of that which has been published would be useless. But in that hypothesis, briefly and imperfectly explained, will be found the real basis of the most philosophical theory of antiquity.—I am, Sir, yours, &c.,

H. SALOWAY.

13, Standard-street, Dover-road, Sept. 12.

HYDROSTATIC STEERING APPARATUS.

SIR,—In your issue of the 27th ult., is a notice of a hydrostatic steering apparatus invented by Admiral Inglefield, who uses the weight of the ship to steer it, and your notice says, "we understand it is cheaper than any other mechanical apparatus yet tried"—"the power it utilises costs nothing," &c. Both these assertions are mistakes, as can be shown. It requires twenty-five men to steer the ship by the ordinary method; now, let us assume each man's work equals 25 foot pounds, the twenty-five men's work would slightly exceed 1,000 tons lifted 1ft. high per hour. Keeping this in mind, let us ask what becomes of the sea water after doing its work in the large cylinder? It cannot flow back to the sea, otherwise we should have something more than perpetual motion. It has to be pumped out of the ship, and the amount to be pumped out will be equivalent to 1,000 tons lifted 1ft., *plus* the amount required to overcome the friction of the extra apparatus. If this work is done by manual labour, fifty men instead of twenty-five would be the number required to keep the ship clear of this water. We may assume, however, this work to be done by the ship's engines, thus necessitating distinct pump machinery for the

purpose, the weight of which, in addition to the weight of cylinder with its piston, rod, barrel, &c., will amount to a good round weight, to be constantly carried about whether in use or not. It is a fallacy to state that "the power is always ready at hand for use." Steam will always be required when the apparatus is in use. Therefore, since it is a question of fuel, we have only to consider which is the cheapest in the long run—the Admiral's gigantic low-pressure apparatus, or special steam hydraulic machinery. My belief is the latter would not be half so expensive to the country as the former, and as an economist I join you in hoping the Admiralty will have its eyes opened to the value of the Admiral's system.—I am, Sir, yours, &c., ROBERT SHENTON.

9, Victoria-place, Millwall, August 28.

PROPOSED ABOLITION OF PATENTS.

SIR,—The MECHANICS' MAGAZINE of August 27 copies an article from the "Engineer," in which "The Abolition of Patents for Inventions" is severely handled:—"The hon. member must needs insult our gracious Sovereign by writing her down as of the neuter gender." "'The Sovereign voluntarily puts itself,' writes Mr. Macfie at p. 74." If you will be good enough to turn up the passage, you will find that the charge made against me is baseless. Allow me to present the *ipsissima verba*:—"The purchase is a compulsory one, with this peculiarity, that whereas the inventor may or may not offer to sell—for he is left at perfect liberty, as in a free country he ought to be, whether to patent and reveal (sell) or not—yet, if he do offer, it is the State, the maker of the law, which, through the Sovereign, voluntarily puts itself under compulsion to accept the offer."—I am, Sir, yours, &c., R. A. MACFIE.

Ashfield Hall, Neston, August 30.

[The delay in the insertion of the above letter has been accidental.—ED. M.M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

MR. R. W. ROW, of High-street, Alton, writes us complaining that we should state, in our notice of his specification, No. 383, at page 180 of our issue for the 3rd inst., that the patent was abandoned, which he says is an error We have inquired into the matter, and find that our notice is correct. The patent was abandoned, and this in consequence of the agent having made the mistake of supposing that he had six months from the date of sealing the patent for filing his final specification. Instead of this—as every agent ought to know—the time is six months from the date of lodging the Provisional Specification. This is one of the results of employing incompetent agents, and is the second case of the kind that has come under our notice within the last few months.

IN our last issue it was stated in the Abstracts of Specifications, that the patent No. 404, J. H. Johnson, had been abandoned. This on inquiry, we find to be an error; the patent having been sealed July 20, and the final specification filed August 7 last.

RECEIVED.—C.R.—J. S. W.—S. and Co.—G. E. P.—H. S.—J. H.—T. W.—E. E.—J. K.—S. E.—C. G. L.—R. M.—H. R. D.—J. H. and Co.—R. S.—J. W. and Co.—R. A. M.—S. G.—R. S.—T. L.—C. W. R.—J. H.—F. P. and Co.—J. H.—J. B. and Co.—H. T.—F. R.—H. J.—T. and B.

Naval, Military, and Gunnery Items

A LETTER dated from the Admiralty, September 13, signed Vernon Lushington, states that the Lords Commissioners of the Admiralty had come to no decision as to the abolition of Sheerness as a naval establishment, and that they, in fact, had never considered the question.

LONDON is at last to have a direct line of steamers from Colon and the West Indies, the West India and Pacific Steamship Company (Limited) having arranged for a monthly line homewards to commence in January next. By the new route, produce will be brought from ports in Central America, California, and on the South Pacific, *via* the Isthmus of Panama, to London.

THE Coastguard service is in future to be one of a more active character than it has hitherto been. We understand that all the captains have received notice from Whitehall that they must be prepared to man their ships and to go to sea for the purpose of exercising and drilling their men every three months.

THE flagship "Formidable," 78 guns, which has been granted by the Government as a training ship for destitute boys of Bristol, has arrived from Sheerness, and is stationed off Portishead. Commander Edward Poulden, R.N., has been appointed Captain Superintendent. The "Formidable" left Sheerness on Monday week, and was towed round by a Liverpool steam tug-boat. She encountered a rough passage, and did not reach Portishead till Saturday afternoon.

THE mitrailleur gun, of which Major Fosberry, V.C., of the Bengal Staff Corps, has had charge, and upon which he has made some alterations, is now placed under the direction of a committee, of which Colonel Wray, C.B., R.A., is president, and will be reported upon to the Secretary of State for War after being put through various trials at the Select Committee Range at Woolwich.

EARLY on Friday morning the new floating and tidal docks at Belfast were flooded by a high tide breaking in a portion of the embankment. It is stated, however, that no injury to the docks has been sustained, as every precaution had been taken to guard against such a contingency. The works are in an advanced state, and the embankment itself was about to be cut away in a few days in order to allow the water to flow into the basin.

THE San Francisco "Bulletin," of September 14, publishes a letter, which it declares to be authentic, stating that documents have been found, near San Buenaventura, giving a detailed account of the desertion of the ships "Erebus" and "Terror," of Sir John Franklin's expedition. According to these documents, the party wintered in 1846 to 1847 at Beechy Island. Sir John Franklin died on June 11, 1847. The papers had evidently been thrown overboard about lat. 59½, long. 98.

DURING the recent cruise of H.M.S. "Blanche," when under full steam at full speed, the sudden alarm of "a man overboard" called everyone to his station. A boy had fallen from the rigging. The life buoy was promptly let go, engines stopped and reversed, life boat lowered, the first lieutenant, boatswain, and the boy picked up, boat hoisted up, and ship going ahead at full speed again in nineteen minutes five seconds. This we may call smart work. Lieutenant Markham and the boatswain had both jumped overboard to save the life of the youngster.

ON Wednesday, August 18, about 40ft. of Buffalo Arsenal fell, carrying with it 30,000 rounds of ammunition. The keeper of the Arsenal, who had been in that portion of the building only a few moments before, had a narrow escape of instant death. And had the accident occurred the evening previous, a large loss of life would have been occasioned, as the 65th U.S. Regiment assembled therein on that evening for drill. Measures will be immediately taken to have the building made more secure.

THE Austro-Hungarian delegations have decided to vote funds for the establishment of a flotilla of monitors on the Danube. These monitors are only to draw 1½ft. of water; each of them will be armed with a gun of the heaviest calibre, and their sides will be protected by plates from 3in. to 8in. thick, made of the best Styrian steel, and provided with joints of teak. As they will have to carry a heavy weight, and at the same time draw very little water, they will be very broad and flat-bottomed.

Miscellanea.

THE imports of iron minerals into France in the first six months of this year have been officially returned at 278,786 tons; of this total 108,228 tons came from Algeria.

MR. TITUS SALT, of Saltaire and Crow Nest, Yorkshire, has received the offer of a baronetcy, which he has accepted. This honour is regarded with unmixed satisfaction by all classes in Bradford.

AN order for 6,000 tons of iron has come to hand in Belgium in connection with a bridge to be constructed at Hamburg; another order for 1,500 tons for Lisbon is also noted.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending September 11 was 5,296. Total number since the opening of the Museum, free daily (May 12, 1858), 1,641,793.

AT a meeting of the Inverness Town Council held on Monday, and specially called for the purpose, a proposal was submitted by Bailie Simpson for conferring the freedom of the burgh on Sir Roderick Murchison, LL.D. The proposal was unanimously agreed to, and the town clerk was instructed to ascertain from the hon. baronet when it would be convenient for him to accept the honour. Sir Roderick is a native of the neighbouring burgh of Dingwall.

THE Humboldt centenary will be celebrated in London at the great hall of the German Turn Verein, where M. Karl Blind has been invited to deliver the festive speech.

THE last of the Mamelukes, Sidi-Ferdouck by name, has just expired at Balana, a small village on the Mediterranean coast. The defunct Sidi was a friend of the Emperor's celebrated Roustan, and served in the Consular Guard, his turbaned squadron creating no small effect in the Carrousel. Sidi fought in Italy, Germany, Spain, and Russia, and altogether must have had a hard time of it in his youth.

A CENSUS of Oude, taken last February, shows that the population is so much as 11,220,747, instead of 8,000,000, as was always estimated. Of these only 1,195,879 are Mahomedans, 6,431 Christians, and 10,002,731 Hindoos. This raises the population of India, without the Feudatory States, to 156,000,000, and of all India to 205,000,000, estimating Bengal at only 38,500,000.

AUSTRALIAN papers state that a number of fine pearls discovered at the fisheries carried on in the vicinity of Nicol Bay, Western Australia, have been exhibited in Melbourne. They are of great size and beauty, the most valuable among them resembling in shape and dimensions the eyeball of a large fish. This is said to be worth upwards of £200.

THE Minister of Public Instruction in France, some time since, founded a museum of anthropology, and confided its direction to M. Quatrefages, member of the Institute. This museum has just been enriched by a collection of types, life-size, of the natives of the Valley of the Nile, painted by M. Georges Lefebure, who has returned from a mission to the East.

THE number of visitors to the South Kensington Museum during the week ending September 11, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 14,747; Meyrick and other galleries, 2,348; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,606; Meyrick and other galleries, 148; total, 18,849. Average of corresponding week in former years, 12,064. Total from opening of Museum, 8,792,855.

THE exports of rails from Belgium continue to show an increase, having amounted in the first half of this year to 41,895 tons, against 24,597 tons in the corresponding period of 1868, and 13,930 tons in the corresponding period of 1867. The imports of minerals into Belgium have largely increased this year. The exports of coal from Belgium in the first five months of this year amounted to 1,397,061 tons, against 1,402,629 tons in the corresponding period of 1868, and 1,332,840 tons in the corresponding period of 1867.

WE have tried many pens of various kinds and qualities, but have not had one which we could really say we liked until chance brought us across the "Waverley" pen. This pen, which has been introduced by Messrs. Macniven and Cameron, of Blair-street, Edinburgh, is admirably suited for rapid editorial writing. The secret of its smooth action lies in the fact that the points are slightly turned back, and until the metal is corroded the pen never becomes "scratchy." The "Pickwick" pen makes a somewhat finer line, but we commend the "Waverley" to all knights of the pen.

ATTENTION has been lately drawn by the "Journal of Franklin Institute" to a curious observation which stands, as yet, as a fact without a sufficient reason. In one case, where hard coal is used in large quantities for purposes of mere evaporation, it appears that some which has been kept on hand in open piles for five or six months is less effective by from 13 to 15 per cent. than that freshly mined. A similar result, corresponding even in the percentage of deterioration, appears in another report from a smelting furnace. The deterioration from decrepitation, caused by absorption of water, is of course well known, but does not seem to apply to these cases.

THE Society of Arts programme of examination is materially altered. Many subjects are omitted, and some are introduced to give a more practical character. A memorandum from the treasurer, Mr. Hyde Clarke, explains a system of *viva voce* examinations in modern languages, more particularly intended to encourage working men to make themselves useful as foremen and directors of labour in India and in foreign countries. It is proposed that the candidates may obtain a certificate for ordinary conversation alone, and with particular reference to the technical terms of his trade. The system is used in the vernacular examinations for the Indian services.

IT having been reported to the Queen that the annual prize of twenty-five guineas, given for the last eight years in the name of the late Prince Consort through the Society of Arts, had been three times obtained by the City of London College for Young Men, and, for the last two years, by the Polytechnic Evening Classes, Her Majesty has been graciously pleased to present copies of the "Early Years of H.R.H. the late Prince Consort," and "Leaves from the Journal of Our Life in the Highlands," to each of those societies.

THE chimney of a flour mill, at Fairfield, Iowa, recently fell, causing the destruction of the entire mill. The catastrophe was caused by turning the escape steam into the brick flue near its base, and at this point the bricks could be crushed between the fingers, while the balance of the chimney was perfectly solid. It is strange that such errors can be committed by thinking men as to let such a subtle agent as steam in upon such an absorbent material as brick. With the exception of oil, there is no more searching power than that possessed by steam, and when we consider how liberally brick admits water into its pores, we cannot be surprised to see what the effect of the injection of steam must be on it.

M. LIEBREICH has presented a memoir to the Academy of Sciences, which contains some interesting details concerning a new anæsthetic he has just discovered. An important difference between this new chemical compound, which he calls chloral, and all other substances used for the purpose of producing insensibility, is that it is administered by absorption instead of inhalation, and this enables the dose applied to be measured with greater accuracy. On passing into the system it becomes decomposed into formiate of potassium and chloroform, and produces more perfect insensibility than either ordinary chloroform or ether. Its use is said to be unattended by any danger. In a very painful and difficult operation lately performed on a woman, M. Liebreich applied chloral with perfect success, the patient being kept under its influence for over two hours.

ACCORDING to the American journals, a novelty in railway management is to be introduced by the Erie Company, who propose to illuminate the whole of that road by night by electric lights at the ferries, in the tunnels, on all dangerous curves, and on every engine. Mr. E. C. Morse, who has charge of the matter, states that he has made several important improvements, among others a plan for preserving the carbon points from wasting away, and keeping them for months in a good condition, a self-sustaining battery, and an invention by which the turning of the wheels of the engine shall collect electricity for use in illumination. There will be a light at each end of the ferry, which, it is believed, will make a collision practically impossible on the darkest and foggiest night. Even with the diminution of light caused by the jarring of the locomotive, it is estimated that the head-lights will show the track to the engineer on a straight line for three miles.

A NEW wrought-iron chimney has been recently erected at the Creusot Ironworks. It is 197ft. high, and 6ft. 7in. diameter. At the bottom the diameter is increased to 10ft. by a curved base, which is fastened by vertical bolts to masonry work. The thickness of the sheet iron is 3-32in. at the top, and 7-16in. at the bottom. There is an inside iron ladder. The weight of this chimney is forty tons; it has been riveted horizontally, and lifted afterwards with a crane. Another one, 275ft. high, will be soon erected, but by a different system; it will be riveted vertically, with an inside scaffolding. These chimneys are built for an extension of the Creusot Works, especially intended for steel making. There will be eight Bessemer converters, where the cast iron will be run direct from the blast furnace; there will be also many Martin's furnaces, and an extensive workshop for melting steel in crucibles, where it will be possible to melt together fifty tons of steel.

THE material generally used by watchmakers on the continent for polishing hard and soft steel as well as brass is a white substance called wiener kalk; it polishes much quicker than crocus, and with a beautiful black gloss. The "Horological Journal" states that it is used in the following manner:—The piece to be polished is first put on a piece of cork fastened in the vice, and rubbed with a piece of plate glass, on which is put a little oil and oilstone dust, till it is perfectly flat and all the file marks have disappeared. It is then cleaned with a brush and soap and water, and dipped in spirits of wine; and, after being dried with a clean cloth, put on another clean piece of cork, in the same way as before, and rubbed briskly with a flat polisher, made either of bell metal or block tin, in which is put a little wiener kalk and fine oil, mixed to the consistency of a thick paste. It is necessary to prevent any dust getting in the polishing stuff or on the piece to be polished.

THE American papers, in their comments on the great feat of reporting the result in America by the Atlantic Telegraph within 23 minutes of the race, state that a portion of this time was occupied in taking the despatch to the Mortlake telegraph station by a messenger on horseback. This is a mistake. The despatch was carried to the telegraph-office by a very fast runner in the service of the Electric Telegraph Company, who is employed on all important occasions by the intelligence department on account of his reliability and great speed. His name is Lewington, and he is known in the service as "Electric Jack." On the occasion of the prorogation of Parliament he ran with the copies of the Queen's speech from Westminster to the chief office in Moorgate-street in 14¼ minutes—a very fast performance, considering the crowded state of the streets during the middle of the day.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—510, 513, 537, 569
BUILDINGS AND BUILDING MATERIALS—493, 499, 518, 535, 548, 570, 578
CHEMISTRY AND PHOTOGRAPHY—481, 563, 574
CULTIVATION OF THE SOIL, including agricultural implements and machines—489, 492, 506, 572, 541, 552, 534, 577
ELECTRICAL APPARATUS—501, 531
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—480, 496, 497, 502, 509, 515, 526, 530, 540, 543, 547, 573, 579
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—539
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—482, 483, 491, 504, 508, 555, 562, 582, 583
GENERAL MACHINERY—487, 490, 500, 507, 516, 551, 567
LIGHTING, HEATING, AND VENTILATING—523, 536, 561, 575
METALS, including apparatus for their manufacture—524, 546, 566
MISCELLANEOUS—484, 485, 494, 495, 505, 520, 521, 527, 528, 534, 542, 549, 559, 563, 571, 576
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—486, 498, 517, 522, 544, 550, 553, 556, 564, 568
SHIPS AND BOATS, including their fittings—503, 538, 545
STEAM ENGINES—481, 519, 525, 529, 560, 572
WARFARE—371

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480 T. SAGAR and T. RICHMOND, Burnley. *Looms* Dated February 17, 1869.

The warp on leaving the warp-beam is taken, as usual, over the vibrator or other equivalent, then over and under a pair of lease-rods mounted on swivel-links which are made to vibrate by a lappet on the lappet-shaft, or other suitable part of the loom, then under a rod or roller extending across the loom, and then through improved healds or healds of the usual construction. The warp then passes through the reed and thence to the take-up roller, as usual.—Patent abandoned.

481 J., B., and R. WOOD, Sowerby-bridge. *Steam engines.* Dated February 17, 1869.

This consists in the application of a separate small steam cylinder and piston with ordinary slide valve; the piston rod thereof is connected with another rod in communication with and giving motion to the spindle of the cut-off valve. The valve rod is provided with two collars or shoulders, between which are two cams mounted upon a hollow spindle, within which works a sliding rod connected to the governor by a bell crank lever and connecting rod. In the sliding rod are fixed two projecting studs or pins passing through slots cut or formed in the hollow spindle parallel to its axis, and made to enter into oblique slots formed in the cams respectively, so that when the sliding rod is moved in either direction in the hollow spindle, the projecting studs or pins will move the cams thereon, altering their position, and thus giving motion to the piston in the cylinder, and thereby move the spindle of the cut-off valve; and by the varying action of the governor causing the steam to be cut off sooner or later, and the action of the governor being quick, the cut off is quickly effected.—Patent completed.

482 E. T. HUGHES, Chancery-lane. *Washing machines.* (A communication.) Dated February 17, 1869.

The machine is composed of a frame supporting the vessel, in which the process of fulling or washing takes place, and which consists of a case resting on the ribs of the frame. The vessel, at the bottom of which are the heating tubes and the discharge orifice, is lined on the interior with a layer of marble, hard slate, or other stone or porcelain, and the beaters pivoting on the axis are also covered with a layer of such material, so that the linen shall only come in contact with perfectly clean and unchangeable surfaces. The point on which the levers operating the beaters oscillates is placed between the said beaters and the crank or eccentrics working in close proximity to the beaters as usual in the present time. For single-action washing machines, where the crank is placed laterally, this would not be inconvenient, but in double-action washing machines it is necessary that the cranks and the mechanism generally should be arranged in the interior of the casing, which renders access to these parts difficult, so that stains caused either by drops of oil or (in case of insufficiency of lubrication) by particles of rust from the bearings become inevitable.—Patent completed.

483 J. ATKINS, Birmingham. *Metallic furniture.* Dated February 17, 1869.

This consists in improvements in manufacturing the head and foot rails or ends of metallic bedsteads and other articles of metallic furniture. The head and foot rails are usually made of rods joined together by cast or other junctions, or of panels inserted in a framing of tubes. In making the head and foot rails according to the invention, the inventor constructs a framing of a rectangular figure by means of flat bars, which framing may be divided into smaller rectangular divisions by parallel flat bars. The rectangular spaces thus formed are filled by straight strips of sheet metal, arranged either diagonally or parallel with the sides of the framing, or the strips may be interlaced. Where the strips cross each other and where they join the flat bars of the framing he connects them together by plain or ornamental rivets or otherwise. Any required ornaments may be attached either at the crossings of the strips or in the open spaces. The flat bars and strips described may be ornamented with surface or other ornaments.—Patent completed.

484 E. ROUND, Sheffield. *Cooling and warming vessels* Dated February 17, 1869.

This consists in constructing vessels with an inner vessel or receptacle and leaving a space or spaces between them into which ice or a cooling matter or mixture may be introduced for the purposes of cooling, and hot water or a warming matter for the purpose of warming, any fluid or material that may be put in the inner receptacle and be kept distinct therefrom, and in furnishing the outer vessel with a false or double bottom and leaving a space between them. The false or upper bottom is furnished with suitable holes or outlets for inserting the cooling or warming material, and for drawing off the water or liquid from the ice or cooling matter when necessary, and so keeping the ice or cooling matter when applied to the space between the outer vessel and its receptacle or inner vessel free from wet or too much moisture, whereby it and a low temperature is longer preserved.—Patent completed.

485 W. E. NEWTON, Chancery-lane. *Stamps.* (A communication.) Dated February 17, 1869.

This consists chiefly in constructing the stamps with a hole or holes through the body of them, and covering or backing the same with tissue or other thin bibulous paper made to firmly adhere to the body and the rear surface of the stamp with its bibulous paper covering to the hole or holes coated or backed with mucilage or other adhesive substance.—Patent abandoned.

486 F. H. COLLINS, Kensington-gardens. *Permanent ways.* (A communication.) Dated February 17, 1869.

It is well known that railroad rails have sometimes been made double or reversible, so that in the event of the upper or bearing surfaces of the rail becoming worn and unsafe, the rail could be turned over and a new bearing surface brought into use. But such reversible rails have been usually made in the shape of a double T, that is like two ordinary T rails having their bases joined together. The invention consists in a form of rail which, while avoiding all the obvious disadvantages of the double T rail, yet possesses all its valuable properties.—Patent completed.

487 A. RANSOME, King's-road, Chelsea. *Wood-cutting machinery.* Dated February 17, 1869.

This relates to the planing part of the machine, in which the inventor employs two rotary adze blocks provided with cutters. One block is intended to plane the upper surface of the wood, and the other to plane the under surface. The wood rests upon and is drawn or pushed along a table, in which is made an opening for the lower rotary planing tool or cutter to act on the wood. The spindles on which these cutter blocks are fixed or secured are distinct from the saw spindle, and are actuated from the driving shaft by means of separate gearing consisting of bands and pulleys, so that either the planing tools or the saw may be worked or stopped without interfering the one with the other. When required, the rotary planing adze blocks and cutters may be removed from their spindles and tenoning blocks may be substituted for them and secured on the spindles. Cutters may be secured to the planing blocks for cutting single or double mouldings.—Patent completed.

488 W. R. LAKE, Southampton-buildings. *Extracts from coal gas.* (A communication.) Dated February 17, 1869.

This consists in placing coal gas in contact with substances which act as solvents for the benzole and homologues contained therein without, at the same time, causing them to undergo any chemical change, and while it has been found that all known solvents of benzole will effect this purpose, the inventor prefers to place coal gas in contact with certain hydrocarbons such as petroleum, schist, and mineral oils, and the higher boiling varieties of coal tar, naphtha, as these hydrocarbons are easily procurable and interfere little, if at all, with the illuminating power of coal gas, and by mere distillation the benzole and its homologues may be separately obtained from their solution therein and the solvent rendered again fit for renewed application.—Patent completed.

489 H. D. BOWYER, Ripley, and J. L. NORTON, Belle Sauvage-yard, E.C. *Wheaten flour.* Dated February 17, 1869.

This consists in subjecting wheat to the action of steam or moisture to such an extent that it takes up sufficient moisture to permeate the husk or bran, after which the wheat is dried in order to cause a contraction of the grain with the object of loosening the husk or bran so as to cause it to separate more freely from the farina or flour, or the moistening of the grain may be omitted and the wheat simply be passed through a drying machine to dry it. After the wheat has been dried it is then crushed by being passed through rollers of metal, or other material either fluted or plain. The wheat is delivered to the rollers in an even stream or thickness by a shaking screen feed motion, which screens the wheat and frees it from dust and small seeds before it enters or passes into the crushing rollers.—Patent completed.

490 H. ALAND, Surrey. *Rotary blowing fans.* Dated February 18, 1869.

This consists in introducing a vertical partition or partitions with central openings in one fan case, thus forming separate fan chambers with inlet openings into their respective fans.—Patent abandoned.

491 F. J. KNEWSTUB, Westminster. *Writing cases.* Dated February 18, 1869.

The inventor constructs the leaves or partitions separately and distinctly from a despatch box, and he applies them or the case containing them to cases, boxes, drawers, or receptacles of any description; the leaves or the case with the leaves may be made in such a manner that they may be used in an upright position separately, or may be made so as to lie flat upon a table, with or without the alphabet, numerals, symbols, or devices impressed, printed, or fitted thereon so as to be observable from above. In order to facilitate the leaves being moved the inventor arranges them upon wires or bars fitted inside the case or in a frame or tray.—Patent completed.

492 J. DARLINGTON, Moorgate-street-chambers. *Drilling apparatus.* Dated February 18, 1869.

This consists in a peculiar combination and application of certain known mechanical forms and movements towards simplifying and rendering more effective the action and consequent force applied to the drill used for boring rocks or mineral substances. The improvements consist in the use of a screw or of a rod having spiral slots in connection with certain wheel gearing, the whole being so arranged and combined that if rotary motion be given to the screw a simultaneous and similar motion is communicated to the drilling bar.—Patent completed.

493 A. BARTHOLOMEW, Glasgow. *Sliding windows.* Dated February 18, 1869.

The inventor applies a plate or plates, or surface or surfaces to the side or sides of the upper sash with holes tapped to receive a screw with a square or other head adapted to receive a loose key, by which such screw is placed in position, and when in position, by acting on the upper part of the lower sash to prevent the one from being raised and the other from being lowered beyond a suitable distance, which may be varied by the position of the screw in the upper sash.—Patent completed.

494 A. MUNRO, Arbroath, and W. B. ADAMSON, Glasgow. *Masons' tools.* Dated February 18, 1869.

This consists in the construction of conical tubular tools. The tools under the first modification constitute a hollow truncated cone or short conical tube. The tools are fixed in the holders of the machine for cutting stone, slate, marble, rock, or other substances, preferably by means of a bolt, which passes into or through the hollow or tubular part of the tool, on or in the other end of which a nut, spring, or cotter is placed, or the bolt may be made to tightly fill the hole in the socket, in which case the nut, spring, or cotter is dispensed with. The bolt on being tightened draws the tool firmly into the recess formed in the socket or holder to contain it. Under a second modification the tool is made hollow for a certain length, only the after part forming a solid shank or bar, which passes into a correspondingly formed hole in the socket or holder, and by which it is held therein. The tools constructed under the first modification are to be formed of chilled iron, steel, forged or pressed into the requisite shape, or of chilled or forged compounds or alloys of iron or steel. The tools constructed under the second modification are to be made of chilled iron or of chilled compounds, or alloys of iron or steel.—Patent completed.

495 A. GARRISON, Birmingham. *Pendant string holder.* Dated February 18, 1869.

This consists in forming them, by preference, of a spherical form, in two parts, principally from wire gauze raised into the desired shape, each part or half being bound by a tinned or other metal rim and united together in any convenient portable way, such as by a hinge and catch, and on the apex of the one half or semi-sphere a strong ring or collar is applied for the convenience of portable suspension.—Patent abandoned.

496 J. D. NICHOL and J. ECKERSLEY, Edinburgh. *Paper apparatus.* Dated February 18, 1869.

This consists in the combination and arrangement of hollow drums, heated by steam or otherwise, over and under and in contact with which the printed sheets of paper are separately passed, and thence through a pair of pressing rollers, when they pass successively into a suitable box or receptacle.—Patent completed.

497 C. BROOK, L. BARKER, and M. THOMPSON, Halifax. *Looms.* Dated February 18, 1869.

This relates to the take-up motion in looms for weaving, or the means or apparatus to be employed for effecting the regular winding on to a beam or roller of the woven fabric as produced, and so that when occasion requires, either by the breakage of the weft or when it is used up, such taking up may cease at the proper place or the beam turn back to it, and at any time the turning back of the beam or roller may readily be effected. For this purpose the inventors apply a short shaft gearing at one end with either the crank shaft or the tappet shaft, as most convenient, by suitable wheels to produce the required rotary motion, and at the other end gearing by means of worm and wheel with the ordinary taking-up gear wheels, or a new arrangement of similar wheels, and so that this end of the shaft may be readily lifted or removed out of gear. To effect this it is attached to a lever fixed on one end of a rod or shaft extending across the loom under the breast beam and supported in the loom ends, and on the other end is fixed another lever, projecting up through the breast beam, and so set that when the weft fork lever is acted upon it will act upon this lever, and thus lift the shaft out of gear with the taking-up wheels, and an adjustable slip catch is also applied to the ratchet wheel for holding the take-up constructed with a slot, so that it may be set by an adjusting screw to let slip or expand to any desirable extent, and thereby allow the beam to turn back the required distance.—Patent completed.

498 R. PYNE, Wellington-street, Strand. *Carriage steps.* Dated February 18, 1869.

Upon the bottom end of the carriage door is affixed a stirrup or suspender, turning freely with the door. Attached to this is a step of wood or metal, so arranged that when the door is shut it projects underneath the carriage, but when the door is opened it radiates from the stirrups and projects in front of the door in a line with the carriage so as to form the step. A guide bar underneath serves both to guide and support it.—Patent abandoned.

499 J. A. WADE and J. CHERRY, Hornsea. *Brick press.* Dated February 18, 1869.

A suitable frame, mounted on wheels or otherwise, carries the fixed die or mould (for forming the sides of the brick, tile, or other article), to which is hinged the movable upper die or lid. The lower die or loose bottom, which works vertically inside the fixed die or mould, and by which the pressure is given, is supported upon two eccentrics keyed upon a shaft capable of revolving in bearings fixed to the frame, and having a hand lever keyed at one end thereof. The hinged upper die or lid, when closed, is held down by a catch, but when released by a cam on the eccentric shaft or a pin on the lever, is thrown back by means of a spring.—Patent completed.

500 T. H. MARTIN, Swansea. *Piston tightener.* Dated February 18, 1869.

This consists in an improved mode of tightening the piston rings of pistons so as to make them fit more exactly in the cylinders, thereby keeping their places better, and exerting more power than hitherto. This improved method is accomplished by placing a movable valve or valves in the body of the piston, which valves are opened and closed by the working pressure (of whatever kind, whether of air, steam, water, or gas, or of other fluids or liquids) on either side of the piston, thereby causing a continual pressure (equal to the working pressure on either side of the piston) to act against the inner sides of the metallic rings composing the piston, thus continually pressing them against the sides of the cylinders, whilst the engine (to which the piston is attached) is at work.—Patent completed.

501 D. G. FITZGERALD, Battersea. *Telegraph voltaic batteries.* Dated February 18, 1869.

This consists in the insulation of a signalling current, not as hitherto by means of a dielectric or insulating material, properly so termed, but by means of good conductors of electricity (metals and electrolytes), so arranged as to generate an electro-motive force, which opposes the escape of the signalling current when the latter is transmitted in a particular direction. Or, in other words, the inventor prevents the passage or escape to earth of the signalling current by generating an electro-motive force, which is made to oppose such passage or escape of the signalling current, thus allowing it to complete the line circuit. This mode of insulating the signalling current he terms "electrolytic insulation," to distinguish it from the ordinary mode of or from "dielectric" insulation.—Patent completed.

502 J. NEWTON, Leeds. *Spinning flax.* Dated February 18, 1869.

In place of making the supports, which carry the saddles, with projecting pins to enter into slots in the saddles the inventor forms the support with two parallel cheeks, between which the centre portion of the saddle is received. A pin carried by these cheeks, and passing across the space between them, enters a slot in the saddle, and the saddle is thus supported. The saddle is formed with parallel sides, which fit between the two parallel cheeks of the support; consequently, the cheeks may be formed to fit against the sides of the saddle for any desired portion of its length, whilst the central portion of the saddle, in which the slot is made, and which fits between the cheeks, may also be made of sufficient depth to give steadiness. By thus constructing the saddles and their brackets or supports, a large bearing surface is obtained to present any lateral motion of the saddle, and in addition as the sides neither of the saddle nor the brackets have any projections from them they may be fitted by grinding or filing at a very small cost.—Patent completed.

503 W. DAINES, Gravesend. *Anchors.* Dated February 18, 1869.

This consists, chiefly, in constructing the stock with inclined pieces, which extend inward from each end of the stock at an angle of about 55deg. to the shank. The latter is provided with chocks or abutments to receive the ends of the pieces, which are held in place laterally by a small pin, passed through the arms and stock, or by a collar or other suitable fastening.—Patent abandoned.

504 F. W. MALLETT, Newhaven, U.S. *Needle machine.* Dated February 18, 1869.

The wires or blanks being cut to the desired length for two needles, are thrown into a hopper, which has in connection with the same a feeding device. This device conveys one blank at a time to the first set of a series of progressive carrying rollers, which take up the blanks in turn and carry them from one to the other; while being so carried by the rollers the needle blanks are stamped, the eyes punched, and the eyes tested by a feeler, which will detect a blank not properly eyed and will stop the feed mechanism for its removal.—Patent abandoned.

505 M. VARY, Scarborough. *Ornamenting surfaces.* Dated February 18, 1869.

The inventor takes a piece of paper, or other suitable material, and coats or prepares it with size, made in any convenient manner, and allows the same to dry. On the surface so prepared he prints, draws, stencils, paints, or otherwise makes any design, device, or character in or of any colour or colours or material required, or he cuts, stamps, or perforates out any design, device, or character, or he partly paints and partly cuts the design or character required. The cutting, stamping, or perforating may be effected either previously to the sizing or subsequently thereto, or subsequently to the printing.—Patent completed.

506 F. DELBREIL, Versailles. *Utilisation of excrement.* Dated February 18, 1869.

The inventor proposes to make use of a locomotive engine suited to run on common roads for the purpose of conveying any convenient number of waggons to the spot at which they are to be loaded with sewage, or other similar matter, and transporting such matter to appointed depots. These waggons should be so constructed as to suit the special service for which they are intended, an enclosed waggon having a body built in the form, for example, of a barrel, would be well adapted for carrying sewage matter in a liquid state.—Patent abandoned.

507 T. FORSTER and P. B. COW, jun., Streatham. *India-rubber pipes.* Dated February 18, 1869.

In manufacturing suction and other pipes the inventors, substitute for the galvanized iron wire coil used in the manufacture of ordinary suction and other hose, alternate rings or spirals of rubber having two different quantities of sulphur in them, so that after the operation of steam vulcanizing every alternate ring or spiral will be hard, while the intermediate ones will be flexible. In manufacturing india-rubber hose, buckets, bags, and such like vessels, the inventors substitute for the cotton or linen fabric ordinarily used for giving strength a material composed of rubber and fibre.—Patent abandoned.

508 W. M. COCHRANE, Surbiton. *Water vessels.* Dated February 19, 1869.

This consists in the use of a bottle or vessel of glass, glazed pottery, or other suitable material (but by preference of ebonite) protected by a covering of felt, or other non-conducting material, which also serves for maintaining the temperature of water or other liquid contained in the bottle or vessel.—Patent completed.

509 T. TUNSTILL and J. DODGEON. *Looms.* Dated February 19, 1869.

The inventors employ ordinary friction pulleys, and chains, belts, or cords, to each end of the beam, and also an ordinary vibrator or shaft, with a vibratory crank bar, which they invert, that is to say, they place the crank underneath or betwixt the shaft and the warp beam, so that the warp will first pass under the crank bar, and thence over the shaft to the healds. The friction chains or cords are each attached to separate levers, each lever being hinged at one end to one of the loom ends respectively. The other ends of the levers projecting towards each other are connected by a T-formed lever, bar, or by chain, belt, or cord and pulley, attached equidistantly from the fulcrums of the lever to a weighted lever hinged at one end to the cross rail of the loom, the other or weighted end of this lever being connected by a chain, belt, or cord to a pulley or lever fixed on the vibrator shaft, so that the pull or stretch of the warp will always lift the weighted lever and release or remove the pressure from the warp beam, and thereby let off the proper quantity of warp required.—Patent abandoned.

510 E. DORSETT, London-street, E.C. *Furnaces.* Dated February 19, 1869.

This consists in the employment of liquid hydrocarbons for the purpose of producing an intense heat in furnaces, chambers, or kilns used for heating, smelting, or working metals and other substances. In carrying out the invention the inventor first evaporates and distributes in the vaporized state under pressure (as described in a patent granted January 18, 1868, No. 176) the liquid hydrocarbons through a pipe or series of pipes, from which the vapour issues in the form of jets. As this vapour escapes from the holes in the pipe it mixes with the air necessary for its combustion (the air being previously heated if required) and the hydrocarbon vapour thus mixed with air (or in some cases with steam or other gases) enters the chamber or furnace through an opening or openings formed therein wherever it may be found most convenient, such openings being provided with doors or other means of regulating the quantity of air or gas required to feed the flame, or to modify its action upon the metal placed in the furnace to be heated, melted, or converted, as the case may be.—Patent completed.

511 A. HENRY, Edinburgh. *Breech loaders.* Dated February 19, 1869.

This consists, in the first place, in arranging the breech-piece, lock, and extractor in such a manner that, on lowering the breechpiece after the discharge of the firearm, the lock is cocked in readiness for the next discharge, and the spent cartridge case extracted. These actions are effected in the following manner:—In the rear end of the breech cavity, an opening is made through which protrudes one end of a bent lever which is carried upon a centre bearing stud or shaft. The lower end of the lever projects downwards behind the breech cavity, and in an opening in the stock wherein the lock is also contained. On depressing the lever to which the sliding breechpiece is connected, the breech being thereby lowered, its under side comes into contact with the projecting end of the lever before referred to, which is therefore depressed, whilst its outer end is elevated, and in being so elevated it comes into contact with a projection attached to the tumbler, which is therefore also raised until it is thrown into "full cocked" or "half cocked" position, in which it is retained by a pawl falling into notches or catches made in the lower edge of the tumbler piece.—Patent completed.

512 L. G. MOORE, Erith. *Windmill feather sails.* Dated February 19, 1869.

The opposite arms are made extending from the extreme end of one sail to the extreme end of the other and opposite sail, thereby having the two sails opposite to each other. On one arm the two sails are fixed at right angles to each other, and the arm is held in such a manner on the axis that it can partly revolve and the sails move with it, so that when one sail is in position to catch the wind the opposite sail coming against the wind is edge-wise, and offers little resistance. The arms are fixed on the sails at a point a little above the centre of gravity, and stops are provided to prevent the arm turning more than required for feathering the sails, which are under the control of a governor worked by the wind.—Patent abandoned.

513 J. LOADER, Finsbury. *Steam generators.* Dated February 19, 1869.

The inventor leads the steam pipe or tube through the main body of the water in the steam generator or boiler.—Patent completed.

514 S. MYERS, New Bond-street. *Churns.* Dated February 19, 1869.

In a cylindrical or otherwise shaped vessel containing the cream, egg yolks, or other matter to be treated, is an axis or shaft free to revolve when turned by hand or otherwise, and communicating motion to a fan wheel or screw, or a contrivance consisting of blades, vanes, or plates, placed in any desirable position with respect to the shaft. For instance, in one arrangement this wheel or fan may consist of segments, sections, or interrupted portions of discs or circular plates, which, if completed (or the planes of which) would intersect each other at right angles or other angle. Two of the vanes may be in a line with, that is to say longitudinally of, the shaft, and two may be at right angles thereto, or they may be at various angles to the shaft and to each other. They may be straight or curved, plane or helical, and they may form portions, segments, or sections of a screw. They may be perforated or not. Rotary motion on being communicated to this shaft or axis transmits such motion to the blades, vanes, or plates mounted in the vessel, and the necessary action is thereby produced on the cream or other substance to be treated in the vessel.—Patent completed.

515 T. SMITH, Manchester. *Treating woollen cloth.* Dated February 19, 1869.

The inventor spreads over the cloth spermaceti, paraffin, or other such matters, either alone or in combination with wax. The arrangement of apparatus employed for applying the material in a cold state, to be subsequently heated, consists of three cylinders made of wire gauze, or otherwise provided with fine perforations; beyond these are steam cylinders such as are ordinarily used for drying woven fabrics, and there are tension rollers as well as a roller upon which the goods to be thickened are placed, and another roller which receives the goods when so treated. The thickening substance having been reduced to a powder, is placed in the first-named cylinders, and the goods are caused by the tension rollers to pass in contact with the surfaces of the gauze cylinders, and subsequently in contact with the steam or second-named cylinders, after which they are wound upon the roller last named.—Patent completed.

516 J. DAVEY, Wisbeach. *Motive power engines.* Dated February 19, 1869.

The inventor causes what may be considered the cylinder head to travel with the piston until it approaches the initial point. It will then rest, and steam being admitted between it and the piston, the piston will be caused to act in the ordinary manner.—Patent abandoned.

517 A. M. CLARK, Chancery-lane. *Increasing tractive power.* Dated February 19, 1869.

This consists in providing a series of flat independent bearing surfaces, each attached at its centre to the periphery of the traction wheel. These flat bearing surfaces are provided with cheeks embracing the rim of the wheel

in the manner of a skid brake, and form horizontal surfaces bearing in succession upon the road in lieu of the circular surface of an ordinary wheel, to which the flat surfaces are tangential.—Patent completed.

518 E. HEWETT, St. Leonard's-on-Sea. *Chimney cowls.* Dated February 19, 1869.

The inventor forms the cowl of a tube of considerable height, and of about the same diameter as the chimney itself, above which it is mounted so as to turn on a vertical pivot. The top of this tube may either be closed and provided with an aperture at one side for the exit of the smoke, or it may be of curved form like an ordinary cowl, and is in each case provided with a suitable vane. The top of the chimney is closed with the exception of a central opening for a smoke tube of about half the diameter of the cowl mounted on the top of the chimney, and passing about half way up the cowl.—Patent completed.

519 H. T. and T. JENNINGS, Sidney-street, City-road. *Steam engines.* Dated February 19, 1869.

In addition to forming the cylinder with two passages leading one to each of its ends, through which steam is alternately admitted to and allowed to escape from the ends of the cylinder by means of a slide valve worked by an eccentric, as heretofore, the inventor also forms another opening at each end of the cylinder, which opening or passage is only employed for allowing steam to escape from the cylinder. The opening and closing of these passages he effects by means of a slide valve worked, by preference, by cams on the crank shaft or by tappets from the piston of the engine, so that as the piston is moving towards one end of the cylinder not only will the ordinary exhaust passage be open to allow steam to escape from that end of the cylinder, but, in addition, there will be a second outlet for the steam, and this second outlet will be kept open until the piston has all but completed its stroke.—Patent completed.

520 J. BARTON, Birkenhead. *Water heater.* Dated February 19, 1869.

This consists in bringing steam into direct contact with the water to be heated in a closed vessel, when the supply of water to such closed vessel is controlled by mechanism operated automatically from or by the water level in the closed vessel or heater.—Patent completed.

521 W. R. LAKE, Southampton-buildings, W.C. *Ice apparatus.* (A communication.) Dated February 19, 1869.

The inventor first constructs a box or case of wood, of which the first thickness is about 8-10in., more or less, according to the size of the box to be made. The interior of this first thickness is furnished with another 1in. and six-tenths or more of some bad conducting material, such as powdered wood charcoal or tan after it has served in the tannery. This bed or thickness is covered with an envelope of wood of slight thickness, so as not to make the apparatus too heavy. This envelope is fixed to the first in such a manner that the non-conducting material or bed cannot escape or be displaced, the sides of the case having altogether a thickness of about 2½in. The whole is covered internally with sheet metal, well soldered at the corners to prevent any communication with the non-conducting bed.—Patent completed.

522 M. M'LENNAN, Liverpool. *Permanent way.* Dated February 19, 1869.

This consists, first, in making the joint sleepers, on which the rails are fixed, of iron, secured at the joints by "monkey plates," and fastened by bolts and nuts in a similar manner to the fish plates now in general use. The rails and sleepers thus become united as one piece throughout, the sleepers being so formed as to keep the rails in gauge. Second, in making the intermediate sleepers of iron on which the rails are fixed by means of bolts, washers, and nuts, sufficient provision being made for expansion and contraction of the rail, and also in forming the sleepers like the joint so as to keep the rails in gauge. —Patent completed.

523 G. G. HAIRS, Little Distaff-lane, E.C. *Burning combustible liquids.* Dated February 20, 1869.

The inventor places over a gas burner a vessel or generator of a double cup-like form, which he sometimes surrounds by a chimney. Petroleum or the combustible liquid to be vaporised is placed in the inner cup, which is closed airtight. Gas is admitted by a pipe to the upper part of the cup-formed generator, and after passing over the surface of the petroleum or other liquid (which, being heated, gives off vapour freely) it passes away to the burner beneath by a pipe descending through the bottoms of the double-cup generator. Other pipes may also be connected with the double cup generator to lead off the gas or vapour to other burners, as may be required.—Patent abandoned.

524 G. GREEN, Aberystwith. *Buddles for separating ores, &c.* Dated February 20, 1869.

The improved apparatus comprises a stationary conical table, with its centre depressed and its outer circular rim in a horizontal plane. A vertical shaft passes up through a central aperture, and is made to revolve slowly by any convenient motive power. A tubular arm is carried by the revolving shaft, and, receiving the ores in a pulverised condition and mixed with some water by a central duct in connection with the shaft, delivers them from its outer end round near the outer edge and upon the higher part of the conical table. The shaft also carries a water pipe, which is furnished with small perforated branches, each with an adjusting cock, the series of branches being disposed in the form of a spiral, the outer end of which is a little behind the end of the arm that delivers the ore.—Patent abandoned.

525 J. D. GAULDIE and T. A. MARSHALL, Glasgow. *Steam engines and boilers.* Dated February 20, 1869.

It is proposed to use high pressure steam in cylinders of comparatively small size and working at a comparatively quick rate, with valve gear which can be varied or adjusted by means of a governor so as to keep the engine at a nearly uniform rate, notwithstanding considerable variations in the load.—Patent abandoned.

526 J. T. WIBBERLEY, Leicester. *Winding apparatus.* Dated February 20, 1869.

On the ordinary sliding shaft which carries the right and left handed nuts, the inventor places an arm extending to the top of the machine, and fixed to a tube which works loose on the ordinary sliding shaft, carrying at each end the right and left handed nuts; he also employs two stays extending through a fixed plate on the top of the machine head, and connected to a slide working in guides or recesses in the fixed plate. On the top of the stays he fixes a plate which supports another movable plate working in recesses and carrying at each side a slide catch spring and adjustable screw, and near each end of the movable plate there is a pin projecting from underneath and working in a slot in the under plate.—Patent abandoned.

527 J. MASSON, Norwood. *Corkscrew and wax receptacle.* Dated February 20, 1869.

This consists in the employment of a lever for lifting the stem or shank of a corkscrew after the ordinary spiral has been inserted into the cork. This lever is hinged to the top of a barrel passed over the bottle neck; one arm of the lever is a curved loop which embraces the stem, and the other arm forms a handle.—Patent completed.

528 A. JACOB, Bromley. *Sewer ventilating.* Dated February 20, 1869.

This consists in purifying the effluvia in their escape to the surface of the ground, and by facilitating the disposal and removal of charcoal or other material having the property of destroying the injurious effects of sewer gases on health by means of manhole covers.—Patent completed.

529 J. EBERHARD, Tolmer-square, Hampstead-road. *Propelling ships.* Dated February 20, 1869.

At that part of the vessel where the propelling blade or blades protrude, a hole is formed or cut, and each hole thus formed is fitted with a movable filling piece hung vertically on pivots. Each movable filling piece is of the external form of a segment of a circle, so that during the portion of the revolution which it is permitted to make, it exactly fits and fills the hole and makes a watertight joint. Each filling piece is also formed with a longitudinal slot of the size of the propelling blade, so that the blade can pass in and out therethrough.—Patent abandoned.

530 H. W. WHITEHEAD, Holbeck. *Wool combing machinery.* Dated February 20, 1869.

This relates to Noble's combing machine. The object of these improvements is to effect the clearing of the fibre from the noil and other impurities, and this is done by causing the teeth of an inverted circular comb, which may be called a noil-intersecting comb, to work between the inner and smaller circular comb and its drawing-off rollers.—Patent completed.

531 M. GRAY, Highbury-hill. *Electrical conductors.* Dated February 20, 1869.

The conducting copper wire or the strands of fine copper slightly twisted to cause them to hold together are enclosed, first, in pure india-rubber in the ordinary way of insulating conducting wires. This insulated core is overlain with a plastic compound of india-rubber and sulphur of any required thickness, the same being applied by means of the machine shown and described in the specification of the patent granted to the present inventor, F. Hawkins, dated August 11, 1868, or any other suitable machinery may be employed for the purpose. The inventor next laps or coils helically around this coating of india-rubber and sulphur compound (while still in a green or uncured state) a tape or strip of cotton or other suitable fibre measuring (say) 1in. (or more or less) in breadth. This cloth covering he pays over with a solution of the rubber compound, and he prepares the face of a second tape or strip of cloth of similar quality and breadth with the like solution. He then laps this coated cloth or tape (the prepared surface inwards) around the coated wire, laying it, however, in the opposite direction to that of the first cloth covering.—Patent completed.

532 J. H. MOEL, Cambridge. *Hair-cutting machines.* Dated February 20, 1869.

The inventor mounts the drum or axis on which helical knives are fixed in spring bearings, so arranged as to allow those knives which are made rotating to recede slightly from the fixed knife when cutting an unusual thickness of hair.—Patent completed.

533 T. H. SIMMONDS, Great Mitchell-street, St. Luke's, and E. B. MORELAND, Bartholomew-close. *Paper collar finishing compound.* Dated February 20, 1869.

The proportions in this compound are as follows:—Starch in solution, about 25 parts; "satin" in solution, about 25 parts; size in solution, about 12½ parts; glue in solution, about 12½ parts. The ingredients, after being reduced to a liquid condition by the addition of a sufficient amount of hot water, are mixed together, and in this condition applied in any suitable manner on the material to be glazed or finished.—Patent abandoned.

534 B. F. WEST, Rochester, New York. *Double jointed butt hinge.* (A communication.) Dated February 20, 1869.

The improved hinge consists of four plates or leaves, two long plates and two short ones. One of the long plates is secured to the door and the other to the post or jamb. The two long plates are each jointed at the opposite sides of each end to one of the short plates, and when the hinge is close the two long plates lie parallel to each other with the short plates between them. The two short plates are placed end to end, and their opposite edges carry the two joint pins of each end of the hinge, each end of the long plates or leaves of the hinge being connected to the joint at opposite edges of the short plates.—Patent abandoned.

535 F. G. FLEURY, Merrick-square, Southwark, *Water meters.* Dated February 20, 1869.

The casing, which is by preference made in three parts or portions, is constructed so as to form four measuring chambers, two of the chambers with a common axis being smaller than the other two chambers, which likewise have a common axis at right angles, however, to the axis of the two smaller measuring chambers. In meters of large size the two large chambers may be provided with covers. Each measuring chamber is provided with a piston fitting accurately within it. The pistons of the larger measuring chambers are both secured to one flat piston rod, one of the pistons being situated at each end of the rod, the pistons of the two smaller measuring chambers are secured one to each end of a bar (by preference slotted) or to a frame.—Patent completed.

536 J DAGLISH, Seaham Harbour. *Ventilating of mines.* Dated February 20, 1869.

The inventor places the ventilator near the bottom of the upcast shaft, and he arranges it so as to exhaust the air from the workings and force it up the upcast shaft, or he places the ventilator at the bottom of the downcast shaft and arranges it to draw the air down this shaft and force it through the workings and thence up the upcast shaft, thereby causing a constant current of air to move down the one shaft, through the workings, and up the other shaft.—Patent abandoned.

537 R. FOSTER, Buxton, Nottinghamshire. *Boilers.* Dated February 20, 1869.

Upon brickwork is a number of firebars, and upon this brickwork are secured a number of metal bearers upon which stand three separate hollow castings. Two of these castings are placed parallel with the firebars and stand upon the bearers, one of their ends being placed close to the casting or framing to which the furnace door is hung. This frame or casting has a door to close the front of the ashpit below the firebars. The other ends of the two parallel castings lie close to one side of a third casting, which forms the back and has its top side somewhat higher than the tops of the two parallel castings.—Patent abandoned.

538 J. E. LUCAS, Allhallows-chambers, E.C. *Floating velocipede.* (A communication.) Dated February 20, 1869.

This consists in obtaining the requisite buoyancy in a velocipede for navigating the water by means of the propelling wheels and rudder. For this purpose the rudder and wheels are each constructed with one or more airtight chambers or compartments.—Patent completed.

539 J. and W. WEEMS, Johnstone, Renfrewshire. *Malting, heating, and drying apparatus.* Dated February 22, 1869.

This consists in having a series of discs or floors arranged one above the other, and passing through the centre of these floors is an upright revolving shaft with radial arms, on which are fixed directing blades or conveyers. These floors have openings at their centre and periphery for the passage of the grain from floor to floor. The barley or malt being fed on to the top floor at the centre is distributed over it in layers by the directing blades, and descending on to the next floor at the outer openings passes from thence to the centre, and falling through the central opening and so on until by the action of the blades all the floors are covered.—Patent completed.

540 W. IBOTSON, New Inn, Strand, W. W. LADELLE, Wraysbury, and A. G. SOUTHBY, Bulford House, near Amesbury. *Paper manufacture.* Dated February 22, 1869.

The inventors feed the materials, in order to secure regularity, either by hand or by a revolving roller or rollers, or other apparatus into one end of a revolving cylinder, and at the same time feed into the other end water or such chemical solutions as may be desirable (the same being either hot or cold) and make the materials pass through in one direction while the water or other solutions pass through in the other, the two being alternately beaten and rubbed together and squeezed apart during their passage by the action of rollers and strainers, or of either of them.—Patent completed.

541 S. OSBORN, Sheffield. *Reaping and mowing knives.* Dated February 22, 1869.

This consists in making the knife bar in the form of a clip by folding a long strip of malleable iron or steel or other suitable metal along a longitudinal line. If preferred, the clip may be folded along a line more or less on one side of the centre line, so that one edge may project beyond the other. The folding of the strip of metal may be effected in any convenient manner, but it is preferred to first bend or partially fold it between a pair of dies in a suitable press, the upper die being a narrow angular piece, which bears upon the longitudinal centre line of the strip or bar, whilst the lower die is in the form of a groove with inclined sides. The strip or bar being suitably heated is laid upon the grooved die and is forced and bent down into the groove by the descent of the upper die. The partially folded strip is then reheated and is placed between a pair of flat-faced dies, which compress the two edges of the strip together. The faces of the second die are slightly inclined towards each other, and they compress the edges of the strip together, whilst leaving the inner parts of the recess or grooves at a distant apart corresponding to the thickness of knife to be inserted. —Patent completed.

542 J. O. C. PHILLIPS, Birmingham. *Artificial teeth.* Dated February 22, 1869.

This consists in setting each tooth in an elastic socket, by means of which the teeth are connected either directly or indirectly to the artificial gums.—Patent completed.

543 J. W. REID, Bayswater. *Paper pulp apparatus.* Dated February 22, 1869.

This consists chiefly in subjecting the wood or other vegetable fibres to the action of heat and alkali, and at the same time projecting them during the whole process, by keeping them covered by the liquor from the deleterious action of the steam necessarily generated by the heat.—Patent completed.

544 W. R. LAKE, Southampton-buildings. "*Locomotive heating.*" (A communication.) Dated February 22, 1869.

The apparatus consists of a vessel fixed to the fire-box, which serves as a reservoir for the coal. This reservoir is filled from the tender through a tube. The reservoir is closed at the top by a conical cover to prevent the falling in of the ashes from the grate bars; the ashes fall upon the cover, and from the cover pass to the ashpit.—Patent completed.

545 G. A. FALL, Hoboken. *Propelling vessels.* Dated February 22, 1869.

The object is to avoid the friction of a vessel sliding endwise through the water. This is accomplished by making the buoyant power a series of revolving cylindrical floats, arranged in pairs on shafts so as to roll over the water and sustain a platform between four or more such floats, or these floats may be arranged one behind the other.—Patent completed.

546 T. S. BLAIR, Pittsburg, U.S. *Iron and steel.* Dated February 22, 1869.

This relates to a previous patent dated November 23, 1868, No. 3565. The inventor now employs manganese, and takes any of the various oxides of that metal according to economic advantage, and reduces the one chosen to about the same degree of fineness to which the iron or other oxide has been reduced that is to be employed in the manufacture of the conglomerate or "pig bloom" by the process. It may be in the form of powder, but as it is important that it should be well and evenly mixed through the ore, it will be found desirable to have the two materials of about an equal degree of fineness.—Patent abandoned.

547 J. and T. LEACH, and J. GOODYEAR. *Wool winding.* Dated February 22, 1869.

In guides at the upper part of two side frames, the inventors place slides carrying discs forming the flanges of the bobbin, there being a central hole in one of the discs for the bobbin to pass through and a central hole in the other disc for a pin which passes through a hole in the centre of the bobbin. In one of the slides is formed a

seating of the same radius as the bobbin and central with it, and in the other slide there is a central hole corresponding with the hole in the disc for the bearing pin to pass through. Below the slides there is a shaft carrying a toothed wheel or pulley for working the machine. A surface drum for causing the bobbin and lap to revolve, and a pinion for giving motion by means of the gearing to a wheel, are placed at an angle for working the traversing lever. On the shaft is also fixed a ratchet and a loose cam having at one side a catch, and arm, and lappets, the catch gearing with the ratchet wheel when revolving motion is required to be given to the cam and lappets for working a lever and plate used for pushing off the bobbin and lap when the winding on is completed and to prevent the catch gearing with the ratchet wheel. Until required, the arm of the catch is held back by a finger on the front slide.—Patent completed.

548 B. J. B. MILLS, Southampton-buildings. *Artificial stone.* (A communication.) Dated February 22, 1869.

This consists in the production of an artificial stone by combining fragments, chips, or powder of stone or other mineral substance with calcined magnesia and bittern water.—Patent abandoned.

549 J. E. LILLER, Bedford. *Apparatus for printing.* Dated February 22, 1869.

This consists in the employment of a band which is made to travel so as to present to the face of the "form" one of its surfaces and to withdraw it again at required intervals. The sheets of paper or other material are placed on the surface of the band which is so presented and withdrawn, and are thus carried to and from the required position.—Patent completed.

550 J. H. JOHNSON, Lincoln's Inn-fields. *Velocipedes.* (A communication.) Dated February 22, 1869.

A wheel is employed in which is a circular opening concentric with the periphery of the wheel, and in this opening is an annular rib on each side of which a flange of a driving wheel fits snugly, but so as to move freely, the peripheries only of the two flanges of the driving wheel bearing against the inside of the annular opening in the main wheel. The driving wheel is secured to a spindle which passes through and has its bearing in the opposite sides of a seat or saddle at one end of the same, the opposite end of the saddle having a spring carrying a flanged roller adapted to the circular rib of the main wheel.—Patent abandoned.

551 W. E. NEWTON, Chancery-lane. *Screw wrenches.* (A communication.) Dated February 22, 1869.

This consists, first, in constructing the hole through the sliding jaw for the shank to pass through sufficiently large to admit of the jaw being readily disengaged from the screw, or be thrown into gear therewith so that the adjustment of the jaw on or along the shank may be effected either by an independent sliding movement of the jaw along the shank or by or through the intervention of the screw, at the pleasure of the operator, and as circumstances require.—Patent abandoned.

552 J. B. RUSHBROOK, Bury St. Edmunds. *Sheep fold hurdles.* Dated February 22, 1869.

This consists in constructing an iron hurdle with two openings capable of being adjusted wider or narrower at will to suit the size of the lambs and sheep that have to pass through them. Another feature of novelty consists in providing the top and sides of such openings with rollers to prevent injury to the lambs, and also to enable them to pass freely through the said openings. It is proposed to use one of these hurdles at each side of the pen or fold, and to connect wooden hurdles of the ordinary kind with the metal hurdles above mentioned in the construction of the fold.—Patent abandoned.

553 R. MELDRUM, Pittormie, Cupar. *Stopping locomotives.* Dated February 22, 1869.

This consists in making communication from the steam boiler, air, gas, or water chamber, directly to or about that part of the cylinder whence the steam, air, gas, or water escapes after having done its work in the cylinder. —Patent abandoned.

554 J. BLYDE, Sheffield. *Gardeners' scissors.* Dated February 22, 1869.

The inventor affixes a spring to one of the blades of the scissors or apparatus, which spring is secured to a piece or holder situate at the side of that one of the blades above referred to, such piece extending beyond the edge of the same and having a broad part which acts against the other blade of the scissors or apparatus, by which arrangements the desired action of the scissors will be obtained.—Patent abandoned.

555 H. F. FREUTEL, Kingsland-road. *Hats and caps.* Dated January 22, 1869.

The inventor proposes, instead of applying a lining or body of cork, gossamer, hair, or other usual fabric, to employ a body or lining of paper, which is to be caused to adhere to the outer fabric or covering by means of a solution of caoutchouc, gutta percha, shellac, or other suitable adhesive solution or any combination of the same.—Patent abandoned.

556 R. P. WILLIAMS, Great George-street, S.W. *Railway crossings and switches.* Dated February 22, 1869.

In constructing railway crossings where two lines cross each other, the inventor forms one of the crossing lines of a continuous rail and the other crossing line in two parts, one on each side of the continuous rail. Each part where it meets the continuous rail is bent round at an angle to come parallel with this rail, and is securely fixed thereto. The bent round end of the rail which comes up to the inner side of the continuous rail is retained at the requisite distance from it to allow of its bent round end serving as a guard rail. The continuous rail and the bent end of one of the parts of the crossing rail are notched out to the requisite depth, for the rail which forms the guard rail is thus notched, but in the case of an acute crossing, then the bent end of the other rail is notched out.—Patent completed.

557 J. T. GAZE and J. HYMAS, Erith, Kent. *Grate bars.* Dated February 23, 1869.

The inventors cast or form the grate bars together in sections or groups of three, by preference with spaces between for the admission of air, so that they form three ribs connected at intervals by narrow strips.—Patent abandoned.

558 A. JOBSON, Darlington. *Coke ovens.* Dated February 23, 1869.

The coke ovens are built on pillars of firebrick or stone in such a manner as to allow of space beneath them for the application of an improved system of unloading or discharging them, and no door is formed in front of the oven. The bottom, instead of being constructed in the ordinary manner, is formed either wholly or principally of a movable bottom or door, opened and closed and supported when shut by means of toothed arcs or segments. The framework of the door is of iron, which may be cast, but it is preferred that it should be malleable iron, the bottom part being one piece of plate secured to the surrounding angle iron in such a manner as to bind the whole securely together, and to exclude the air as far as practicable. On the plate iron are supported fireclay quarries of suitable thickness, bedded in ground fireclay to protect the iron from the action of the fire, and to maintain the lower part of the coke oven as hot as possible. To still further prevent the radiation of heat a stratum of any non-conducting substance may be interposed between the fireclay quarries and the bottom iron plate.—Patent completed.

559 J. BREEDEN, Birmingham. *Taps and stopcocks.* Dated February 23, 1869.

The body of the tap is made in two halves or parts joined together by flanges, the body having internally the general figure of a hollow cylinder. The entrance pipe opens into the lower half or part, and the exit pipe into the upper half or part of the body. A circular disc of strong and hard leather is inserted and fixed between the flanges of the two parts of the body of the tap, the disc constituting a diaphragm extending across the middle of the said body. This diaphragm has one or more perforations in it through which the liquid or fluid passes, and on the lower side of the diaphragm is fixed a metal strengthening plate having an opening in it coincident with that in the diaphragm. In the upper half of the body is a plug, the lower portion of which is of the same diameter as the body, and works closely but freely therein. The upper end or stem of the plug passes out at the top of the tap, and is provided with a handle or with a lever for giving a rotary motion to the plug. The lower end of the plug bears upon the upper side of the leather diaphragm, and has a hole in it similar in size, shape, and position to that in the diaphragm.—Patent completed.

560 J. JOHNSON and W. GILL, Unstone, Derby. *Rotary engines and pumps.* Dated February 23, 1869.

This consists of a cylinder secured on a foundation, and having a central shaft working in bearings at each end or side of the cylinder. On this shaft is mounted a circular piston revolving eccentrically around and within the cylinder, at the top of which the inlet and exhaust pipes are applied.—Patent completed.

561 B. W. FAREY, Bermondsey. *Gas valve facings.* Dated February 23, 1869.

A groove is formed in one or both of the seatings or faces of the valve, into which groove is introduced, by any suitable means, water, oil, or other fluids, which must be at a pressure exceeding that of the gas for which the valve is employed to regulate or stop the flow. It will be readily understood that should the seatings or faces of the valve not be tight, a leakage of water, oil, or other fluid will take place, thus effectually preventing all escape of gas between the seatings or faces. Any water, or oil, or other fluid so leaking through can be taken off by syphons, one on each side of the diaphragm or slide of the valve, or by any other convenient method.—Patent completed.

562 W. F. C. MOUTRIE, Southampton-row. *Pianofortes.* Dated February 23, 1869.

This consists in the addition of one or more strings to the scale of the ordinary pianoforte now in use, when by means of any convenient mechanical arrangement the player can at will alter the pitch from that in ordinary use to a lower one, or if he should desire it to a higher one.—Patent abandoned.

563 J. NEILSON and J. MARSHALL, Glasgow. *Metallic capsules.* Dated February 23, 1869.

This consists in coating the end or other part of the metallic capsule with varnish or resin, in pressing thereon paper which has had the trade mark, name, or device printed on it on the face or side that is applied to the capsule, in washing away the paper, and in finally protecting the trade mark, name, or device which remains on the capsule with a thin coating of glue or varnish.—Patent completed.

564 A. V. NEWTON, Chancery-lane. *Locomotive fireboxes and ashpans.* (A communication.) Dated February 23, 1869.

This relates, first, to the use in locomotive engines of fireboxes with solid or pan-like bottoms (that is, without grate bars or openings through the bottoms), whereby the live coal will be retained in the firebox until wholly consumed, and any scattering of coals or fire upon the track will be prevented. Second, to the arranging of the draught flues and dampers so that the air will pass over the firepan or ashpan and feed the fire from the four sides of the furnace, and at a convenient distance above the bottom of the pan, which arrangement secures a very effective feed or supply of the air to the fire. Third, to a combination of angle plates with a firebox having a close or solid bottom, whereby the fuel is made to slide down and press together in close contact as it is being consumed.—Patent completed.

565 S. HOLROYD, Newton Heath, Manchester. *Recovery of water from gas purification.* Dated February 23, 1869.

The inventor takes the substance which is commonly employed for abstracting sulphur from the gas (oxide of iron, for instance), and places it within a suitable vessel, to which steam or air is admitted, and the temperature thereof being raised, the sulphur is detached from the iron and may be recovered for the manufacture of sulphuric acid or other ordinary purposes.—Patent abandoned.

566 H. BESSEMER, Queen's-street Place, Cannon-street. *Making cast from pig iron.* Dated February 23, 1869.

The inventor prefers to place two or more converting vessels in such a position with reference to each other that their respective axes are in a straight line with the axes, being at a distance of 3ft. to 4ft. above the general floor level. Beneath each vessel a small pit is formed, and an arched passage passes from one pit to the other in the line of the vessels' axes, and terminating beyond the building, so that, by means of a line of rails laid in the passage, the ashes or other debris of the operation may be readily removed on trucks moving on three rails. An incline or a lift may be employed to raise the trucks up to the general ground level.—Patent completed.

567 W. E. GEDGE, Wellington-street, Strand. *Hand vice.* (A communication.) Dated February 24, 1869.

The horizontal screw of ordinary hand vices is in this invention replaced by a vertical pressure or adjusting screw, which is pierced in its entire length, as is also the handle to facilitate working upon a long rod or spindle, on which it is desired to cut a screw or make a long pin.—Patent completed.

568 J. J. MYERS, Spa-road. *Railway warnings.* Dated February 24, 1869.

Inside and longitudinally with the ceiling of each carriage, the inventor uses a cord, rope, or chain, connected with a screw and nut or hook and eye in each compartment, so as to form a continuous line capable of being disconnected at will in each division of the carriage. One end of this cord, rope, or chain is fastened inside to one end of the carriage, and the other end is connected with a weighted lever (with or without a spring) fixed and working a movable shaft or spindle in suitable bearings on brackets projecting from and fixed to one end of each carriage outside. The shaft or spindle at one of its ends has a projection at a right angle similar to a half crank or fork, with or without a wheel or roller to diminish friction connected thereto; the under side of the cranked part or fork is bevelled sharply off to form a steep incline. —Patent abandoned.

569 J. WHITEHEAD, Oldham. *Furnaces.* Dated February 24, 1869.

This consists, principally, in the application of a perforated block of brickwork or fireclay of any length, which is placed above or in the place of the ordinary bridge at the back end of the firebars. This block of brickwork or fireclay rises from the level of the firebars up to the top of the flue in fluid bodies, and up to the boiler in fireplaces for egg-ended or any other kind of boilers which are fixed underneath.—Patent abandoned.

570 W. A. IVES, New Haven, Connecticut, U.S. *Tenon and mortise machines.* Dated February 24, 1869.

This consists of a table on which is laid the woods to be tenoned and mortised. This table has appropriate machinery for imparting to the wood intermittent reciprocating movements back and forth, as well as laterally, like a planing machine, for the purpose of feeding the wood up to a mortising expansive bit and tenoning hollow expansive auger, which are held in position by a tool holder and holders being sustained in bearings on the stand, and having toothed wheels on their inner ends which engage with a wheel on the driving shaft carrying a pulley and belt through which the combination is operated.—Patent completed.

571 W. WILLIAMS, Liverpool. *Pipe joint.* Dated February 24, 1869.

This joint is designed to avoid the defects found in rigid and flexible joints as at present formed. It consists in the direct contact or union of a cylindrical socketed tube with a spherical butt-ended pipe without the intervention or use of lead or packing.—Patent completed.

572 J. COOKE and C. HIBBERT, Richmond. *Steam jet vacuum power.* Dated February 24, 1869.

In applying this invention to a steam engine the inventors connect the exhaust pipe from the steam cylinder to a vessel into which water flows or is injected, and a jet of steam is caused to act on the water as it is passing to the discharge pipe. The nozzle of the steam pipe is tapered off and fits into an enlarged portion of the discharge pipe, the action of the steam inducing a powerful current which draws the air and water from the steam cylinder and produces the desired vacuum therein.—Patent abandoned.

573 B. HUNT, Serle-street, W.C. *Bobbin friction regulators.* (A communication.) Dated February 24, 1869.

The object of this invention is to remedy this defect by rendering automatic the displacement of the small friction cords above mentioned, which may be effected in the following manner:—First, by making the notched bar over which the cords pass advance longitudinally and thus increase the contact of the cords with the bobbins. In this case the points of attachment of the friction cords to the bobbin rail remain fixed. Secondly, by leaving the notched bar a fixture, and causing a bar which carries all the points of attachment of the friction cords to travel longitudinally.—Patent completed.

574 J. I. VAUGHAN, Keusal Green. *Utilising waste liquors from tin plate works.* Dated February 24, 1869.

A quantity of crude magnesite is broken or pulverised and placed in a receptacle containing a liquor containing copperas or sulphate of iron, which is allowed to filter through it, by which means the free sulphuric acid is neutralised. The filtrate is then heated with a further quantity of pulverised magnesite and subjected to heat, whereby the sulphuric acid of the copperas or sulphate of iron contained in the liquor is expelled therefrom and absorbed by the magnesia, the iron being left in the form of oxide. This process may be varied by treating the filtrate with calcined magnesite or magnesia so as to throw down the iron, the supernatant liquor being cleansed and boiled down and the precipitated oxide of iron treated as may be required by drying or roasting to render it applicable for polishing, the manufacture of colours, and other useful purposes.—Patent completed.

575 R. MORTON, Nine Elms. *Gas apparatus.* Dated February 24, 1869.

This consists in casting the mouthpiece somewhat thicker than usual at its outer extremity so as to form a surface about an inch wide all round. The face of the mouthpiece is then turned, planed, and scraped, or otherwise surfaced. The lid may be made of cast malleable iron or steel or other suitable metal, but it is preferred to make it of wrought-iron plate, stamped, shaped, or fashioned into a concavo-convex form with its edge bent up all round its periphery.—Patent completed.

576 G. REES, Holloway. *Designing on glass, &c.* Dated February 24, 1869.

The object is to produce ornaments or devices by vitrifying pounded glass upon glass and glazed ware or by cementing together fragments of coloured glass or glazed ware arranged in patterns or not by vitrifying a layer of pounded glass on to and amongst such fragments. The glass after it is pounded is sifted through sieves, the meshes of which correspond to the size of the particles of glass intended to be used on the surface of the gloss or glazed ware. By way of example, the inventor takes a sheet of glass, whether polished or not, and prepares the surface by brushing or otherwise applying a gummy or other adhesive liquid thereon. He then sprinkles pounded glass over the gum, which adheres to it. The glass thus pre-

pared is placed in a furnace or under heat in any suitable manner in order to vitrify the pounded glass upon the surface of the sheet glass. The pounded glass may be of one or a mixture of colours, or the sheet glass may be of a white or other colour.—Patent completed.

577 J. T. Griffin, Fleet-street. *Harvesting machines.* Dated February 24, 1869.

The finger beam and cutters are connected to bars or supports which pass through one of the main driving wheels, which is supported upon rollers attached by bars to the main axle. The main axle is rigidly fixed to the frame. The driving wheels are each made with an internal rib or feather, the collars bearing upon or against the rib of one of the wheels. The insides of the rim of the wheels are formed with teeth for pinions to work in which drive or operate the cutters. The bars or supports for the finger beam are jointed to the main frame so that they can be raised and lowered by means of a chain and lever placed within reach of the driver in order to regulate the height of cut, the lever being held in place by a bolt passed into holes in a quadrant. The axle in which the pinions are mounted is furnished with two clutches, the forks of which are connected to one hand lever so that both can be thrown into and out of gear simultaneously.—Patent completed.

578 W. H. Tooth, Greenwich. *Manufacture of bricks.* Dated February 24, 1869.

This relates to an improved composition of which bricks, tiles, and the other articles required in building operations may be made. The base of the composition, as in most concrete masses used for similar purposes, is gravel, broken stone, or other hard material, preferring such materials as contain a proportion of iron. The mass is wetted with a solution of soda or other alkali together with a small quantity of sal ammoniac. The addition of a little sulphur in powder will quicken the setting of the ingredients, as it will act on the iron and will develop heat. When well mixed the ingredients may be moulded and pressed in the machine, which also forms the part of this invention, but which it is impossible to describe here. —Patent abandoned.

579 E. A. V. Leroi, Paris. *Carding engines.* Dated February 25, 1869.

This consists, first, in producing, by means of ordinary cards or carding apparatus, madding pieces and slivers of horse or other hair of a description similar to those produced from cotton. Second, in obtaining on the card or carding apparatus products of various textile materials laid one upon the other.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated September 7, 1869.

2627 R. Martyn, Clinton Villa, Redruth, Cornwall, W. W. Martyn, Pennance Gwennap, Cornwall, and W. C. Trevena and T. H. Harry, South Downs, Redruth, Cornwall. A wheel buddle for dressing tin ores, and ores of all metals and water, with ore in suspension and earthy substances.

2628 W. B. Thompson, Dundee. Improvements in auxiliary screw propellers.

2629 W. H. Richards, Birmingham. Improvements in chair and trunk nails, which nails are employed also for other useful and ornamental purposes.

2630 S. Rawsthorne and J. Metcalf, Preston, Lancashire. Improvements in mules for spinning.

2631 A. M. Clark, Chancery-lane. Improvements in the construction of ships and other vessels.

2632 F. Ellershausen, Southampton-buildings, Chancery-lane. Improvements in the means and apparatus for utilising the force of the waves.

2633 T. King, Manchester. Improvements in pianofortes.

2634 G. Little, Rutherford Park, New Jersey, U.S.A. Improvements in apparatus for composing, transmitting, and receiving telegraphic communications.

2635 A. V. Newton, Chancery-lane. An improved mode of preventing the radiation of heat from steam boilers.

Dated September 8, 1869.

2636 R. E. Hodges, Southampton-row, Middlesex. Improvements in keyhole guides.

2637 R. H. Hill, Parliament-street, Westminster. Improvements in crossings for railways.

2638 H. D. P. Cunningham, Bury, near Gosport, Hants. Improvements in means for lifting up and taking off heavy bodies on and from racks or stands or carriages, and in the construction of such stands or racks.

2639 H. B. Barlow, Manchester. An improved knitting machine.

2640 S. Oddy, Adelphi Iron Works, Salford, Manchester, and R. Nuttall, Bury, Lancashire. Improvements in mules for spinning.

2641 C. P. Stewart and J. Kershaw, Atlas Works, Manchester. Improvements in centre rail locomotives.

2642 K. Kraus, Sidmouth-street, Middlesex. An improved watch protector.

2643 T. Walker, Robert-street, Chelsea, Middlesex. Improvements in electro-telegraphy.

2644 C. H. Murray, Loman-street, Southwark. Improvements in the manufacture of screw propellers.

2645 W. E. Newton, Chancery-lane. Improvements in metallic packing for piston rods and other purposes.

2646 A. M. Clark, Chancery-lane. An improved machine for cutting or dressing millstones.

2647 A. and G. E. Earnshaw, Sheffield, and F. Earnshaw, Harrington-street, Middlesex. A new or improved mode of, and apparatus for, comparing musical keys, and for examining and explaining musical relations and harmonies, chords, and consonances.

2648 J. A. Muller, Chancery-lane. Improvements in apparatus for measuring and registering the flow of water and other liquids, part of which improvements is applicable to measuring and registering the flow of gases.

2649 W. Baines, Railway Plant Works, Soho, Smethwick, Staffordshire. Improvements in apparatus for ensuring safety to railway trains by controlling the signals and switches, and by disconnecting and stopping the carriages when requisite to avoid accident.

Dated September 9, 1869.

2650 W. Palliser, Army and Navy Club, Pall Mall. Improvements in rails for railways.

2651 D. J. Williams, Birmingham. Improvements in movable partitions for the interiors of buildings, and in shutters for such wide openings in the outside walls of buildings as require no glass or like substance.

2652 F. Forder and J. J. Traves, Wolverhampton. Improvements in the bearings of loose axles for velocipedes and other carriages.

2653 J. Gillies, Glasgow. Improvements in bushes or shields for the bungholes of casks or other vessels, and in the means employed for fixing the same therein.

2654 A. H. Gilmore, Edinburgh. Improvements in means for protecting or shielding wounds, cutaneous injuries, and sores.

2655 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in electric batteries.

2656 W. T. Lillicrap, Stonehouse, Devonshire. Certain improvements in carts and other vehicles, and in apparatus connected therewith.

2657 J. A. Jaques and J. A. Fanshawe, Tottenham, Middlesex, and J. T. Oakley, Grange-road, Bermondsey, Surrey. Improvements in machinery for grinding and surfacing rings, plates, discs, and other analogous articles.

2658 D. Colville, Red Lion Court, Fleet-street, City. An improved mode of, and apparatus for, producing printing surfaces.

Dated September 10, 1869.

2659 A. H. Brandon, Rue Gaillon, Paris. Improvements in central-fire cartridges for breech-loading firearms.

2660 P. Hall, Birkenhead, Chester. Improvements in apparatus for transmitting motive power.

2661 W. Morris, Whitechapel, Middlesex. A new and improved method of, and apparatus or appliances for, the manufacture of cigars.

2662 W. N. Nicholson, Newark-upon-Trent, Nottinghamshire, and G. Black, Grantham, Lincolnshire. Improvements in agricultural drills for sowing grain and seeds with or without manure, and also for sowing or distributing manure.

2663 J. H. Johnson, Lincoln's Inn-fields. An improved fastening for metallic hoops or bands.

Dated September 11, 1869.

2664 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus for extinguishing fires.

2665 L. Henrion, San Pier d'Arena, Italy. An improved mode of, and arrangements for, promoting combustion in fireplaces and furnaces.

2666 S. Simpson, Preston, Lancashire. Improvements in machinery for drawing fine wire.

2667 B. Kershaw, Warwick-place, Maida Hill, Middlesex. Improvements in the construction of vessels or apparatus for preserving meat and other articles of food.

2668 J. E. Moorhead and W. Dudgeon, Donacloney, Ireland. Certain improvements in jacquard machines.

2669 J. H. Johnson, Lincoln's Inn-fields. Improvements in apparatus for producing sonorous signals and musical sounds.

2670 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in machinery or apparatus for moulding articles in ceramic or plastic materials.

2671 W. A. Lyttle, The Grove, Hammersmith, Middlesex. Improvements in telegraph posts.

2672 M. Andrew, Birmingham. Improvements in locks and latches.

2673 J. Betteley, Cavendish House, Bootle, Lancashire. Improvements in constructing and sheathing ships.

2674 S. Fox, Stocksbridge Works, Deepcar, near Sheffield. Improvements in the permanent way of railways.

2675 J. B. Palmer, Palace Works, Old Ford-road, Bow, Middlesex. Improvements in the manufacture of matches and fusees, and of surfaces to be used for igniting matches and fusees.

Dated September 13, 1869.

2676 F. S. Cocker, Kingsland, Middlesex. Improvements in velocipedes.

2677 W. E. Gedge, Wellington-street, Strand. An apparatus termed The Indispensable for preventing liquids in ebullition from boiling over.

2678 A. V. Newton, Chancery-lane. Improved means for extinguishing fires and watering streets.

2679 C. Burke, Upper Distillery, Bandon, Cork. Improvements in the treatment of fatty and oily matters to prepare them for the manufacture of candles and for other purposes, and in apparatus for such treatment.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," September 14, 1869.

1344 W. B. Robins	1458 P. W. Flower, H. Nash, and R. Heathfield
1346 J. P. Balm and R. Newton	1529 W. Naylor
1353 P. Barry	1549 W. M'Adam
1355 S. H. Hodges	1560 A. A. Rossignol
1357 J. B. Nimmo	1563 M. Jarvis and E. Millward
1359 D. P. Wright and C. Butler	1656 A. Homingwey
1364 C. Topham	1781 H. W. Hammond
1366 T. Cockroft	1883 S. Holmes
1370 W. E. Gedge	1944 J. Lomax
1386 J. E. Phillips	1960 W. Cowan
1389 E. N. Hudson	2259 T. Winter
1402 R. Fennelly	2333 F. C. Colney
1403 D. and A. Posener	2425 J. Lewis
1405 J. Ramsbottom and T. M. Pearce	2443 J. G. Dale and E. Milner
1410 W. Henderson	2457 R. F. Fairlie
1419 H. A. Dufrene	2486 W. R. Lake
1422 R. Blezard	2490 W. Byrne
1425 R. F. Hoppe	2507 T. Whitehead
1440 W. R. Lake	2527 T. Coley
1445 J. B. Payne	2537 W. R. Lake
1454 J. B. Handyside	2544 B. Hunt
1456 H. Robinson	2556 J. Holdsworth
1493 L. A. V. Dubourg	
1511 W. R. Lake	

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2374 B. Bayliss	2388 G. T. Bousfield
2375 C. C. Connor	2430 A. V. Newton

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2481 W. Hirst	2514 J. R. Johnson and J. S. Atkinson
2506 W. Richards	2520 G. Bedson
2509 T. Molluenx	

LIST OF SEALED PATENTS.

Sealed September 10, 1869.

741 J. B. Bernier	805 W. and C. S. Catt
754 H. Ormson	1231 W. Robinson
766 G. Bray	1846 J. Tangye
784 J. Tenwick	2166 J. H. Johnson
795 W. R. Lake	

Sealed September 14, 1869.

798 W. M'Adam and S. Schuman	1032 J. Sterriker
802 W. Robertson	1034 G. T. Bousfield
806 E. Roper and G. Shaw	1061 W. E. Newton
812 H. Claughton	1088 A. V. Newton
814 M. Rourke	1102 D. B. Peebles
818 J. H. Bennett	1135 A. V. Newton
822 G. R. Mather	1268 J. Crabtree
834 J. Cox	1316 J. Frolich
836 J. Thomas, W. Bacon, and H. Groves	1343 J. Wilson
837 F. W. Fox	1385 C. J. Galloway and J. H. Beckwith
838 A. Albini	1600 J. Brittain
850 H. Whitehouse and W. Probert	1734 F. Lewis
855 J. Kay	1746 A. C. Engert
864 W. G. Crossley	2043 F. Walton
965 T. A. Dillon	2114 S. E. Crispe and J. West
1001 J. Cruttenden and T. Wells	2148 R. P. Williams
1018 F. W. H. Medhurst	2173 W. Leftwich
	2234 J. Hayward
	2248 W. Dredge and A. Stein

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1456	2483	2529	2542	2552	2561	2570	2579
1911	2511	2530	2543	2553	2562	2571	2585
2313	2513	2532	2544	2554	2563	2572	2591
2338	2517	2533	2545	2556	2564	2574	2593
2357	2519	2535	2547	2557	2566	2575	2595
2395	2522	2536	2549	2558	2567	2576	2599
2423	2523	2538	2550	2559	2568	2577	2601
2433	2524	2540	2551	2560	2569	2578	2603
2463	2527	2541					

LIST OF SPECIFICATIONS PUBLISHED

For the week ending September 11, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d		s. d.		s. d.		s. d.		s. d.
3759	0 8	122	1 8	170	0 8	229	0 8	330	0 4	357	0 6
19	0 4	126	0 8	172	0 10	233	0 10	333	0 4	358	0 4
20	0 10	137	1 4	174	1 0	239	0 10	334	0 4	364	0 4
36	0 10	140	1 6	175	0 8	243	0 6	336	0 6	365	0 4
38	1 6	141	1 0	176	0 10	245	0 10	337	0 4	371	0 4
65	2 10	142	0 8	177	1 4	255	0 4	338	0 4	373	0 4
70	0 10	144	0 8	178	0 10	256	0 6	339	0 8	376	0 4
80	1 2	146	0 10	179	1 4	277	0 10	341	0 4	377	0 4
86	0 6	147	2 6	184	0 10	310	0 4	342	0 4	379	0 6
87	0 6	154	0 10	188	0 10	313	0 4	343	0 4	381	0 4
99	0 8	157	0 8	193	0 10	314	0 4	344	0 4	382	0 4
104	0 8	159	1 4	195	1 2	316	0 4	345	0 4	385	0 4
105	0 8	160	1 10	199	1 2	322	0 4	346	0 4	386	0 4
111	0 10	162	0 10	207	0 10	323	0 4	348	0 4	390	0 4
113	1 4	163	1 0	210	1 4	325	0 4	349	0 4	399	0 8
114	1 6	165	0 6	215	1 6	326	0 6	350	0 4	404	0 4
117	1 6	166	0 10	219	1 0	327	0 4	352	0 8	422	0 4
118	1 4	167	1 0	220	0 10	328	0 4	353	0 4	500	0 6
121	1 6	169	0 10	228	0 8						

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, SEPTEMBER 24, 1869.

ASPHALTED SURFACES.

A MIXTURE of the ordinary coal gas tar and common gravel constitutes nine-tenths of the so-called asphalte, and it is no wonder, when the spurious article is passed off for the genuine, that the latter suffers in the estimation of the public, and many refuse to believe in the durability and efficiency of an asphalted surface. This is the natural result of the very cheap and very bad footpaths and platforms that have been laid down in numerous localities and composed of the ingredients referred to. A surface thus constructed will, in spite of the imperfect nature of its components, if the formation of it be carefully attended to, exist for a time in a smooth and apparently sound condition. This appearance is, however, deceptive. The influence of wear and tear, combined with the action of wet, speedily produces hollows and irregularities, cracks and crevices extend their ramifications in every direction, and the opposite effects of heat and cold are equally active in the work of disintegration and destruction. The one renders it sticky in summer, and the other brittle in winter; the whole mass soon breaks up and has to be removed, to the loss and disgust of those who laid it down, and who register a vow never to employ "asphalte" again for any purpose whatever. If we now consider the difference between the spurious and genuine articles, it will not be surprising that the former has no claims to the title that belongs properly to the latter. Instead of being the hasty result of a mixture of tar and sand or gravel, the genuine asphalte has a very different composition. Its chief ingredient is derived from a natural production, drawn from foreign quarries, or mines as they are generally termed. At present, there are very few of these mines, of which the best known is probably that of Pyrimont. The raw material arrives in the form of dark-coloured amorphous lumps containing a large proportion of bitumen, which is extracted by the employment of suitable mechanical means. One of the principal components of bitumen, according to the nomenclature of M. Boisingault, is the substance asphaltene. It has a chemical composition represented by the formula $C_{20}H_{16}O_3$, and we recommend it to those whom it may concern as an excellent name whereby to distinguish the genuine from the spurious article. When it is kept in view that, in order to obtain a material fit for manufacturing asphalte as it ought to be made, it is necessary to import the chief ingredient from Italy, it is evident at a glance that there will be a wide difference in the price of the foreign and the home production. As the price, so is the quality. A permanency and durability are obtained by the use of the extracted bitumen which cannot be expected from the wretched stuff prepared from the ingredients to which we have alluded. At the same time, it is equally necessary to ensure good and sound workmanship in the laying down of asphalte as to provide the best materials. There is a company which has portable machinery, especially designed and constructed for this purpose, which allows of a large area being covered in a comparatively short space of time. As we have deprecated the use of bad and inferior asphalte as exceedingly deceptive to the public, and prejudicial to the prospects of the only proper substance, it is but fair to give a few instances where the latter may be seen and its value appreciated. One of these is, in the words of Mr. Hepworth Dixon, "Her Majesty's Tower." Most of the footpaths, and some portions of the roof, have been laid for some years past with Pyrimont asphalte, and yet present no signs of deterioration. The roof of the new prison at Holloway, and the extensive footpaths around the fountains in Trafalgar-square, are other examples.

According to the climate and the purposes for which it may be intended, so can the composition and character of asphalte be varied. From its nature, it must always possess some little elasticity, even when that quality is required to be reduced to a minimum. This is one of its properties, which is frequently of considerable advantage. It renders it exceedingly valuable as a "damp" course in buildings, and much superior to slates, tiles, concrete, or other hard and unyielding substances. Considering them all on a par with respect to waterproof qualities, the asphalte alone possesses the capability of yielding to any local pressure. Consequently, if any portion of the foundation settle, the slates, tiles, or other hard substances at once break across, and the watertight continuity is destroyed. The asphalte, on the contrary, adapts itself to the settlement of the foundations, and preserves the waterproof layer intact. Anyone who has walked over a large area of properly executed asphalte cannot fail to ask himself the question, whether its application could not be extended to road and street traffic. There is no doubt but that the substitution of asphalte for granite or macadam would be hailed with ecstatic delight by the riders of bicycles. What a road to run on! A portion of Threadneedle-street has within the last nine months been laid down with asphalte, but upon a different principle to that upon which footpaths are constructed. Some time must elapse before it will be possible to judge of the suitability of this surface for the severe tax made upon its powers of resistance and durability by the exigencies of our metropolitan traffic. There is another situation for which an asphalted surface appears to be well adapted, and in which its property of elasticity can be advantageously brought into play. It is in the case where it is necessary to form a footpath on made ground. The most extensive example of this kind is probably to be found in the foot thoroughfares of the Thames Embankment, and anyone who is in the habit of traversing that on the north side cannot fail to perceive how badly the paving flags adapt themselves to the irregularities caused by the "giving" of the ground underneath. A very slight subsidence, which would be scarcely appreciable under ordinary circumstances, is quite sufficient to destroy the evenness of a flagged footway. As it is, many of the flags are disturbed to an extent which throws up one end fully an inch above its neighbour, and imparts a very jagged appearance to the surface. Taking them up and relaying them is the remedy, but how often this remedy will have to be repeated it is impossible to assert, for railway experience has demonstrated that it frequently requires a long time for a heavy embankment to settle permanently to its "bearings." In pointing out the manner in which paving flags behave under the conditions in question it is not intended to assert that they ought to be replaced wholesale by an asphalted surface, but had a small portion of the Embankment been covered by the latter substance, the relative merits of the two descriptions of paths would have been fairly and impartially tested. The principle of giving every method of executing any particular description of work a fair trial is one that needs urgent adoption by the various branches of our civil and military departments. By every method is signified every one that possesses manifest claims to consideration, and does not, of course, include the mere ideas of inventors, or hobbies of patentees which are destitute of all practical utility. But, when an individual or a company is willing to test, solely at their own expense, any plan they consider likely to effectually accomplish any desired object, they ought to be allowed to have an opportunity of so doing. It might be urged that the public ought not to be put to any inconvenience with respect to interruption of the ordinary traffic, supposing the trial concerned the taking up of any part of a street or thoroughfare. What with gas and water companies who are perpetually breaking up the streets, the public is pretty well used to such inconveniences. Moreover, as the object of all proposed improvements is to benefit the public, the end fully justifies the means. There are undoubtedly many valuable inventions totally lost to us solely because we never permitted them to be fairly and dispassionately investigated, and their practical merits submitted to the crucial test of actual experience.

IODIZED COLLODION IN PHOTOGRAPHY.

IN the early days of photography collodion containing iodides only and no bromides was in almost exclusive use. Spots, fogging, and all kinds of evils then beset the photographer, who was not long in tracing most of these evils to impurities and too much acid in the nitrate of silver crystals which were used in making the sensitising bath. Still a residuum of imperfectly understood causes of failure remained, until bromo-iodized collodion was introduced in company with development with protosulphate of iron. This very much reduced the chances of failure, so that commercial photographers of necessity adopted the new plan, and then, after purer materials began to be used in the manufacture of collodion, failures ceased altogether among intelligent photographers who used moderate care in the selection of their chemicals.

With the light of the better knowledge thus gained by photographers by experience, Mr. Thomas Sutton, B.A., of Jersey, tried some experiments with the old-fashioned simply iodized collodion, in conjunction with the purer chemicals of later date. He found it to be much less liable to spots and markings than generally supposed, and the few sources of error remaining he traced to impurities in re-crystallized nitrate of silver, quite pure enough, however, for use with bromo-iodized collodion. He accordingly exerted himself to introduce an exceedingly pure description of nitrate of silver into the market, and of all the strong proclivities of Mr. Sutton to turn his discoveries into commercial profit, for this one he certainly deserves the thanks of photographers and gain to himself. With such nitrate of silver, and other chemicals of moderate purity, it was found that the sources of failure with iodized collodion had been abolished, but by this time the new method of operating had struck such deep root that few photographers re-entered the ancient path thus cleared of its difficulties by industrious experiments.

The statement of facts in the foregoing preamble is intended to lead to the consideration of the question whether the desirability of returning to iodized collodion in portraiture is not worth very serious consideration. In the first place, every plate coated with iodized collodion abstracts by chemical decomposition much less silver from the bath than bromized collodion, therefore it is cheaper to use. In the second place, the iodized plate requires a shorter time of immersion in the bath, so is cheaper in the saving of time. An iodized collodion requires about three minutes in the bath, a bromized collodion requires about twelve minutes in the bath, and a collodion containing chloride only requires more than half an hour in the bath, as discovered by Mr. Harrison, to give a good film. Iodized collodion again requires the weakest bath of the three, 25 grains of

nitrate of silver to the ounce being sufficiently strong; the other two collodions require 60 and 100 grains to the ounce respectively. Another advantage of good iodized collodion is that it permits of very short exposures and rapid development with pyrogallic and formic acids, so rapid, indeed, that it is doubtful whether iron development will give more rapid results. The advantage of this is that with a suitable pyroxyline in the collodion and pyrogallic development a good intense picture can be obtained at once, so as to save the photographer all the dirty work and waste of time of after-intensification. The ordinary formic acid of commerce is very impure, and nine samples out of ten are pretty sure to cause fogging and other evils. The pure monohydrated formic acid must therefore be used. This is only obtainable with difficulty, and is usually imported by wholesale dealers from the continent; we do not know that it is on sale in London by any chemists except Messrs. Hopkins and Williams, for several photographic chemists who have it on their lists have it not in stock. The pure acid, when obtained, should be diluted with water, as it acts very painfully upon the flesh. The quantity of it required in the developer is so small that it is less expensive to use than the acetic acid ordinarily employed for the purpose. Some of those very few photographers who have tried iodized collodion now that the conditions of invariable success with it are known say that it gives rather hard pictures. So it does when the lighting of the sitter is the same as for bromo-iodized collodion, and some of the hardness complained of was caused by the too great reduction of the time of exposure in the attempt to get instantaneous results under unfavourable conditions. M. Claudet, F.R.S., frequently used this process in portraiture with much success as to rapidity, but his glass house had too much top light and too little side light to give the best results by any process.

What is required is that some commercial photographers should give this process a long and fair trial. The probable result will be a saving in time and money and the general abolition of the tiresome work of intensification. But the chemicals must be pure to avoid failure, and some little care must be taken to light the sitter properly. Much as iron development is in vogue, we know some photographers in a very large way of business who turn out capital portraits regularly by the old pyrogallic development. It would be well to try the merits of the old plan once more, with the present advantage of higher knowledge and purer materials.

THE LATE PROFESSOR GRAHAM, F.R.S., MASTER OF THE MINT.

THE announcement made in our columns last week of the alarming illness of this eminent chemist no doubt prepared the public for the event which has now taken place—his decease. The unfortunate gentleman never rallied from his severe and somewhat sudden attack of inflammation of the lungs, but rapidly sank, and died on the night of the 16th inst., at his house in Gordon-square, London. Mr. Graham was, to a certain extent at least, what is known as a self-made man. He was, in fact, one in the ranks of that numerous army of adventurous North Britons who, year by year, find their way southward, and who succeed in securing for themselves so many of those rich prizes which are the rewards of energy, perseverance, and tact.

The late Master of the Mint was born in Glasgow in 1805, his father having been a manufacturer in that city. His boyhood was spent in the midst of that industrial hive, and he obtained the rudiments of education in the grammar school of his native place. At a proper age he was entered as a student in the University of Glasgow, and in 1824 took the degree of M.A. Under Dr. Thomson, then Professor of Chemistry at the University, young Graham took his first lessons in the science of which he afterwards became a celebrated expositor. For two years the young scholar pursued his studies in chemistry, diversifying the labour with mathematical pursuits. Subsequently he removed to Edinburgh, where he gained the favour and patronage of Sir John Leslie, so well known for his investigations of the phenomena of heat. Mr. Graham returned to Glasgow in 1828, and established a public laboratory there for the study and practice of chemistry. This led to his appointment as lecturer at the Mechanics' Institute of Glasgow, and where he became somewhat popular. In 1830 he was nominated Andersonian Professor of Chemistry in the University. This post he held until, his fame having found an echo in the British metropolis, he was appointed to the chair of chemistry in University College. In 1837, Graham was elected a Fellow of the Royal Society, and for the space of ten years he held also the office of Chemical Examiner in Arts in the London University. In 1846 he was named as a member of the commission appointed to report to Parliament on the ventilation of the Houses of Parliament. Mr. Graham was the first President of the Chemical Society, which he was instrumental in founding (in 1841), and to the transactions of which he largely contributed. At the Great Exhibition of 1851 the subject of this memoir acted as vice-president and reporter to the jury on chemical and pharmaceutical products.

It is scarcely possible on this occasion to enumerate the various scientific discoveries and inquiries with which Mr. Graham's name is associated, but the most remarkable and important, perhaps, is his elucidation of the law which governs the diffusion of gases. For his investigations into and demonstrations of this peculiarly interesting subject he received the Keith Prize at the hands of the Royal Society of Edinburgh, and the Gold Medal from the Royal Society of London. He was besides connected honorarily with the Institute of France and the Academies of Washington, Berlin, Munich, Turin, &c. In the year 1855 Mr. Graham received the appointment of Master of the Mint, rendered vacant by the resignation of Sir John F. W. Herschel. It is understood that the late Prince Consort was the mainspring of this upward movement in the career of the late Professor. He had previously filled the office of an assayer to the Mint, and it was imagined by his patron that his chemical knowledge would be found valuable in that establishment. This, however, was scarcely the case, as other assayers were appointed whose duty it was, and is, to submit all bullion presented for coinage, and all coin produced from it, to scientific control. It is by no means necessary, therefore, that the Master of the Mint should be a chemist. Far less is it essential that he should be an astronomer! The real qualifications for the post are a complete acquaintance with machinery and mechanical operations, mathematical knowledge, and familiarity with the art of banking and the laws of political economy. It is questionable whether the late Master's chemical acquirements were of any real service in the money manufactory itself, however useful they may have been to the world at large. At his laboratory in the Mint, nevertheless, many experiments in physical science were no doubt conducted, and many of Mr. Graham's more recent contributions to the scientific wealth of the country were there concocted. His assistants—Messrs. Stoikowitsch and Roberts—were his able and zealous co-operators. As has been stated, Mr. Graham became Master of the Mint in 1855; this was some three years after the departure of the Company of Moneyers, and the reorganisation of the establishment by Captain (now Lieut.-Colonel) Harness, R.E., who, it was thought by some, might well have been promoted to the Mastership after the successful accomplishment of that work.

The new Master found, on his assumption of office, that its duties were onerous and difficult in themselves, and that they were not diminished by a certain spirit of personal antagonism existing within its walls. His own close attention to business, and the zealous aid which was given him by some of his subordinate employés, enabled him to surmount many obstacles of a social and practical nature, and to establish a control which was paramount and effective. The remodelling of the copper coinage in 1860-1, and its re-issue in the form of bronze, may be justly considered the most arduous and important work executed during the fourteen years of Mr. Graham's rule at the Royal Mint. The advantages which have resulted from this change in the subordinate currency of the United Kingdom are too well known to need further comment here, but it may be remarked that, instead of the pockets of the British public being encumbered with five or six thousands of tons of copper money, two or three thousand tons of bronze are all they now have to support. Within the fourteen years alluded to nearly one hundred millions of sovereigns and half-sovereigns, and some two or three hundred millions of silver coins, have been stamped into existence at Tower Hill. In the interests of truth it must be admitted that the late Master of the Mint did not seem to understand, or at least did not always practice, that gentle art which has the effect of inspiring colleagues and subordinates with an affectionate attachment to their chief. He was consequently not a popular Master, however conscientious he may have been in fulfilling the requirements of his office.

Mr. Graham's remains were removed to Glasgow on Tuesday last, and his funeral took place at the scene of his nativity yesterday. It is but seven months since his brother John, who filled the post of chief coiner for a brief period, preceded Thomas Graham along that dark vale whither the footsteps of all humanity tend. The Royal Mint was closed yesterday as a tribute of respect to the memory of its departed Master, who, it is somewhat singular to observe, is the only one that has died in office since the days of Sir Isaac Newton.

THE STEAMSHIP "MALTA."

ABOUT two months since we placed before our readers some particulars respecting the steamship "Malta," a vessel which was then attracting notice on account of being the first ship built and engined complete by a single firm on the Wear. She was turned out by Messrs. Oswald and Co., of the Pallion High Yard, Sunderland, and has since made a most successful trip, particulars of which and of her machinery it is now our purpose to give. The "Malta," we may here mention, has a length of 221ft. over all, with a breadth of 30ft. 6in. and a depth of 17ft., her builder's measurement being 919 tons, and her dead weight capacity 1,300 tons. She is fitted with water ballast tanks (in the form of a double bottom) containing 180 tons of water, and so arranged that they can be pumped out in 1h. 15m. The "Malta" is fitted with screw engines of the inverted direct-acting type and on the surface-condensing high-pressure expansion principle, with improved expansion valves. They have a nominal horse power of 99, and an indicated power of 659. The cylinders are 39in. in diameter, length of stroke 33in., length of connecting rod 6ft., diameter of piston rod 4¾in., diameter of crank shaft 8¼in., diameter of air and circulating pumps 20in. The area of condensing surface in the surface condenser,

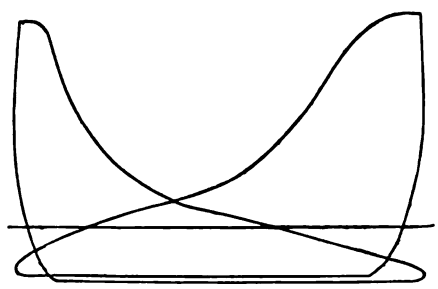
with 1in. diameter brass tubes, is 10 square feet per horse power.

In the design of these engines simplicity and accessibility of working parts, and regularity, compactness, and proportion of the stationary parts, as the framing, &c. (or what may be termed the architecture of the machinery), were the chief points aimed at, and certainly the Messrs. Oswald have been very happy in this respect in this their first production. The expansion valves are not arranged for a variable expansion, but have a set expansion cutting off at 6½in. of the stroke. This expansion cannot be reduced, but can be increased by means of the sweeps, *i.e.*, by linking them up from 2in. to 6in. The advantage considered to be gained with the "set" expansion is that the engineer in charge cannot alter it as he likes. In practice, with the variable expansion engines it is found that the consumption of fuel is much larger than it should be, and the inference drawn from this is that the engineers, when away, grow careless and do not treat with the expansion properly. The cylinders of these engines are steam jacketted around as well as at top and bottom, and are supplied with superheated steam direct from the superheater. The cylinders are also fitted with small independent slide valves, to be used for starting the engines when necessary.

The cylinders are supported by four cast-iron main frames of the hollow column form and of the O G shape, which stand on a ribbed box, bottom, frame, or bed-plate. Rectangular recesses are cast in this bed-plate for the bearers of the crank axle. Provision is also made in the bed-plate for the air and circulating pumps to be placed immediately behind the hinder main frames or columns, on which projections are cast for carrying the bearers of the inside and outside side levers, which work the pumps by means of the piston rod, to which one end of each of the side levers is attached by a gudgeon. One pump to each engine serves as the circulating and air pump combined, the air pump being at the bottom and the circulating arrangement at the top. The air pump valve boxes are contained in the bed-plate, those for the circulating pump being cast separately and fixed overhanging the top of the pump. The feed and bilge pumps are side by side, and are placed on the outside of the air and circulating pumps. The whole of these pumps are connected with one crosshead, and the side levers which work the pumps are attached by means of links to these crossheads. The surface condenser also stands on the bottom frame, immediately over and in immediate connection with the air pump valve boxes. It is placed directly between the air and circulating pumps and the two hinder columns, there being sufficient space left between them for the clearance of the hinder levers which work the pumps. The tubes in the condenser are placed horizontally, and the doors are arranged so that the tubes can be drawn through in between the engines or behind them if required at pleasure. The circulating water is admitted at the top of the condenser, which is so constructed, divided, and partitioned that the circulating water travels backwards and forwards the length of the condenser four times before being discharged from the bottom of the condenser.

The slide valves are placed in between the cylinders, and are worked in the usual way with eccentrics, links, &c. The reversing gear is of a simple, quick, and powerful construction, and is fixed on the front after column with the reversing wheel. The handles for the starting valves, the throttle valve, and regulator to steam jackets and safety valves are within immediate reach. The boilers, two in number, are on the circulating multitubular return tube principle, and of the round form, fitted with 3¼ lap-welded iron tubes. The boilers are 9ft. diameter and 11ft. long, and have a heating surface (with both boilers combined) of 2,909 square feet. There are two furnaces in each boiler 2ft. 6in. diameter. The superheater, which is placed horizontally on the top between the two boilers, is 5ft. 6in. diameter and 7ft. long, and is fitted with 4in. tubes, the uptake surrounding the whole of it. The water tubes fitted in the boilers help to make the circulation most perfect.

The "Malta" made her first voyage from Sunderland to Rotterdam, a distance of about 300 miles, in 26 hours, the weather being favourable and the vessel in good trim. The consumption of fuel was measured and found throughout to be from 9½ to 10 tons in the 24 hours, or 1·42 on an indicated horse power of 659, or under 1½lb. per indicated horse power per hour. The safety valves are loaded to 50lb. per square inch, the working pressure averaging 45lb. The vacuum was continual and steady at 26in.; the average revolutions were 63; the steam was superheated from 320 to 350deg. Several indicator diagrams were taken which were highly satisfactory. One of these diagrams we give in the annexed figure. This diagram was taken with steam at 50lb. per square inch, number of revolutions 64.



The "Malta" did her 10 knots or 11½ miles per hour easily on a consumption of under 10 tons of coal in the 24 hours. The carrying capacity of the vessel is 1,300 tons dead weight, so that she will carry 100 tons of dead weight 100 miles on a consumption of 7½cwt. This is very low indeed, and we are not aware that there is any other vessel running which has done the same, except on a considerably higher consumption. On the whole, the construction and performances of both engines and vessel are alike satisfactory, and reflect great credit upon the firm who built and engined the "Malta."

ENGINEERING PAPERS.

UNDER the above heading we have year by year for some years past noticed a volume replete with original information of a practical character upon the varied subjects which go to make up the sum of engineering work. This volume consists of a series of well illustrated papers which have previously been read before the Society of Engineers, and which, with the interesting discussions thereon, form its yearly "Transactions."* During the year 1868 the Society was under the able and energetic presidency of Mr. Baldwin Latham, who inaugurated the session by an address which mainly discusses sanitary matters, upon which Mr. Latham is well known to be an authority. The modern works of sewerage and water supply have been great experiments made for the purpose of improving the state of the public health. That they have accomplished the end for which they were inaugurated is shown by a table which Mr. Latham gives, and which contains the results in twelve towns. From this table it is shown that in Cardiff and Newport the saving of life per cent. of the population since the works have been carried out is 32. In Croydon it is 22, in Macclesfield and Salisbury it is 20, whilst in other places it is proportionately high. This address, with which the volume opens, is an admirable exposition of the principles of sewerage and irrigation, and forms a striking comment upon the great value of sanitary works.

Following the President's inaugural address comes a valuable paper by Dr. Cullen on the surveys of proposed lines for a ship canal between the Atlantic and Pacific oceans. The necessity for a direct route from Europe and the United States to the western shores of America, Australia, and China has long been fully recognised, and several surveys have been made with a view to carrying out the project. Dr. Cullen has himself made a survey, and he gives his own experience as well as that of others who have accomplished the same object. These several surveys and reports all agree as to the desirability of the undertaking, although they differ as to its practicability. The Cordillera and the Rocky Mountains appear to interpose an almost insuperable barrier to the work. Dr. Cullen, however, seems to have hit upon a valley between these two mountain ranges, although there is great doubt from contemporaneous evidence whether such facilities do really exist. Our readers may remember that we announced a few months since that a company in America was preparing to carry out the scheme. A subsequent announcement, however, showed that the negociation had fallen through. We then remarked that the opportunity was again open for English capitalists to step in and promote the undertaking. Whoever next may set to work upon it will find Dr. Cullen's paper—as well as a second and third, by the same author, upon the Panama Railroad and upon the Isthmus of Darien and the ship canal—most useful in connection with the question. They contain all that is known on the subject of inter-oceanic communication, and are illustrated by maps and plans and sections of proposed routes. Undoubtedly, a ship canal for connecting the Atlantic and the Pacific Oceans through some point of the Isthmus of Panama or Darien would prove a most desirable undertaking, and one which would be an advantage to all the trading nations and maritime powers of the earth.

We next come to a paper by Mr. F. C. Danvers on the subject of engineering in India, in which the author refers to the gigantic works which have been carried out in India in past ages, and of which ample evidences remain. Roads, however, appear to have been sadly neglected, probably because there was an almost total absence of wheeled conveyances. In this respect, however, modern engineers have improved the country, and also with respect to bridges, which render the roads very perfect. The author also touches upon the method of carrying out the works of public departments in India, and the salaries paid to engineers of various grades. He admits that the pay is comparatively small at the outset, but against this he places the fact that it is sure, and this is no weak argument at the present time, when engineering appointments at home become more and more rare every day.

After Mr. Danvers' paper is a report of a very pleasing character. It is that of the presentation of a testimonial to Mr. Alfred Williams, who has been for many years past, and still is, the honorary secretary of the Society of Engineers. The testimonial consisted of a handsome silver tea and coffee service, bearing an appropriate inscription, and accompanied by a suitable address. Having upon many occasions, in the interests of this journal, experienced the greatest courtesy at the hands of Mr. Williams, we heartily concur in the concluding wish of the address, that he may continue for many years to retain the post of honour which he now occupies in the Society.

Passing on to the next paper we find a description of the Redhill sewerage works by Mr. Sydney A. Reade. Although the sub-

* Transactions of the Society of Engineers for 1868. London: E. and F. N. SPON, 48, Charing Cross. 1869.

ject is a special one as far as regards site, yet the paper is a valuable one, inasmuch as it contains a large amount of practical information upon sewer construction which applies to the matter in general. The forms and dimensions of various kinds of sewers are given, with the rules according to which they are constructed, and the methods upon which they are built. Manholes, ventilating shafts, gulleys, &c., &c., are fully described and illustrated. The Redhill sewage works were carried out under great difficulties, and cost more than usual in consequence of the nature of the subsoil. The methods adopted, however, proved thoroughly successful, and form a practical example invaluable to those who may have the like difficulties to encounter.

The paper following is by Mr. Arthur Rigg, jun., who has made some important experiments with the screw propeller, and has here embodied them for the use and guidance of those interested in screw propulsion. There are many curious theories afloat respecting the screw propeller and the way in which it acts with relation to the water. It has been frequently assumed that water acts the part of a solid in resisting the screw, but this Mr. Rigg shows to be a fallacy This is almost self-evident, as water cannot act like a liquid and yield to the ship's advance, then immediately change all its properties and become a solid resistance to the screw at the stern. The various points to be considered in arranging the best screw propeller for any particular example are carefully gone into, and the results of the author's experience and observation are given, the principles which regulate the true proportions of the screw being laid down. This paper is followed by a most interesting discussion, in which several conflicting opinions are given upon the subject.

We next have a paper by Mr. Henry Gore on modern gas works at home and abroad. The paper is by no means exhaustive, but it touches upon the main points of manufacture, and describes some of the methods pursued in different localities abroad. The author deals with the leading principles of construction essential to the production of the greatest amount of light from a given quantity of materials employed, and to the situation in which the manufacture may be most successfully conducted. In the adjourned discussion which follows this paper, Mr. Ewing Matheson describes Best and Holden's machine for charging and drawing retorts. This machine is stated to be in successful working at the Alliance Gasworks, Dublin, although it was not received with much favour by several gas engineers of experience at the meeting.

Following Mr. Gore's paper comes one by Mr. E. Matheson on the accumulator cotton press. After describing several presses for packing cotton, including Hodgart's, Mason's, and M'Combe's, the author gives a detailed description of that by Mr. George Ashcroft, which is on the accumulator principle, and was designed to fulfil the two main requisites of power and speed. During the time of filling the boxes with cotton, changing them, and hooping the bales, the pumps are quietly at work forcing up the accumulator box, which, at the proper moment, gives forth all its power, and does all that is required in a few seconds.

The two remaining papers are upon one subject—that of the application of steam to the cultivation of the soil. They are by the President, Mr. Baldwin Latham, and, so far as the matter has been treated, they form a valuable history of the subject. We say "so far" as it has been treated because the author has only pursued the subject up to a certain point, and we understand that further papers in continuation are being prepared by the author for the Society. For these we shall look with interest; in the meantime we shall glance at the papers before us, as we hope at a future time to be able to reproduce portions of them in our columns. The author points out the advantages of steam culture, and shows how far superior it is to that done by horse labour. It is not an entire substitute for horses, but it will perform the hard work better and cheaper than it can be done by horse power. The author then gives the early history of steam cultivation, showing that its present position is due to the aggregation of the ideas of a great number of inventors. He divides the systems into four classes, viz.:—1, Traction engines or machines which draw the implements of cultivation after them; 2, locomotive engines travelling upon fixed railways; 3, fixed engines communicating the power to the implements by the agency of chains or ropes; 4, traction engines moving along the headland or other part of a field and working implements by the agency of wire ropes. The latter portion of the first paper is occupied with a consideration of engines of the first class. The second paper is devoted to those of the three remaining classes, and to a discussion of the relative merits of stationary and locomotive engines when tilling the soil. These papers are accompanied by nine folding plates containing more than thirty illustrations of the various engines and systems of cultivation referred to. It will thus be seen that these papers possess a special interest and value, as they illustrate the history of steam cultivation from the earliest times down to the present.

Out of this varied collection of contributions three have been selected by the council for premiums, or, more correctly speaking, three authors have been selected, as Dr. Cullen himself has three papers to which a premium has been awarded. Mr. Reade received a premium for his paper on the Redhill sewerage works, and Mr. Rigg for his paper on the screw propeller. The president, however great may be the value of his paper, cannot have a premium awarded him, as by the Society's rules members of council are disqualified in this respect, otherwise there can be no doubt but that it would have been honoured with the recognition it deserves.

It will be seen that the volume of Transactions before us is a valuable contribution to scientific literature, and will form a standard for reference upon the several subjects on which it treats. The illustrations to all the papers are executed in excellent style, and we hardly know which to admire most, the tinted maps which accompany Dr. Cullen's papers or the finely executed mechanical drawings attached to those by Mr. Latham. Certainly the volume is well got up and does credit to the members of the Society and their publishers.

TELEGRAPHIC NOTES.

IN our telegraphic intelligence last week, we noticed a letter from the solicitors to the Telegraph Construction and Maintenance Company respecting Mr. Rowett's cable and the Land and Sea Telegraph Construction Company. The secretary of the latter company now writes to say that it is quite true that the Land and Sea Telegraph Construction Company have the right to the exclusive use of Mr. Rowett's patented deep sea hemp-covered cables, and it is likewise true that the Atlantic cables are manufactured on Mr. Rowett's principles. The writer continues:—Messrs. Bircham, Dalrymple, Drake, and Co. omit, however, to state that Mr. Rowett, as patentee of those cables, has instituted suits in Chancery against the Telegraph Construction and Maintenance Company, the French Atlantic Cable Company, and other companies, to protect his rights, and these suits are being prosecuted on his behalf by the eminent firm of solicitors, Messrs. Ashurst, Morris, and Co. It was considered that Mr. Rowett's rights were of such value as to be worth acquiring by the Land and Sea Telegraph Construction Company. At the same time, the Land and Sea Company, although having this exclusive right, will be prepared to construct cables on other principles if required. A piece of the cable just manufactured under the superintendence of this company's engineer, and now being laid for the Scilly Islands Telegraph Company, can be seen at the office of the Land and Sea Company, and the secretary asserts, on the best scientific authority, that both mechanically and electrically it is greatly superior to any submarine cable ever yet laid.

It is stated that Messrs. Aubert, Gérard, and Co., of London, Paris, and Harbourg, have the sole contract for the manufacture of the cable for the International South Transatlantic Telegraph Company, the decree of which company appeared at length in the "Journal Officiel de l'Empire Français" of the 17th inst.

The number of messages over the French Atlantic Telegraph Cable during the week ending September 18 was 547, the cable charge upon them being £1,323. In the previous week, the amount was £1,068.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

PHOSPHATES AS MORDANTS—PURIFICATION OF FATTY OILS—SHELLAC VARNISH—DANGER FROM INCREASED COAL CONSUMPTION—THE PASCAL-NEWTON FORGERIES.

M. COLLAS has introduced phosphates with the idea of replacing alumina as a mordant. He first passes the tissue or yarns to be dyed through an acid bath of phosphate (say of lime or magnesia), then through the bath of colouring matter, and lastly through a weak alkaline bath. The process is particularly applicable, he states, for aniline colours, and most especially for aniline purple. Lakes can also be prepared by means of phosphates, preferably with phosphate of lime. Thus, to obtain a cochineal lake, an infusion of the colour is first made, and then a gelatinous precipitate of the phosphate is added, and the mixture is well stirred for a time. The colouring matter is precipitated as completely as by alumina. Insoluble colouring matters may be used as dyes by employing gelatine in combination with phosphate of lime.

A new process for purifying fatty oils is given by M. de Keyser, which may be very effective, but can hardly be cheap. To 100 kilogrammes of the oil he adds 600 grammes of strong caustic ammonia, and mixes the two thoroughly by continued agitation. The mixture is then allowed to settle in a close vessel, and after three days we read that the oil may be drawn off quite bright, the ammonia and all the impurities having gone together to the bottom.

That shellac is soluble in a solution of borax is a well-known fact, and the solution has received some applications. As a varnish, however, it does not answer well, on account of the quantity of borax dissolved. Shellac is also soluble in ammonia, and the solution makes a very good waterproof varnish. Puscher publishes some suggestions for making varnishes of various colours with the solution. Most of the insoluble earthy colours may be mixed with it. Sulphate of lime, however, is said to decompose the solution. Extract of logwood easily dissolves in it, so likewise does aniline green. We have long employed it to make an indelible ink, which is especially useful for laboratory labels, a mixture of lampblack with the shellac solution remaining quite unaffected by acid vapours. The coloured solutions are, in fact, available for many decorative purposes. The plain solution is made by macerating three parts of white shellac in one part of strong ammonia, diluted with six or eight parts of water. This mixture must be frequently shaken for twelve hours, after which the solution may be completed by the application of a gentle heat.

The consequences of the enormous extension of the consumption of coal are serious enough. Whether Mr. Jevons be right or wrong in the estimate of the time at which our coalfields will be exhausted, the time no doubt will soon come when coal will advance in cost. That is a certain source of inconvenience to the pocket; but a

Frenchman has recently speculated on a more serious consequence to the health of the world from the vastly increased consumption of coal. He imagines the world being gradually suffocated by means of carbonic acid. The same idea occurred to us, and probably has occurred to many others; but a few calculations soon set our minds at ease. We found that it would take some thousands of years to bring the proportion of carbonic acid in the entire atmosphere up to that which has been found in a London theatre. At first sight, the Frenchman's notion seems plausible enough. The consumption increases, while vegetation, by means of which carbonic acid is removed from the air, proportionably diminishes. Whether an acre of cereals will assimilate as much carbonic acid as an acre of forest trees we cannot say. But certain it is that forests are disappearing, and hence the unhappy savant's alarm. A few figures, however, will show how remote the danger is. The proportion of carbonic acid in normal air is about 0·04 in 1,000 parts. The amount of carbonic acid in the whole of our atmosphere is calculated, we believe, at about two and a half billions of tons. If the two hundred millions of tons of coal now raised annually in all parts of the world were completely burned, they would add to the atmosphere about five millions of tons of carbonic acid. Any reader who is disposed may calculate for himself how long, at this rate, it would take to bring the atmosphere up to the dangerous limit, four per cent. of carbonic acid.

Having several times, in these notices, referred to the forgeries imposed upon M. Chasles as the writings of Pascal, Galileo, and some other learned men of the same time, we may mention that at last M. Chasles is convinced that he has been duped. The forger has been arrested—or perhaps we ought to say the copyist, for, since he turns out to be a man ignorant of Latin, Italian, and mathematics, he could hardly have composed the letters. There are others, most likely, who assisted in the fabrication of the correspondence, the man arrested being simply a somewhat skilful imitator of old writings. His trial will probably produce some curious revelations.

THE LIBRARY OF THE BRITISH MUSEUM.

DURING last year 42,331 volumes and pamphlets were added to this library (including books of music and volumes of newspapers), of which 992 were presented, 6,099 were received in pursuance of the laws of English copyright, 346 were received under the international copyright treaties, and 34,894 were acquired by purchase. There were added also 33,403 parts of volumes (or separate numbers of periodical publications and of works in progress). A total of 1,145 sets of newspapers were received from the Inland Revenue offices of the United Kingdom, of which 131 were published in Scotland, 138 in Ireland, 238 in London, and 638 in the rest of England. Of music, 2,121 pieces were acquired, each piece complete in itself, of which 1,527 were received by English, and 576 by international copyright, and 18 were purchased. Of 779 portions of musical works in progress, 473 were received by English, and 306 by international copyright, and 253 works of music of greater extent than single pieces were also acquired, comprising 25 by English, 66 by international copyright, and 162 by purchase. A total of 5,773 articles were received in the department, not included in the foregoing enumeration of volumes and parts of volumes, consisting of playbills, single pieces of music, broadsides, songs, ballads, and other miscellaneous items, giving a grand total of 81,507 articles received during 1868 in the department.

THE NEW HARBOUR AND DOCKS IN TABLE BAY.

THESE extensive works, which have been in progress since 1860, have recently been completed. The undertaking appears to be of a thoroughly comprehensive character; it consists of a breakwater about 2,000ft. in length, an outer basin of 6 acres connected with an inner basin or dock of about 10 acres, with 24ft. of water at low water, and 30ft. at high water of spring tides. In connection with this basin, there is a patent slip, which is adapted for the repairs of the largest class of shipping. The total length of quayage in the dock is 2,500ft., and in the basin and along the jetties, 1,400ft. Ample provision has also been made for wharfage purposes and the erection of warehouses. The total amount expended upon the works up to the present time is about £345,000. They were designed by Mr. Coode, C.E., the engineer-in-chief in England, and have been carried out under the able and energetic supervision of Mr. A. T. Andrews, C.E., the resident engineer in the colony. Water was admitted to the inner basin on the 21st ult., to the great satisfaction of the colonists, whose prosperity will be enhanced by the works just completed.

TRIAL TRIP OF THE "EUROPE."

A SATISFACTORY solution of the all-important question of the economical propulsion of steam vessels has just been arrived at in the "Europe" steamship, which was built by Messrs. Napier for Messrs. Marc Fraissinet, Pere et Fils, the well-known steamship owners of Marseilles. Her dimensions are:—Length, 315ft.; breadth, 37½ft.; depth, 29½ft.; tonnage, builder's measurement, 2,130 tons; engines, of the high and low pressure kind, 230-horse power nominal; boilers, cylindrical and tubular. The trials of the "Europe" took place on the 11th and 14th inst., on the estuary of the Clyde. On the date first mentioned, the "Europe" went out for her high speed trial, and, while carrying a deadweight cargo of coal and iron of 2,220 tons, attained an average speed, at the Admiralty measured knot, at Wemyss Bay, of 11·14 knots per hour. This result, so highly satisfactory, was obtained in spite of the tempestuous weather experienced, and with a consumption of fuel very considerably under the quantity stipulated. The second trial, which lasted for twelve hours, was for the purpose of ascertaining the vessel's normal speed and consumption of fuel when loaded at sea. On this occasion, the "Europe" started from the Tail of the Bank at six a.m., under the same conditions as regards draft, displacement, and weight as on the former trial; and, notwithstanding the still stormy state of the weather (a gale blowing the whole time of the trial), she continued running for twelve hours between the Cloch and Cumbrae Lights, realising an average speed for these twelve hours of over 9·6 knots per hour, with a consumption of fuel as before, in every way satisfactory, being at the rate of 1·9lb. per indicated horse power per hour, a rate of consumption very much under the stipulations of contract. We understand that Messrs. Napier have a second vessel—sister ship to the "Europe" —on hand for the same firm of owners.

THE IRON AND STEEL INSTITUTE.

THE first provincial meeting of the members of the above Institution was held at Middlesborough. The proceedings commenced on Tuesday last, and included meetings for the reading of papers bearing upon the iron trade, visits to the ironworks in the Cleveland district, and a dinner at Saltburn, where the Institute was entertained by the local iron trade. A great many members of the iron and steel trades were present. The papers read were contributed by Messrs. Isaac L. Bell, J. T. Smith, Edward Williams, C. W. Palmer, R. Howson, T. Whitwell, G. H. Benson, and J. P. Budd, and were all upon subjects more or less intimately connected with the manufacture of iron. The conception of this Institution occurred about a year since, when a paper was read at the ironmasters' quarterly meeting in Newcastle by the secretary to the trade, suggesting the establishment of a scientific institute for the iron trade, somewhat similar in its constitution to the technical societies connected with civil, mechanical, and mining engineers. The proposition was well received, and a committee was at once appointed to lay the plan before the iron and steel trades. The efforts of this committee very soon resulted in the enrolment of nearly 200 gentlemen associated with these trades as members. The Duke of Devonshire, chairman of the Barrow Hematite Steel Company, was elected the first president, and the inaugural meeting was held in the rooms of the Society of Arts at the end of June last, when the president delivered an able address. At the meeting in London invitations were received from the North of England iron trade soliciting the Institute to hold its first provincial meeting in the Middlesborough district, which was accepted.

ONE hundred and ten thousand pilgrims are estimated to have assembled at Mount Ararat, in the late Mecca pilgrimage, or about 25,000 more than in 1868.

PONTOONS FOR TRANSPORT SHIPS.

THE question of having pontoons for our transport ships was first mooted by Admiral Mends some two years since. Upon his recommendation, some pontoons of cylindrical form were constructed of steel by Messrs. Maudslay for the "Serapis." Four of these were made to constitute the raft, the weight of each being about 55cwt. On the official trial of them it was suggested that pontoons constructed of Mr. Clarkson's patent cork material would possess qualities of lightness, strength, and buoyancy peculiarly suitable for the operations such pontoons would be called upon to perform, and that they would also be more easily repaired if damaged by musketry fire. Four pontoons were therefore ordered of Mr. Clarkson for experimental trial, and these were successfully launched, on Monday afternoon, at East Greenwich. Their dimensions are:—Length, 36ft., diameter, 4ft. 6in. The construction is as follows:—A light framework is made of wood as the skeleton of the structure. The form is then completed by planking of ¼-inch thick pine wood, both sides of which are covered by stout canvas adhering closely and firmly to the surfaces by a waterproof solution not affected by the variations of heat within the limits of terrestrial atmospheric temperatures. Over this, again, sheet cork is applied by the same adhesive substance; the whole pontoon is coated with the solution, and a strong jacket of canvas is superadded as the external covering. On the lower side of the pontoon is a keel and stem and stern post firmly bolted through to kelson and corresponding upright so as to give great longitudinal strength; and, combined with the sectional plates, equal vertical stiffness is obtained. The advantage of this material is that it possesses elasticity and such capacity of cushioning blows or thrust that the vessel receives no injury from such concussions as would be liable to fracture or indent metal structures; and even with the passage of shot, there is the total absence of splinters, and a natural tendency on the part of the cork material to close up the orifice made by the missile. Repairs are temporarily made by merely plastering canvas over the hole or fracture. The whole vessel, indeed, may be renewed by recoating with canvas, as the internal substance of the fabric, namely, the cork material, is scarcely at all subject to decay. The pontoons, which only weigh about 26cwt. each, were floated down the river to the factory of Messrs. Maudslay, Sons, and Field, where they were fitted together by spars and lashings, and a stage or platform for landing or embarking guns, troops, horses, &c., erected upon them. The pontoon raft swam very lightly and easily upon the water, and was towed down by the "Bustler" to Woolwich dockyard, where it awaits orders for official trial.

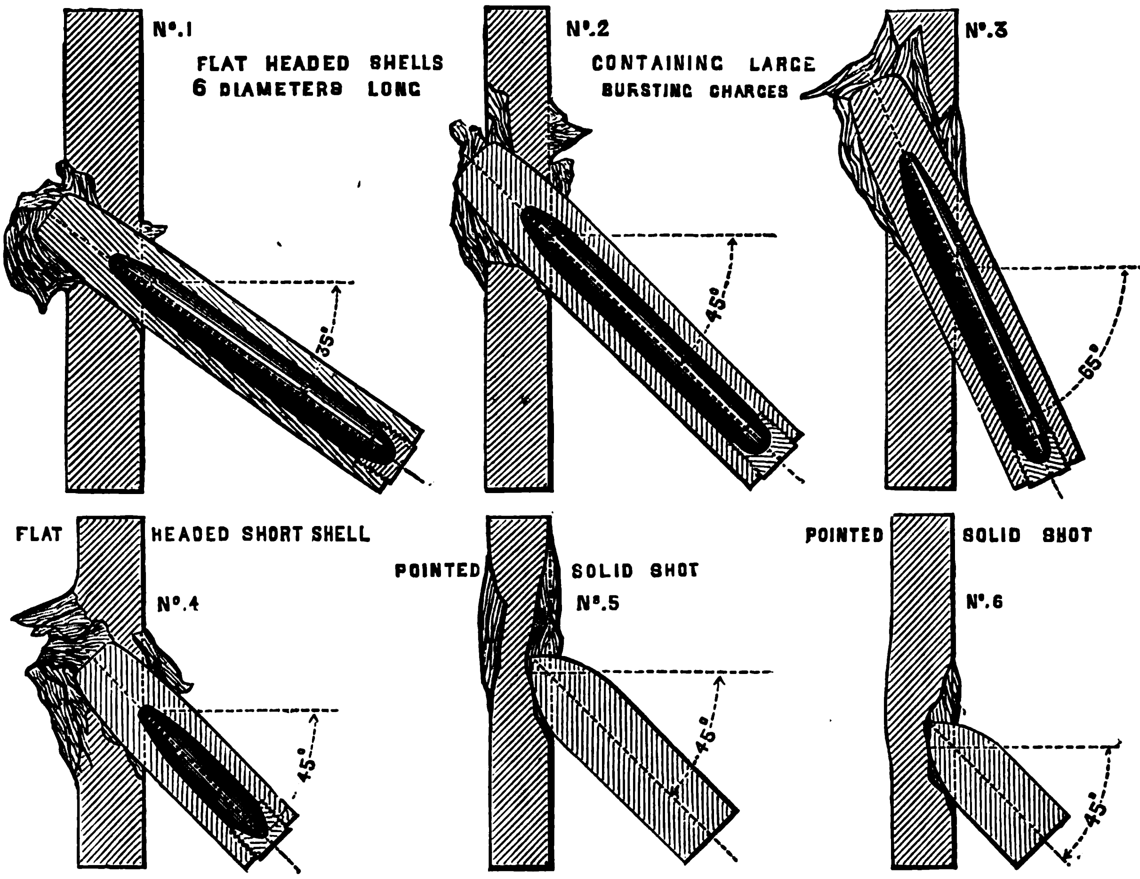
THE NEW VADE MECUM.

THE above is the name given to a very useful pocket companion, in the shape of a telescope, within which is stowed away a microscope of great power. It is the invention of Mr. C. H. Vincent, of 23, Windsor-street, Liverpool, who is now manufacturing them in large numbers. The outer barrel of the telescope is made somewhat larger than would be otherwise necessary in order to enable the microscope to be carried within it. An examination of these useful little articles proves that the telescope possesses a good range, and will be found a handy companion for tourists who do not wish to encumber themselves with a large and unwieldy instrument. The microscope has great power and excellent definition, and has the additional recommendation of not adding to the bulk of the tourist's equipment, whilst it affords all the pleasure and possesses all the usefulness of the more expensive and elaborate kinds. The price of this ingenious combination is so low as to place it within reach of everyone.

FOR some weeks past Russian military engineers have been occupied in Lithuania in selecting the best positions to be fortified for the formation of a line of defence. Among the towns to be examined for that purpose are Kowno, Grodno, Slonim, Minsk, Orsza, and Bieszenkowice. The fortresses already existing in the province are those of Brest-Litewski, Brobruisk, Wilna, and Dunabourg; those to be constructed are intended to form a strategical line with the above. A rumour is also current in military circles that the Russian government intends to transform Warsaw into a citadel of the first class.

ON THE PENETRATION OF ARMOUR PLATES.

BY MR. WHITWORTH.



ON THE PENETRATION OF ARMOUR PLATES WITH LONG SHELLS OF LARGE CAPACITY FIRED OBLIQUELY.*

BY MR. JOSEPH WHITWORTH.

AT the meeting of the British Association at Norwich last year, I contributed a paper to this Section "On the Proper Form of Projectiles for Penetrating through Water." This paper was illustrated by diagrams showing the effects produced on an iron plate, immersed in a tank of water, by projectiles with flat hemispherical and pointed heads. Copies of those diagrams are now before you. In that paper, I claimed for the flat-fronted form of projectile, made of my metal, three points of superiority over the ogival-pointed projectiles adopted in the service—1. Its power of penetrating armour plates, even when striking at extreme angles; 2. Its large internal capacity for bursting charges when constructed as a shell; 3. Its capability of passing undeflected through water, and of penetrating iron armour below the water line. This latter feature was, I think, satisfactorily proved by the experiments described last year, and I now desire to draw the attention of the Section to the experiments I have made for illustrating the penetrative power of long projectiles with the flat front that will contain large bursting charges fired at extreme angles against iron plates. These experiments are illustrated by the projectiles actually fired and the plates they penetrated, which are laid on the table, and also by the diagrams before you.

The gun from which all the projectiles were fired is called a three-pounder, though capable of firing much heavier projectiles; it weighs 815lb., and the maximum diameter of its bore is 1·85in. The charge of powder used in all cases was 10oz., and the weight of the 6 diameter projectiles is 6lb. The following were the examples submitted:—No. 1, a portion of a plate 2in. thick, penetrated by the 6 diameter flat-fronted projectile at an angle of 35deg. No. 2, a similar piece of plate, 1·7in. thick, completely traversed at an angle of 45deg. by the flat-fronted projectile, which buried itself to a depth of 30in. in a backing of iron borings. No. 3, a piece of plate 1·75in. thick, penetrated at an angle of 65deg. by the flat-fronted projectile. No. 4, a plate 1·7in. thick, nearly penetrated at an angle of 45deg. by the 3½ diameter flat-fronted projectile. No. 5, a plate 1½in. thick, against which the ogival-pointed projectile was fired at an angle of 45deg.; the projectile failed to penetrate the plate, being deflected in consequence of the pointed form of head; the distortion of its shape shows the force with which it struck the plate, and proves the good quality of the material which could resist such a test. No. 6, a plate also 1½in. thick, against which an ogival-pointed projectile 2½ diameters long, made of Pontypool white iron, with the ogival-pointed form of head, has been fired; the projectile has scooped out a furrow 4in. long and 7-10ths of an inch deep. It broke up into fragments, of which forty-eight were recovered.

The plates Nos. 1 and 3 were purposely thicker than the projectiles could quite pass through, in order that the "work" of the projectiles might be as severe as possible. An examination of the projectiles themselves will show how well they have withstood the severe strain to which they have been subjected. The data thus obtained fully establish, I think, the superiority I claimed for the flat-fronted projectiles made of my metal, and satisfactorily prove—First, that the flat-fronted form is capable of piercing armour plates at extreme angles. Second, that the quality of the material of the shells enables their length to be increased without any risk of their breaking up on impact, and thus materially augments their bursting charge capacity as shells. Third, that this increase in length, while adding to the efficiency of the projectile as a shell, in no way diminishes, but, on the contrary, proportionately improves, its penetrative power. Fourth, that the amount of rotation I have adopted in my system of rifling is sufficient to ensure the long projectiles striking "end on," and consequently to accumulate the whole effect of the momentum of the mass on the reduced area of the flat front. These experiments show further that the ogival-pointed hard metal projectiles have but small power of penetration when striking at an angle, on account of the form of the head, a projectile of Whitworth metal, with the like ogival-pointed head as the service projectile, having resisted the shock of impact without breaking up, but being deflected in precisely the same manner as the pointed service projectile, which, on account of the brittleness of the metal, was shivered into fragments. The objections I made in my paper last year to the Palliser projectile—first, that its form of head causes it to glance off from plane or convex surfaces when hitting diagonally; and, second, that the brittleness of its material renders it liable to break up on impact—I have now proved to this Section.

The facts illustrated by these experiments are not of recent discovery; ever since 1858 I have experimented upon and advocated the flat front. I have on the table a small plate, half-inch thick, experimented upon in 1862 with hardened steel bullets, fired from my small-bore rifle. No. 39 is the hole made by a flat-fronted bullet, which has penetrated the plate at an angle of 45deg. No. 40 is the indent of a hemispherical-headed, and No. 41 of an ordinary round-nosed bullet, both fired at the same angle of 45deg. These three rounds were fired in 1862. Within the last few days I have had an ogival-pointed bullet fired at the same plate at the same angle, in order to compare the effect with that produced on a larger scale on plate No. 6. It is interesting to observe how closely the results obtained with the small calibre of the rifle agree with those of the 3-pounder gun, which form the subject of this paper. The experiments recorded in the paper were made with a gun of small calibre, from considerations of economy and convenience; but I have always found that what I could do with the smaller calibres of my system could be re-produced in the larger sizes; and from my past experience I feel warranted in asserting that the effects of penetration now exhibited could be repeated on a proportionate scale with my two 9-inch guns at Shoeburyness, or with the 11-inch guns my firm are now engaged in constructing.

A glance at the formidable nature of the projectiles thrown by these guns, and a consideration of the effects they may be expected to produce, will show the importance attaching to the question of penetration of plates by long projectiles. The 9-inch guns, to which I have referred, weigh 15 tons each, and are capable of firing powder charges of 50lb. A 9-inch armour shell, five diameters long, weighs 535lb., and will contain a bursting charge of 25lb. I have no hesitation in saying that these projectiles would pierce the side of a ship plated with 7-inch armour at a distance of 2,000 yards, and at some depth below the water-line. The 11-inch guns will weigh 27 tons each, and will be capable of firing 90lb. powder charges. The 11in.

* British Association.

shells, five diameters long, will weigh 965lb., and will contain bursting charges of 45lb., and would pierce the side of the ship "Hercules," plated with 9-inch armour, at a distance of 2,000 yards. Were it not that the increased destructiveness of war must tend to shorten its duration and diminish its frequency, thus saving human life, the invention of such projectiles could hardly be justified; but, believing in the really pacific influences of the most powerful means of defence, I have named these long projectiles the "anti-war" shells. The principle I have always insisted upon, and laid down for my own guidance in artillery experiments, when either a low trajectory or penetration is required, is "that every gun should be in strength capable of withstanding the largest charge of powder that can be profitably consumed in its bore."

I have drawn up the accompanying table of the sizes of the bores of my guns, with their proportionate powder charges, and the guns will all be fully equal to this duty, and I believe the greatest possible effect, from the consumption of a given quantity of powder, will be obtained. But the guns adopted in our naval service are not equal to such a test, nor, as I believe, are they so proportioned as to realise the best effect from the quantity of powder they consume. Four guns of 12in. bore have lately been put on board the "Monarch;" they weigh 25 tons each, and charges of 50lb. and 67lb. have been fired from them with projectiles of 600lb. weight. I have no doubt that these guns have been made with all possible care, and are as strong as their material and construction admit; but if the weight of these guns was in proportion to the capacity of their bore, and if the material were the best that our metallurgical skill could supply for such a purpose, they ought to fire 117lb. of powder, and projectiles of 1,250lb. weight. They would then be efficient weapons, but at present they are more formidable in name than in reality. We are often flattered by being told that we have the best guns in the world. That may or may not be the case, but I think that we should not rest contented while we are still so far from having attained as much as our present advancement in mechanical and metallurgical science has rendered possible for us.

PARTICULARS OF AMMUNITION FOR WHITWORTH GUNS FROM 5·5IN. to 13IN. BORE.

Calibre of bore.	Powder charge.	Common shells, cast iron, 3·5 diameters long.		Armour shells, Whitworth metal, 5 diameters long.	
		Bursting charge.	Weight of shell.	Bursting charge.	Weight of shell.
in.	lbs.	lbs.	lbs.	lbs.	lbs.
5·5	11·0	4·0	70	6·0	120
7·0	23·0	8·5	150	12·0	255
8·0	34·0	13·0	220	18·0	375
9·0	50·0	18·0	320	25·0	535
10·0	70·0	24·0	440	35·0	740
11·0	90·0	32·0	580	45·0	965
12·0	117·0	40·0	750	58·0	1250
13·0	150·0	51·0	960	75·0	1615

Mr. Whitworth's patent cartridge increases the range from 15 to 20 per cent.

IMPROVEMENTS IN PAPER-MAKING MACHINES.

THE invention we are about to describe consists in the application to paper-making machines of a roller coated with vulcanite and with vulcanised india-rubber, and which is substituted for the ordinary metal under press roll of the machine, and may be used as an under or upper second press roller. It has been patented by Mr. Robert Craig, of Newbattle Mills, near Dalkeith.

In the paper-making machine now in use, the pulp for forming the material of the paper is projected in a fluid state upon an endless wire cloth, and is kept from overflowing at the sides by endless bands (commonly termed deckle straps) after having a greater portion of the water sucked from it by capillary attraction and the action of air pumps. The endless wire cloth carrying the moist pulp upon its upper surface passes between a pair of couching rollers, the upper roller of which is usually made to press upon the under roller. These couch rollers are usually covered with a woollen jacket, and also are constructed of metal in the case of the under and of wood in the case of the upper roller. The web of paper, having passed between the upper and under couch rolls, next passes between another pair of rollers called first press rollers, which have an endless woollen cloth or felting of open texture (technically called a wet felt) between the web of paper and the surface of the under first press roll for the purpose of expressing or discharging the water contained in the paper.

The under press roll is made of iron, the endless woollen cloth or felting passing between the under press roller, and the upper press roller carries the web of paper with it between the upper and under press rollers. In so passing between the press rollers, the web of paper, as at present manufactured, is subjected to considerable pressure, by which the substance of the paper is made thinner, and the natural elasticity of the fibrous pulp of which the paper chiefly consists becomes greatly impaired. The woollen cloth or felting also being subjected to considerable pressure while passing in a damp state between the ordinary metal first press rollers carrying the moist web of paper, suffers great tear and wear from the attrition caused by the hardness and unyielding character of the two metal rollers.

By the substitution of a composite under press roller possessing a slight degree of elasticity, the web of paper, in being carried upon the endless woollen cloth or felting between the press rollers, is subjected to a less pressure than is received by the ordinary pair of metal rollers, while, at the same time, a sufficient pressure is given to effect the purposes for which the web of paper is passed through the press rollers, viz., to express or discharge the waters still remaining in the pulp to a degree sufficient to enable the web of paper to be led round the drying cylinders of the machine. From the slightly elastic and softer character of the new under press roller, the natural elasticity of the web of paper is preserved, and the fibrous substance of the web of paper not being crushed together, as in the case of the ordinary metal first press rolls, permits the web of paper in the succeeding process of drying upon cylinders to become more bulky, and therefore more valuable than by the ordinary process, and thereby the character of paper so made thus becomes more akin to paper made by hand by the great increase of body or bulkiness acquired by the freedom from the effects of the severe pressure imposed in the case of the use of ordinary metal first press rollers. The endless woollen cloth or felting, from being subjected to an elastic pressure, suffers very much less attrition or tear and wear in passing over the softer and elastic material of the under press roller, and the action of the felting is thereby such that it goes much longer without washing, and is not liable to cut by its creasing or otherwise.

In those paper-making machines in which a second set of press rollers is employed, Mr. Craig also substitutes his composite rubber roller in the place of the second under press roller, except in those machines in which the second upper press roller serves to carry the wet felt, and which has the wet felt between it and the paper. In this latter instance, the composite rubber roller will be applied to the second upper press roller, as it thus performs functions similar to the first under press roller. The materials of which the roller is composed are as follows, viz.—a metal roller of the ordinary size at present in use has applied to it a first or inner coating of vulcanite cured and hardened only to such an extent or degree as to adhere or stick firmly to the metal shell of the roller, which it covers, and then an outer coating covering the vulcanite coating, composed of vulcanised indiarubber or indiarubber not so highly cured, and therefore of a softer and more elastic character than the inner coating. With rollers thus covered, there is no tendency in the covering to separate from the metal, and the rollers consequently are thereby much better fitted to withstand the pressure which they receive when in use, and, in consequence of the interposed coating of vulcanite, are not liable to strip.

IMPROVEMENTS IN CHANNEL STEAMERS AND CABS.

THE very defective state of the accommodation afforded by the Channel steamers plying between this country and the continent having been brought under the notice of the Council of the Society of Arts, they offer the gold medal of the Society and the large silver medal of the Society for the best and second-best block model of a steamer which shall afford the most convenient shelter and accommodation to passengers on the deck of the vessel crossing the Channel between France and England. The steamer is not to exceed in tonnage and draught the best vessels now in use between Folkestone and Boulogne, and the model must be on a scale of a quarter of an inch to a foot. The models, marked in cypher, are to be sent in to the Society of Arts' House, John-street, Adelphi, on or before November 1, 1869, with a sealed envelope, giving the name and address of the designer. The Council reserve the right of withholding either or both medals in case, in their opinion, the models sent in do not possess sufficient merit. The following particulars of the South-Eastern Channel steamers "Victoria," "Albert Edward," and "Alexandra," are given for the convenience of competitors, but it is not intended to confine the designs to them, except as to tonnage and draught:—Length between perpendiculars, 200ft.; breadth of beam, 24ft.; depth underside of deck amidships, 12ft. 6in.; draught of water, 7ft.; bow, clipper; stern, elliptic; rig, polacca with two masts, lug foresail, gaff mainsail, staysail, and flying jib; engines, oscillating; paddle wheels, 17ft. 6in. diameter; tonnage, 568 tons; speed, 17 miles an hour.

The condition of our cabs has not escaped the notice of this most useful society, and the Council offer the following medals for improved hackney carriages specially suited to the metropolis:—The Society's gold medal for the best and most convenient open hackney carriage for two persons. The Society's silver medal for the second best ditto. The Society's gold medal for the best and most convenient closed hackney carriage for two persons. The Society's gold medal for the best and most convenient hackney carriage for four persons, either opened or closed, or both. The Society's silver medal for the second best ditto. Lightness of construction, combined with adequate strength and durability, will be especially considered in making the awards. The awards will be made after actual trials of the carriages extending over a certain period. Communications describing the carriages must be sent to the secretary of the Society of Arts before January 1, 1870, the carriages to be sent to a place hereafter to be appointed. The Council also offer the Society's silver medal for the best instrument to be affixed to a cab or other hackney carriage for indicating the fare as between the passenger and the driver, whether by registering the distance travelled or otherwise, and which instrument shall also indicate, for the convenience of the cab-owner and of the driver, the total distance travelled during the day, and the total amount earned. The instruments competing, with full descriptions of their construction, to be sent to the Society's house before January 1, 1870. Competitors may, at their option, sign their communications, or may forward with them sealed letters containing the name and address of the writer. The Council reserve to themselves the right of withholding all or any of the medals in case none of the carriages or instruments possess, in their opinion, sufficient merit. In the trials of the several carriages, the small amount of vibration and noise will be duly considered by the judges.

SPECIFICATIONS OF PATENTS AT THE SOCIETY OF ARTS.

ATTENTION has been drawn by Mr. W. Lloyd Wise to the present unsatisfactory arrangement and condition of the specifications, indexes, &c., presented by the Commissioners of Patents to the library of the Society of Arts for the use of the public. It appears that the indexes have long remained uncut, so that it has been necessary for each reader to cut the leaves for himself, besides which many of the specifications are in very inconvenient situations, and cannot be picked out without considerable loss of time. If greater facilities were afforded to inventors for ascertaining what has been already protected we think that much would be done to obviate the objection now raised by "abolitionists" against patents, viz., that many inventions are re-patented. No doubt it was in a great measure with the view of having their publications easy of access to inventors and others in the Adelphi and its neighbourhood that the Commissioners gave these books to the Society, and it is to be regretted that so little has been done to carry out their good intentions. We hope there will be some real improvement now that public attention has been called to the subject.

MR. JAMES YOUNG, so well known in connection with the paraffin industry, has presented 10,000 guineas to Anderson's University, Glasgow, for the purpose of founding a chair of technical chemistry, and establishing bursaries, scholarships, &c. Mr. W. H. Perkin, F.R.S., who, it will be remembered, delivered a course of Cantor lectures before the members of the Society of Arts during the last session, has been appointed the first professor.

MACHINE FOR TIPPING PILE FABRICS.

BY MR. B. NORTON.

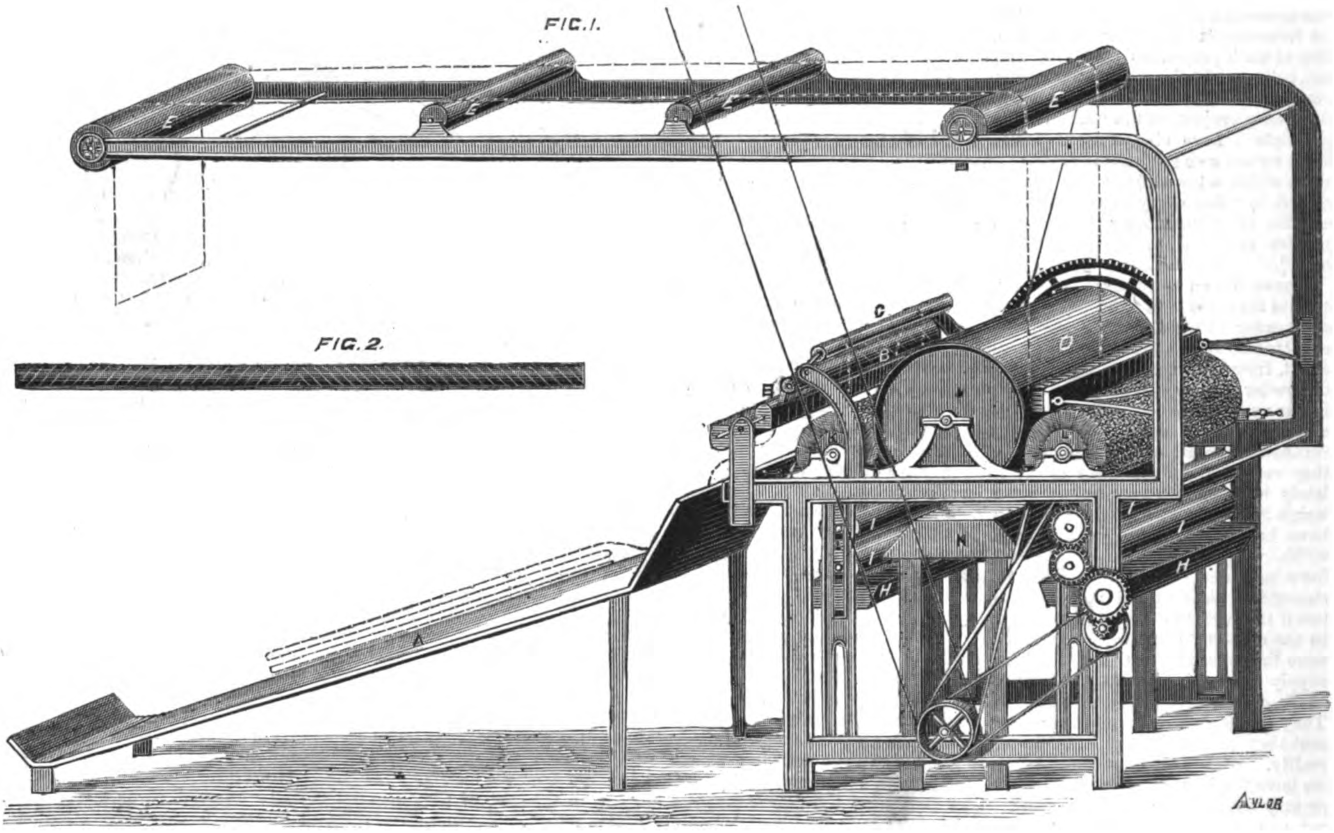


FIG. 1.
FIG. 2.

TIPPING PILE FABRICS.

THE invention illustrated in the accompanying engraving has for its object improvements in tipping pile fabrics. It has been patented by Mr. Benjamin Norton, of Nortonthorpe Mills, near Huddersfield, who applies colour, lacquer, resist, or discharge to the tips of the pile by means of circular revolving brushes. The pile fabric is led around a portion of the circumference of a drum with the pile outwards, and, whilst so supported, colour is applied to the pile by means of the circular revolving brushes.

Fig. 1 shows a perspective view of the machine. A is the scray upon which the piece is laid; B B B are fluted guide bars, the flutes of which incline from the centre to the ends in opposite directions, as shown separately in fig. 2, so that the cloth, as it passes over them, is extended to its full width, and the piece is also kept sufficiently tight as it is passing through the machine. C is a plain roller over which the piece passes. D is the large drum around which the cloth is led; on the under side of this drum is a guard of zinc or other material to prevent it being smeared with colour. E E are rollers over which the cloth is conducted as it passes forwards to a board on a table, where it is cuttled. If required, it can be hooked on to frames direct from the last roller E. H H are boxes containing colour. I I I I are regulating colour rollers supplying the brushes K L. The manner in which these rollers are driven is clearly shown by the engraving. M is a stationary brush carried at its two ends by pins passing through arms on the framing. This brush is set up towards the large drum D by means of screws. N is a guard to prevent any colour from the brushes or rollers falling under the machine.

When using the machine for tipping pile fabrics, the operator cuttles the piece straight and lays it upon the scray with the face downwards, and to the end of it he then attaches one end of a piece of canvas, and to the end of this three cords at equal distances, the canvas and cords being each of sufficient length to go through the machine. He then passes the cords through the machine, setting it in motion as soon as they have got under the large drum, and, when a portion of the canvas has passed the brushes, the boxes can then be supplied with colour or other liquid, so that the brushes may be fully saturated by the time the piece comes on to the large drum D. By this means, the piece is carried forward to the board, and is tipped in its progress. The cords and canvas are taken off as soon as they have passed the last roller E, and the canvas is attached again to the end of the last piece, and remains in the machine till it is required again.

The colour boxes are now lowered, and the brushes and colour rollers cleaned and replaced. The colour boxes can be raised or lowered as required, and are made of wood where the colour is used cold, but of iron or other metal where the colour is required to be kept hot. In this case, gas jets are applied under the box, or, in place of this, a box with a false or hollow bottom supplied with steam may be employed. The colour rollers are moved to or from each other by screws or other means, according to the quantity of colour required to be put on to the piece by the brushes. These rollers are of cast iron, hollow, with shafts through them, so that they can be heated by steam if required in order that the colour or other substance may be kept hot. Should the rollers not take up sufficient colour, they can be covered with india-rubber or other material to cause them to take up more.

In ordinary tipping, the first brush revolves in the same direction as the large drum carrying the piece, and the second one in the opposite direction. A little above this second brush is a stationary flat brush, the pressure of which is regulated by screws so that it shall just reverse the pile. In addition to these, more brushes, either circular or flat, can be employed, and they may be caused to move across or diagonally when the colouring matter or other liquid requires to be worked deeper into the pile. It is preferable to put the most colour on with the first brush, and for the others to brush it into the pile. The revolving brushes are driven at a surface speed of about eight or nine times the surface speed of the large drum, and the colour rollers at a surface speed of about twice the surface speed of the large drum. We may add that this machine is in daily use at the Nortonthorpe Mills, where it fully answers every expectation.

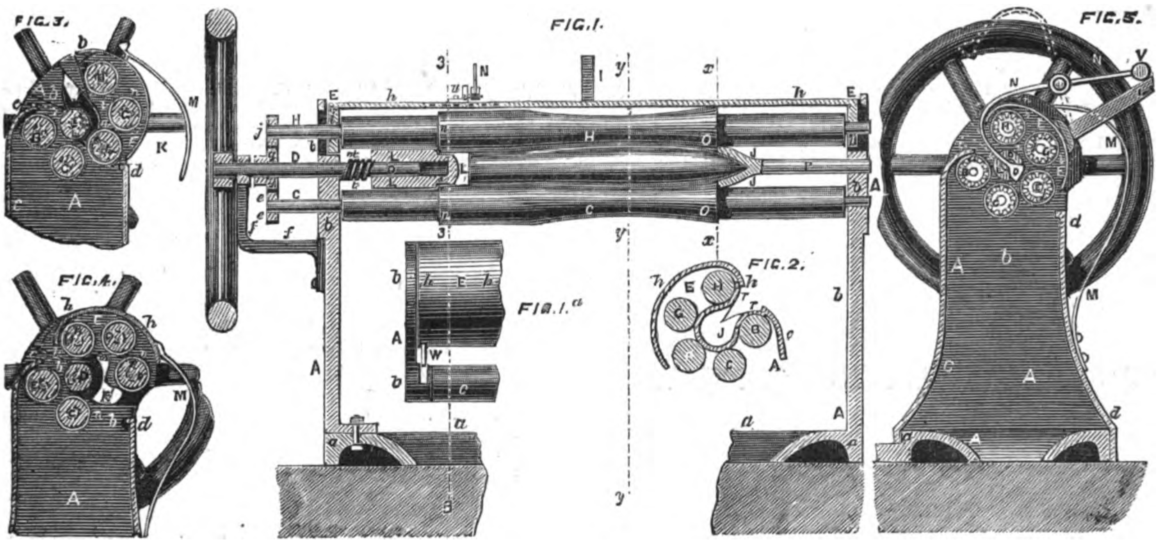
BALANCING HEAVY CYLINDERS.

THE shaking of heavy cylinders, grindstones, millstones, &c., when out of balance, depends upon and is caused by the irregularity of centrifugal force on the opposite sides of the wheel. That is, if the centrifugal force, or the sum of the tendencies to fly off in tangents to their arcs of revolution, possessed by all the particles on the lighter side, be represented by a, and that on the heavier side by b, the power to which the shaking is due will be represented by the expression $b-a$. Suppose, in a given case, b equals a pressure of 4,000lb. and a equals 3,750, the force with which the cylinder would be shaken would be 250lb., moving from one side of the axis to the other, and a vibration would be produced upon each interchange of place between the heavier and lighter sides, having for one of its elements of measure the ratio existing between the difference of the centrifugal forces of the opposite sides and the weight of the cylinder. If all the supports of such unbalanced wheels or cylinders were perfectly rigid and inelastic, no vibration would be felt, but the strain upon the axle journals and boxes would remain undiminished, so that greater strength of parts would be necessary in order to avoid breakages, and loss of power would accrue. In order that a cylinder may be perfectly balanced when in motion, it is necessary that the sum of the moments of the particles on one side (that is, the sum of their several weights multiplied into their several velocities) should exactly equal the sum of the moments of the particles on the other side, when the cylinder is running at any speed. This can never be more than approximately attained in practice. The writer, who has had considerable experience in balancing heavy cylinders, designed to run at high speeds, has found the following method the best. The cylinder being keyed upon its axle, as it is intended to run, is lifted by a tackle or crane, and lowered, so that each of its journals rests upon a stout steel straight-edge placed so that its upper surface is exactly level and parallel with its fellow. These straight edges should not only be so rigid as to suffer no sensible deflection from the weight of the cylinder to be balanced, but they should be very hard and as smooth as it is possible to make them; and great care should be taken to keep them free from indentations. The journals of the cylinder must also be round and polished in order to secure delicate action. All the friction is thus converted into rolling friction, and this is reduced to a minimum. The cylinder can now be loaded on its lighter side, or *vice versa*, until it will remain perfectly motionless when stopped in any part of its revolution. We have balanced heavy cylinders in this way until they would revolve by placing upon either side one twenty-thousandth of their weight. The method sometimes practised of suspending a cylinder by the centres of the journals is not sufficiently delicate. Either the lathe centres will be so forced in as to greatly increase friction, or there will be some play, so that the centre of suspension will be outside the centre of the axle. The latter makes no difference where the cylinder can roll, as on the steel straight edges, but when suspended from a point, it will certainly defeat the attainment of any great degree of accuracy.—"Scientific American."

AT a meeting held in Stirling it has been resolved to take steps to erect a monument to King Robert Bruce at Bannockburn.

MACHINE FOR MAKING CIGARS.

BY MESSRS. BRIGHT AND STONE,

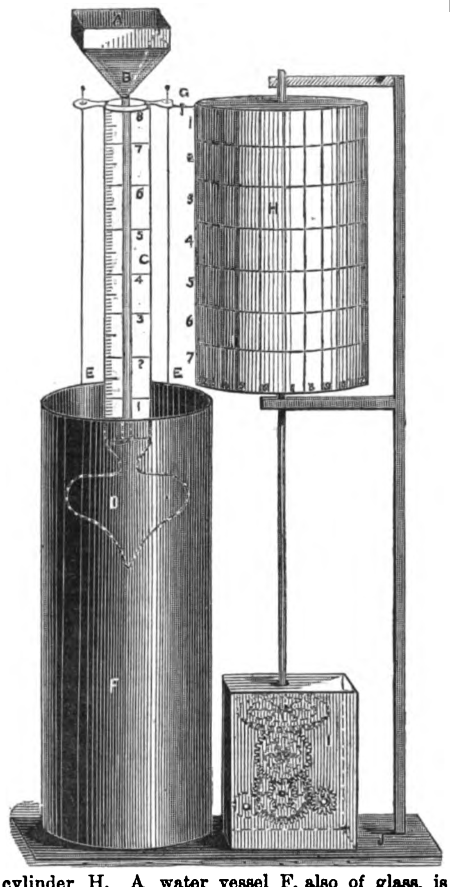


ON SELF-RECORDING ANEMOMETERS.

By M. Charles Rabache.

AT the recent meeting of the British Association, in Exeter, a self-recording rain gauge, invented by Mr. R. Beckley, of the Kew Observatory, and made by Messrs. Beck, of London, was presented in Section A; a paper was read, and a print containing its description was distributed.* Great and minute precautions have been taken in the invention and construction of this instrument, in order to render it as perfect as possible. In my opinion, however, it will not accurately record the quantity of rain fallen at a precise given time, and this for several reasons, amongst which are the following:—First, the tube, copper bottle, mercury surface, syphon, &c., will always retain a certain portion of the fallen water. Second, mercury being used to transmit to the recording cylinder the pressure of the water, will continually vary, not only according to the quantity of rain, but also conformably with its temperature and that of the ambient atmosphere, which, changing continually, will cause mercury to contract or expand accordingly, even when there will be no rain at all. In such changes of temperature, the pencil will indicate the fall of rain in dry weather. Warm or cold, summer or winter, rain will effect the mercury differently, and the same volume or weight of water will not be recorded by the same figure on the cylinder in every season. Third, the action of the syphon causes an intermittence, and its emptying and that of the bottle will never be instantaneous and complete. The rain falling while the syphon is in action will not be recorded. Fourth, the instrument being constructed in oxidable metals, oxidation is sure to take place in time. Fifth, the friction rollers will also more or less affect the instrument. Being complicated, it must, consequently, be expensive.

These defects suggested to me the invention of a new instrument, of which the following is a description, reference being had to the accompanying engraving. My instrument is of glass, consequently, is not oxidable. It is self-recording, and gives at the same time with the greatest precision three indications—weight, volume, and time. One of its parts controls the other. It can be made of any size, and adapted to different purposes. A funnel-shaped receiver A, of any calculated surface, has a long and narrow tube B, curved at right angles at its lower extremity *o*, to take the water down to the bottom of the meter, and deliver it horizontally, so as to avoid a pressure which would act on the instrument. The meter C is composed of a properly graduated glass tube, every degree of which represents in volume one cubic centimetre, and in weight one gramme of water. Each degree is divided into tenths, indicating the tenth part of a centimetre or one millimetre of water. The lower part of the meter is formed of a float D, which makes it float in water up to the flotation point *o*. At the top of the tube is a metallic circle, into which pass two pins or slide rods E E to prevent oscillation. On the right side is a pencil G supported by a flexible metallic spring. This pencil presses slightly against a



cylinder H. A water vessel F, also of glass, is filled with water; its depth is proportioned to the length of the meter. I is a clockwork arrangement which can be placed at will, the spindle of which, being vertical, gives motion to the recording cylinder H at the rate of one degree per hour, or one revolution in a day. The circumference of the recording cylinder is horizontally graduated in degrees, corresponding with those of the meter. Longitudinally it is divided into twenty-four parts indicating the twenty-four hours. The whole rests upon a stand J. The entire instrument may be cased in a mercury air-tight case if thought proper. In case a syphon should be found useful, it can be adapted to the meter.

The action of the instrument requires no long description. The rain fallen in the funnel of a known surface is directed into the meter in *o* flotation point, its weight deepens the meter in the water contained in the water vessel in a proportion or degree indicated by the rule which, at the same time, indicates the volume. Therefore, by merely looking at the instrument in water, we see the quantity and weight of rain fallen. As the meter deepens in the water, the pencil placed at its top descends, and makes a trace on the recording cylinder. The heavier the rain, the faster the meter deepens; the rule or scale of the recording cylinder being the same as that of the meter, they both give the same indication, and control one another. The meter only shows the quantity and weight of water fallen on a given surface, but it does not indicate the time of the fall. This is shown by the recording cylinder. As long as there is no rain falling the pencil remains at the same height; the recording cylinder turning regularly on its axis, the pencil mark is a horizontal line extending to as many degrees as there are hours without rain. As soon as rain falls, the pencil moves downwards, and every minute, second, part of a second, &c., the quantity of rain falling is instantly recorded in pencil writing on the cylinder. Supposing the surface of the receiver to be 1,000 square centimetres, a fall of rain of one millimetre in thickness collected in the mete r wil fill one centimetre of it; and if of one centimetre in thickness, it will deepen it ten centimetres. Instruments with small receivers will suit for recording heavy rains, whereas large receiver ones will do better for minutely recording light rains. —Marchain, Somme, France.

* An illustrated description of Mr. Beckley's Anemometer will be found at page 24 of our present volume.

MACHINE FOR MAKING CIGARS.

THE machine represented in the annexed engraving is designed to manufacture cigars complete. It is to roll the filling, to wind the inner and outer wrapper around it, to form the point, and to cut off the end so as to form a perfect cigar. It is the invention of Mr. Bright and Mr. Stone, of New York, and has been patented in England. In our engraving fig. 1 represents a vertical longitudinal section of the machine; fig. 2 is a detail vertical transverse section taken on the line *x x*, fig. 1; fig. 1a is a detail plan view of the same; figs. 3 and 4 are vertical transverse sections taken on the line *y y*, fig. 1; fig. 5 is a vertical transverse section taken on the line *z z*, fig. 1. A represents a metallic frame consisting of a slotted bed plate *a*, of two uprights *b b* at the end of the bed plate, of a front-face plate *c*, and of a rear plate *d*. The front and rear plates extend from between the two uprights and to the bed plate. In the end pieces, *b b* are the bearings of two horizontal non-elastic rollers B and C, which carry each at one end, outside of the frame, a small pinion *e*, as seen at fig. 1. D is a short horizontal spindle having its bearings in one of the uprights *b* and in an arm which projects from it. The inner end of the spindle extends about an inch beyond the inner face of the upright *b*. The spindle D carries a toothed wheel *g*, which gears into pinions *e e*, and carries a flywheel and a crank or pulley for the purpose of receiving motion. E is a frame consisting of a long curved plate *h* and two vertical end pieces *i i*, which rest with their lower edges on the endpieces *b b*. In the end pieces *i i* of the frame E are the bearings for three horizontal non-elastic rollers F G and H. The axes of these rollers project through one of the perforated uprights *b*, and carry pinions *j j* of the same size as the pinions *e* seen in fig. 5. The lower edges of the end pieces *i i* are provided with two rounded projections *k l*, fig. 4, and between them is a rounded recess *m*. Corresponding to them are formed on the shoulders of the uprights

b rounded recesses k' l', and between them a rounded projection m', fig. 4.

The frame E has a projecting handle I by which the frame can be swung so as to turn around the projection k or l as may be desired. The upper part of the front plate c is bent somewhat over the roller B, whilst that of the back plate is bent as seen in figs. 3, 4, and 5. When the frame E is so set that its edges k l m all come in contact with the parts k' l' m' of the frame A, the pinions of its rollers F G H will all be in gear with the wheel G, as seen in fig. 5, otherwise they will not be in gear. Each roller is provided with two shoulders n o between the uprights of the frame A; the shoulder n being near the spindle D, the other, o, being near the opposite upright b, as seen at fig. 1. Between these shoulders, each roller is formed with a curved side, which is thinner in the middle than near the shoulders, so that between the fine rollers a cavity is formed resembling the shape of the cigar. Opposite to the spindle D, and in a line with it, is fitted through the upright b a pin P, on which the point-former or header J is secured. This header is a metal plate of the shape of an open cone, with two projecting lips r r which fit under the plates c and h, as seen in fig. 2. These lips prevent the header from turning. The inner end of the header abuts against the shoulders o of the rollers. Upon that portion of the spindle D which projects from the inner side of the upright B, is fitted a cylindrical block L which has a shoulder s. Between this block and the upright b is interposed a spring t, which serves to push the block forward so that its shoulder s is always in contact with the shoulders n of the rollers, whilst, at the same time, the spring will allow the block L to yield to pressure against its inner end. A spring M is fastened to the frame A to hold the frame E in any desired position, either by mere friction or by fitting in notches formed in the plate h. N is a curved bar pivoted to an adjustable ear u, which is fitted upon the plate h. One end of this bar has a weight V, whilst the other end carries a knife O, as seen at fig. 5. The weight keeps the bar N always in the position shown by dotted lines in fig. 5, that is, out of the way; but the bar can be swung so as to bring the knife between the rollers to sever anything held between them.

In working this apparatus, the frame A is set up so as to be immovable. The frame E is, by means of the handle I, swung back so as to swing around the projections k; thereby the rollers B and H are brought far apart, as in fig. 3, to allow the insertion of the tobacco for forming the filling between the rollers. The frame E is then swung forward into the position shown in fig. 5, to bring all rollers in gear with the spindle. The rollers are then all revolved, and roll the filling into the desired form. The follower L will yield to the tobacco if there should be so much as to make the cigar longer than required. The inner and outer wrappers are then, with their ends, inserted between the rollers B H, and will be wound around the cigar. The header J causes the required form of point to be produced on the cigar. When the cigar has been completely rolled, the knife is brought down to cut the broad end off and to trim it so that the cigar will be of a certain desired length. To vary the lengths of the cigars, the ear u is adjustable on the plate H, as indicated in fig. 1. The cigar is now complete, and, by swinging the frame E forward, as in fig. 4, to bring the rollers C and F apart, it will be discharged from between the rollers, and will drop through the slot of the bed plate a into a receiver. By making one of the uprights detached from the plate a and face plates c d, the machine is so arranged that the parts can be separated so that the rollers of various kinds of cigars, as well as headers and followers of suitable form, may be inserted. From the front of the frame E project tongues W fitting into corresponding recesses of the frame A, as seen in fig. 1 a, to keep the frame E steady when the machine is in operation.—"Tobacco Trade Review."

OVERHEATING OF FURNACE CROWNS AND OTHER BOILER PLATES WHEN COVERED WITH WATER.

By Mr. L. E. Fletcher.

(Continued from page 211.)

Another very similar case of failure of furnace crowns was met with in May, 1866. It occurred in the neighbourhood of London to a Cornish boiler fed with the New River Company's water. This boiler I was informed had failed at the furnace crowns, and repeated repairs been resorted to. These, however, had such little effect that one boiler after another had been laid down till some three or four boilers had been ruined in the course of three years; while one of the boilers had received a new flue-tube. Added to this, experiments had been tried by altering the steam dome, and, altogether, the owner informed me the affair had cost him £700. Disheartened with these repeated failures, he was persuaded to exchange the internally-fired boiler for an externally-fired one with a couple of return tubes running through it, which he had just laid down at the time of my visit. On making an examination of the boiler I found that it contained a good deal of fine floury deposit of a light colour, and that the feed water was heated by the injection of the exhaust steam from the high-pressure engines, so that the grease from them passed through into the boiler. I called the owner's attention at once to these facts, and explained to him that these were the causes of all the trouble he had experienced. He urged by way of objection that prior to the last three years the boiler had worked for a considerable time with the same water and with the feed heated by the exhaust steam, without giving trouble, and therefore argued that the fault could not be with the water or with the grease discharged from the engines. This objection appeared at first sight difficult to meet, but on inquiry it was found that about three years before then the work became too severe for the engine, when its power had been doubled by the addition of a new cylinder, which gave the boiler more work to do and necessitated its being more severely fired. This at once made the whole matter plain. The tendency had existed all along, but had not been developed till the fires were pressed.

The following is an analysis of the deposit in question:—

Carbonate of lime	73·87
Carbonate of magnesia	4·59
Oxide of iron and alumina	7·07
Organic matter	3·15
Sand silica alumina	11·32
	100·00

N.B.—This was a fine dry powder of a slate colour, difficult to wet with water.

It will not escape observation that this floury deposit contained as high an amount of carbonate of lime as 73 per cent., and, simple as it appears, it was through the presence of this fine flour or dust that the four boilers referred to above were ruined, and the expenditure of £700 incurred. In the new boiler a good surface blow-out apparatus was adopted, and the boiler was frequently blown out at the bottom as well as from the surface of the water. This proved sufficient to remove the difficulty, though the credit was wrongly given to the change from the internally-fired boiler to the externally-fired one. Externally-fired boilers are affected by this description of feed water as well as internally-fired ones, which will be seen from the next case of injury.

A third case was met with in June, 1867, at a colliery in the neighbourhood of Ruabon, North Wales. In this instance six new plain cylindrical egg-ended externally-fired boilers failed within six weeks after they were set to work, giving way at the plates over the fire. These boilers were 5ft. 6in. in diameter, 36ft. long, made of plates ⅜in. in thickness, and worked at a pressure of 40lb. per square inch. The owners threw the blame of the failure of these boilers on the makers, attributing it to the quality of the plates or workmanship, and consequently a dispute arose, and I was requested to make an examination. On doing this I found that the plates over the fire were of Low Moor iron and of good quality, and that the fault did not rest with the boilers but with the feed water, which formed, as in the previous instance, a fine floury deposit, consisting to a great extent of carbonate of lime, while it was heated by the exhaust steam from the engines and thus charged with grease, in consequence of which, as in the previous cases, the plates over the fire had been overheated and bulged down out of shape, while, in addition, leakage had taken place at the seams of rivets. The manager was unwilling to accept so simple an explanation of the difficulty, though he had previously received a similar opinion from another engineer and been advised that he must either change the feed water or give up heating it with the exhaust steam, so as to prevent the introduction of grease to the boilers. Though ridiculing the recommendation, he had nevertheless diverted the exhaust steam from the feed water, when he found that the result justified the explanation given and the remedy proposed. Time showed that overheating did not recur, and the boilers worked on without further trouble.

The following is an analysis of the deposit formed within these boilers, and which, I believe, was taken from them before the arrangement for heating the feed by the exhaust steam was given up, so that at that time grease was admitted:—

Carbonate of lime	75·26
Sulphate of lime	10·02
Carbonate of magnesia	8·78
Oxide of iron and alumina	0·47
Insoluble matter (sand, &c.)	2·68
Organic matter	2·79
	100·00

N.B.—This sediment was a white powder and smelled of tallow. By digestion with ether some grease was extracted and collected.

The following is another analysis of the deposit taken from these boilers subsequently to the last specimen, and after the practice of heating the feed water with the exhaust steam had been discontinued, when the boilers were fed with cold water:—

Carbonate of lime	84·10
Sulphate of lime	2·25
Carbonate of magnesia	8·73
Oxide of iron and alumina	1·41
Insoluble matter (sand, &c.)	1·98
Organic matter	1·53
	100·00

N.B.—The organic matter does not contain grease.

It will be observed the grease was detected when the feed water was heated by the exhaust steam but not after that practice was discontinued.

In addition to the above, further analyses were made at a later date both of the fine floury deposit and of the scale:—

FLOURY DEPOSIT.

Carbonate of lime	80·00
Sulphate of lime	6·08
Carbonate of magnesia	12·44
Oxide of iron and alumina	0·98
Sand, &c.	0·5
	100·00

SCALE.

Carbonate of lime	77·40
Sulphate of lime	9·52
Carbonate of magnesia	10·90
Oxide of iron and alumina	1·22
Sand, &c.	0·96
	100·00

The following is an analysis of the water with which these boilers were fed:—

The total solid matter left on evaporating a portion of the water amounted to 40·15 grains per gallon. This consisted of—

	gr. per gal.
Carbonate of lime	23·75
Sulphate of lime	1·57
Sulphate of soda	4·33
Common salt	2·63
Carbonate of magnesia	5·18
Organic matter and loss	2·69
	40·15

N.B.—The carbonates of lime and magnesia are kept in solution by the presence of free carbonic acid. If this is neutralized by the addition of lime, a portion is precipitated. By this means nearly one-half the total matters in solution may removed. Also in boiling the water, before evaporation commences, a portion is precipitated.

From the above analyses the high proportion of carbonate of lime will be seen in each case:—

		per cent.
Analysis No. 1 gave—	Carbonate of lime	75·26
„ No. 2 „	Carbonate of lime	84·10
„ No. 3 „	Carbonate of lime	80·00
Mean result		79·78

From this it appears that the mean result was nearly equal to 80 per cent. of carbonate of lime contained in the fine floury deposit.

It should be added that at the same colliery there was another range of plain cylindrical externally-fired boilers, which had been working for a number of years, without failing as the new ones had done. The manager, therefore, pointed to this fact in support of his view that the new boilers were at fault, and not the feed water, since the feed water appeared to him to be as good in one case as in the other. To settle this question an analysis was made of the water with which the old range of boilers were fed, as well as of the deposit formed within them, in order that a comparison might be instituted, when the following was found to be the result:—

SEDIMENT.

Carbonate of lime	22·0
Sulphate of lime	63·78
Magnesia	14·07
Oxide of iron and alumina	0·09
Sand, &c.	0·06
	100·00

SCALE.

Carbonate of lime	10·17
Sulphate of lime	72·94
Carbonate of magnesia	15·89
Oxide of iron and alumina	0·63
Sand, &c.	0·37
	100·00

The following is an analysis of the water:—

A portion of the water, evaporated to dryness, left a residue amounting to 90·3 grains per gallon. This contained—

	gr. per gal.
Carbonate of lime	0·15
Sulphate of lime	16·93
Sulphate of soda	51·55
Common salt	2·93
Carbonate of magnesia	17·11
Magnesia	1·22
Organic matter and loss	0·41
Total	90·30

N.B.—As this water is concentrated by evaporation it becomes alkaline.

The addition of lime gives a precipitate amounting to nearly one-third the total matter in solution.

Boiling the water causes no precipitate. There was a deposit of organic matter at the bottom of the jar which contained the water.

The results of the analyses of the feed waters of the new and old ranges of boilers, as well as of the sediment, will be the more easily compared on reference to the following table:—

NEW BOILERS.	Percentage of carbonate of lime in fine floury deposit.	Grains of carbonate of lime in a gallon of water.
Which failed after six weeks' working	79·78	23·75
OLD BOILERS.		
Which worked for years	22·0	0·15

From this table it will be seen how different were the characters of the waters by which the two ranges of boilers were supplied, and how much more carbonate of lime was contained in the one that fed the new boilers which failed after six weeks' work, than in the one which fed the old boilers which worked on for years, while it corroborates the view that the failure of the new boilers was not due to their material or workmanship, but to the fine floury deposit formed by the feed water.

(To be continued.)

IMPROVED PISTON FOR STEAM AND OTHER ENGINES.

By Mr. T. H. Martin.

At the annual meeting of the Miners' Association of Cornwall and Devon, recently held at the Polytechnic Hall, Falmouth, Pendarvis Vivian, Esq., M.P., in the chair, the following important and interesting paper, by Mr. T. H. Martin, of the Morfa Copper Mills, Swansea, was read, it being selected from amongst several other papers which had been sent in for discussion:—

The piston being the medium by which the power of the steam is exerted and transmitted through the rod to the work to be performed, it naturally forms one of the most important parts of the steam engine, consequently the duty of the engine, in a great measure, depends on the efficiency of its work. Pistons are of various constructions, but all may be classified under two heads, viz., those for single-acting and double-acting engines. In single-acting the steam is admitted on one side of the piston only, the reverse side being generally hollowed out; whilst in double-acting engines the steam is admitted on both sides alternately. It is not material in the construction of a piston whether the engine is condensing or non-condensing.

I propose to refer to each class of piston in the following order:—First, to those for single-acting pumping engines; second, to those for double-acting engines. I purpose briefly describing the form, and to point out the disadvantages attached to pistons that are generally applied to single-acting engines. They are variously constructed, as before remarked, particularly those parts—*i.e.*, the rings—which are brought into rubbing contact with the cylinder. These are generally made parallel or bevelled; they are invariably packed behind with greased gasket, india-rubber, lead, or with patent packing, for the purpose of pressing them against the cylinder, or to make them steam-tight. Goodfellow's bevelled rings, fitting between flanges of piston, with a narrow wedge-like ring behind, are sometimes used; also Ramsbottom's small square rings, which are fitted into the periphery of the piston. Some use Stephenson's method, consisting of rings with steel springs, and bolts for tightening; others adopt segments with wedges. These and various other methods have been applied from time to time for producing continuous steam-tight pistons, but hitherto without success. Having briefly described a few of the varieties of pistons in use, which may be classified under two heads, viz., packed and spring, I will now point out the disadvantages attached to each. Packed pistons are those which are packed with gasket, &c. They continue steam-tight for a very short period only, and even when in that state produce enormous friction, so much so that the engine is deprived of much of its power. The friction is also the same in the "outdoor" as in the "indoor" part of the stroke; this is unnecessary, for the piston is not required to be steam-tight in going the "outdoor" part. Spring pistons are those which are provided with steel springs, bolts, wedges, &c. They quickly (through wear and tear, heat, &c.) lose their elasticity, producing results precisely the same as in packed pistons. The steam in escaping is not only a loss of power in itself, but on its escape to the other side of the piston, which is open to the condenser, partially destroys the vacuum.

The following may be taken as showing the principal disadvantages attached to pistons now in use. First, when steam-tight, increased friction from being newly packed, and unnecessary friction when going the outdoor part of the stroke. Second, steam, in escaping, is a loss of power in itself. Third, in its escape it considerably decreases the vacuum, which is also a loss of power; and, last, the great expense of labour and materials, &c., in packing, with the necessary delays occasioned therefrom.

It is an admitted fact by all engineers who have at all considered the matter that the Cornish pumping or single-acting engine is capable of developing a far greater amount of duty than any other class of engine when under similar conditions; and it is with the view of an increased development of power in this type of engine that I suggest the introduction of steam-tightening pistons. The good results obtained from trials made prove that the great advantages they possess result from the principle on which they are constructed, and I feel assured that a trial only is necessary to convince anyone of their superiority over the present method. Steam-tightening has been adopted for many years past for locomotive and other small engines, but from the imperfect method of admitting the steam, and defective construction of the piston and rings, they have in most cases been abandoned.

The forms of piston I propose for single-acting pumping engines are in figs. 1 and 2 in accompanying engraving. Fig. 1 is for a piston where

FIG. 1.

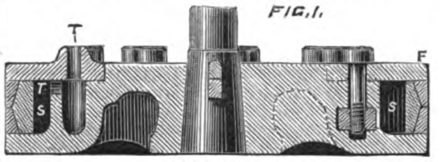
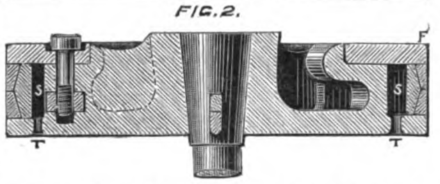


FIG. 2.



steam is admitted on top, as for the ordinary single-acting pumping engine. Fig. 2 is for a piston where steam is admitted under, for single-acting of the inverted type.

The piston may be described thus:—The form of the body does not vary much from those now in use, and may be fitted to the rod in precisely the same manner. The difference is in the rings, which are three in number, and are well fitted to each other, ground and scraped to flange of piston, and to lugg ring. To allow for the wear of the outer rings, the inner one is made a little larger in diameter, and a piece is cut out of its circumference to make it fit at the back of outside rings; a space S (a little larger than that which is generally allowed for packing in packed pistons) is provided for steam which is admitted through holes T, arranged as in figs. 1 and 2. By this arrangement, when steaming, a continual pressure, equal to the working pressure, acts against the inner surfaces of the inside ring F, which presses the others against the cylinder in such a manner as to effectually prevent any escape of steam from one side of the piston to the other.

The advantages gained by the above piston over that of the ordinary construction are:—Economy in fuel; increased power from less friction (for when in equilibrium the latter would be very trifling); the saving of steam that would otherwise escape, thereby increasing the vacuum; effecting a great saving in labour, and materials for packing, and also in preventing delays. Seventy-five per cent. of the old pistons could be easily converted into steam-tightening on this principle, and at a very trifling expense.

Referring, secondly, to pistons for double-acting engines. Those generally used are, as before described, for single-acting engines, and any advantages with regard to increase of power and economy in fuel which may be derived from steam-tightening in that type of engine would be double when applied to engines of this class. The method for admitting steam behind the rings, as shown in figs. 1 and 2, would necessitate the piston being provided with two sets of steam-tightening rings, one for each side of the piston, also with two lugg rings, with bolts, nuts, &c., and then only one set of rings would be steam-tightening at the same time, the other being drawn inward by vacuum, when from one side or the other a continuous rattling of the rings would ensue, thus producing the following objections for steam-tightening the pistons of double engines, on the principle of those for single-acting:—First, the piston would be required more than twice the depth it need be. Second, the continuous noise consequent from rings being acted on alternately by steam and vacuum.

To obviate these objections, and to use only one set of rings, I have designed a piston as seen at fig. 3 in the accompanying engraving, and for which letters patent have been granted.

FIG. 3.

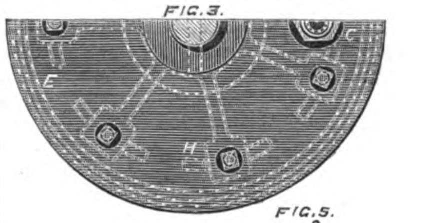
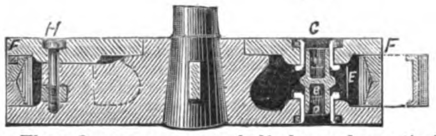


FIG. 5.

FIG. 4.



These figures represent a half plan and a vertical section of the piston of a 36-inch horizontal condensing engine, which has been working for the last six months night and day (Sundays excepted) effecting a saving in fuel quite 15 per cent., with 10 per cent. additional power. The cylinder was opened a few days since merely for inspection of piston, and to my great satisfaction scarcely the slightest amount of wear was discovered, either in valve or rings, it being steam-tight in all parts of the stroke. The vacuum has been improving from its commencement, and may now be considered as almost perfect; this has arisen no doubt from the rings and cylinder becoming better fitted to each other.

The invention consists in the introduction of a valve C in the body of the piston having chambers B formed in its interior at each end. Around the sides or walls of these chambers, and communicating with the interior of the piston, are any convenient number of ports or openings D. These, as the valve is forced to and fro alternately, communicate with the interior of the piston E, allowing the steam to press or tighten the rings F against the sides of the cylinder. H are bolts for securing the lugg ring. To prevent "blowing through" while the valve is in motion, the portholes are so constructed that one side will have closed before the opposite one opens. The valve or valves may be made either single or double, and placed opposite to each other, or otherwise as may be found most convenient.

The advantages gained by this invention comprise the following—the economising the entire cost of the springs, bolts, and nuts used in the construction of ordinary spring pistons, and with the common packing with yarn, vulcanised india-rubber, and lead. There will be a great saving also in labour and fuel, prevention of delays in opening cylinders, &c., and the loss of power to the engine on account of the springs, rings, and packing losing their elasticity.

After reading the paper, Mr. Pearce remarked that he could bear testimony to the efficiency of the new description of pistons, having seen them in engines at Swansea.

We understand Mr. Martin's improved piston has been tried and found to answer with the most marked success. Mr. Wm. Williams, of the Millbrook Ironworks, Swansea, says "The construc-

tion of the piston is very simple, and it does its work very efficiently, and I firmly believe it will work much more economically than a piston fitted with steel springs in the ordinary way." Mr. William Williams, engineer, of the Hafod Copper Mills and Foundry, says, "In my opinion, it is the most effectual working piston out." Mr. John Burgess, of the Perran Foundry, Cornwall, says, "The action of the valve when the piston reaches each end of the cylinder is perfect, as could be distinctly heard by listening close to the cylinders whilst at work. The vacuum obtained was the best I ever saw obtained in any engine; in fact, it appeared quite perfect, whilst a great advantage must be obtained by the pressure of the piston against the cylinder being constantly in proportion to the load. That this pressure is not at any time too great is proved by the large saving effected in coals. I was much pleased with its action." Mr. Thomas White, of the Lliw Forgery, Swansea, says, "Although, for the last twenty years, I have had great experience in both marine and stationary engines, I have never seen one so simple and effective, or less liable to get deranged, neither have I ever seen such a good vacuum as your gauge registered." Many other testimonials bespeak the value of Mr. Martin's patent, and, as a mechanical improvement in the right direction, there are ample grounds for believing that it will prove a practical success and quickly find its way into general use.

GOVERNMENT STORES.

THAT wonderful clerk in the War Office who struck out the sublime idea of taking the Sunday's pay from the gunnery serjeant-instructors and the serjeant-instructors of gymnasia, for which idea we understand he is to be permitted to take rank beside Cole, C.B., should cast his inquiring eye over the mode in which government stores are sometimes disposed of. We, "United Service Gazette," have heard strange stories of the way in which soldiers' coats are sold to the few brokers who have the privilege of the *entree* to the auction, and the fabulous sums that are afterwards divided at the "knock-out." There has been, we are credibly informed, as much as £140 per man divided on those occasions. When we know that overcoats lined with woollen all through, and almost new, go for 6s. each, and Highland beavers, with their ostrich plumes, and of which the first cost was £3 19s. each, for 8s. 6d., this liberal division of "swag" is not surprising. The ingenious expedient by means of which the auction-room is made select has also come to our knowledge. No intending purchaser is admitted until he has first paid £5 for a catalogue, the amount to be afterwards deducted from the price of his purchases. It is not difficult to imagine how much this ingenious expedient must increase the publicity of auctions which are ordained to be "public" by act of parliament.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

MR. R. R. EDWARD.—Your communication should have been directed to the editor, and not to Mr. J. Passmore Edwards, whose connection with the MECHANICS' MAGAZINE ceased at the end of 1867. Directed as it was it has failed to reach our hands.

H. K.—The above observations apply to the remarks in your letter, and we would call the attention of our correspondents generally to the notice which always appears on this page, that literary communications are to be addressed to the editor, and letters relating to the advertising and publishing department to the publisher. Letters relating to other matters may be addressed to the proprietors, Messrs. Robertson, Brooman, and Co.

RECEIVED.—R. S.—L. P. S.—J. N.—B. D.—J. H.—S. and A.—R. M.—G. H. W.—T. H. M.—S. A.—E. M.—R. R.—A. F. W.—L. C.—H. J.—F. M.—R. G. S.—F. O.—S. J.—W. L. W.—H. V.—R. I. W.—B. F.—H. T. B—R. D.—J. B. and Co.—G. W. H.—S. E.—J. N.—B. J.—R. H.—F. E. C.—T. B.—L. S. G.—H. M.—J. C. P.

A WOMAN named Godzielska has just died at Posen, aged 99 years. She formerly served as vivandiere in the armies of Napoleon I., and went through the campaigns of Spain, Russia, and Germany.

Naval, Military, and Gunnery Items.

IT is with regret we have to announce the wreck of the Peninsular and Oriental Company's fine steamer the "Carnatic," involving the loss of several lives, with the whole of the specie and cargo on board. The calamity occurred on the 13th inst., off Shadwan, in the Gulf of Suez.

THE remainder of the inmates of Greenwich Hospital who have agreed to accept special pensions under the terms of a recent Act, have left the establishment, and the building will shortly be appropriated for the purposes of a national naval collection, under the direction of the Lords of the Admiralty.

THE Lords Commissioners of the Admiralty have notified that the Royal Naval School, New-cross, will, under the new regulations respecting naval cadets, receive in future four competitive, instead of two actual nominations. These are in addition to the nominations for clerks' assistant and navigating cadetships already placed at the council's disposal.

THE "Victoria and Albert," Royal yacht, having undergone extensive alterations and repairs, was taken out of No. 8 dock and placed in the steam basin at Portsmouth, on Friday. The dock thus vacated will be available for the reception of the partially constructed keel of the "Devastation," armour-plated turret ship, which is to be built at Portsmouth.

WE are informed that it is the intention of the Admiralty to hold a medical examination for the entry of naval cadets and navigating cadets at Somerset House for the future, a board being summoned by the Director General for the purpose. This (says the "Lancet") is probably only a step towards the whole of the admissions to the service being decided by a medical board, instead of a single medical officer, as at present.

THE Public Works Loan Board have issued a return which shows that in 1868 they decided on making the following harbour loans at 3½ per cent. interest:—Carnarvon, £10,000; Great Yarmouth, £27,000; Isle of Man (Douglass), £40,000; Tyne, £25,000; Wear, £25,000. The following applications were refused:—Bray, Bristol and Portishead Pier and Railway, Dublin Port and Docks, Drogheda, Wicklow.

ON the 12th inst., the 15th anniversary of the death of Blucher was celebrated with some solemnity at Krieblowitz, where his body lies buried. During the day the tomb was visited by large numbers of people, and at six o'clock in the evening the riflemen marched with music to the spot. A poem in honour of the warrior was then recited, a cheer given for his Majesty the King of Prussia, and the crowd dispersed singing patriotic songs, which were frequently interrupted by salutes.

THE English Government has presented the chief pilot of the North German navy, who served on board the "Minotaur" during her visit to Wilhelmshaven, with a splendid telescope and double eyeglass, which bear the following inscription:—"Presented by the Lords of the Admiralty to Herr J. P. Hanke, Chief Pilot of the North German navy, in commemoration of the visit of H.B.M.S. 'Minotaur' to Wilhelmshaven, on the opening of that port by H.M. King William of Prussia, June 17, 1869."

MR. KEY, of Kirkcaldy, recently launched from his building yard at Abden, near Kinghorn, the largest iron ship ever built on the Forth. The vessel is named the "Abden." She is the ninth steamer Mr. Key has launched since he commenced operations at Abden, and is the finest as well as the largest. She is 320ft. in length, 38ft. in breadth, and 28ft. in depth. Her engines, which have been made by Mr. Key, are surface-condensing, on the horizontal principle. They are 500-horse power nominal and 1,700-horse power indicated, and are calculated to give a speed of 14 knots an hour. The diameter of the cylinders is 70in., and the stroke is 38in. Steam is generated in four tubular boilers, with four furnaces each.

A 13-INCH sea service mortar, of 5 tons weight, has been ordered to be converted upon Major Palliser's plan into a 9-inch rifled mortar of about 6¼ tons weight, to fire the 9-inch service rifled shell, which contains a bursting charge of 18lb. of powder. The bore of the mortar will be elongated to about 4ft. 6in.; and a range of about 7,000 yards is expected to be obtained from a charge of 20lb. of powder. Some further experiments are being carried on with two 10-inch shell guns, which are being converted respectively into an 8-inch and a 7-inch rifled gun, in order to determine the most suitable calibre for the conversion of cast-iron 10-inch shell guns. The whole of the 212 8-inch guns converted into 6·3-inch rifled guns by Sir William Armstrong and Co. have been passed into the service, and 200 more are in course of conversion in the royal gun factories. It is probable that a considerable number of guns will be converted next year for land defences, the whole of the above 437 guns being for the navy.

Miscellanea.

AT a recent meeting of the Glasgow police board, Messrs. Honeyman and Drummond obtained the sanction of the authorities to run steam omnibuses, by way of experiment, on the streets of Glasgow.

THE opening of the railway from Monaco to Mentone will take place towards the end of October next; the laying of the rails has been commenced at both ends and is rapidly progressing.

THE total cost of the Customs establishments in the United Kingdom during the year 1868 was £792,221 16s. 7d. The amount of Customs duty collected was £22,693,507.

THE Prussian Bible Society in Berlin has distributed since its foundation in 1814 more than three millions of copies of the Holy Scriptures. In the year 1867 alone, the number was 90,000.

THE statue of Mirabeau, by M. Trupheme, which appeared in the present year's exhibition at Paris, has been presented by the Government to the Palace of Justice at Aix, in which town Mirabeau was born.

THE exhibition building at Pilsen, in which the machinery had been deposited, was blown down by a violent storm from the west on the evening of the 13th inst. It is feared that the loss will be very heavy.

THE Bengal opium crop of 1868-9 has produced 46,894 chests, in place of 58,000, as was at one time expected. It is therefore thought there will be no difficulty experienced in bringing forward 48,000 chests for sale in 1870.

DURING the past year the quantity of silkworms' eggs exported from Japan amounted to 2,195,651 cards. Of this number 800,000 have been sent to France, Spain, Turkey, Persia, and other countries, and the remainder to Italy.

THE Belgian Minister of Public Works has just organised a system of trains for the benefit of the workmen who live out of Brussels. The payments are to be made weekly and in advance, and the rates vary from 1f. 20c. for one league to 2f. for twelve miles for the six days.

LUIGI POLETTI, the most celebrated Italian architect, has just died at Milan, aged 77. His last work was to direct the construction of the church of St. Paul at Rome, which the Pope desires to have terminated by the period fixed for the opening of the Council.

THE next ordinary monthly meeting of the London Association of Foremen Engineers will be held at the City Terminus Hotel, on Saturday, October 2, when Mr. Nicholson will read a paper on a new expansive steam engine. The chair will be taken at 8 p. m. precisely, by Mr. Joseph Newton, Royal Mint, President.

A MEETING of great interest to admirers of horses will take place in France on October 4, 5, and 6. General Fleury, Grand Equerry to the Emperor, and who is charged with the direction of the Government breeding-studs, will proceed at that period to Le Pin, in Normandy, to preside over the commission charged with purchasing Anglo-Norman stallions required for the State establishments.

ACCORDING to an American paper a man who owes a bill in London can now pay it in four hours by simply going to Wall-street and purchasing a document known as a "cable transfer," a device born of the great Atlantic telegraph enterprise, whereby the equivalent of the money which he gives in New York will be immediately delivered to his creditor in London.

A NUMBER of submarine sweet water springs are known to exist along the coast of Istria and Dalmatia. As the coastal districts of these provinces suffer from want of a sufficient supply of water, and it is possible by means of the Norton pump to save much that is now lost, the Austrian Ministry of Agriculture has published a book on the means of finding and utilising submarine fresh water springs on the Austrian coasts.

THERE is one curious feature in the present short crop of cotton in Queensland that, whilst some planters have gathered from one bale to one bale and a half per acre, others have come off with practically nothing at all. A great deal of this difference proceeds from the various descriptions of soil in which the cotton has been planted, and it is strongly suspected that the rich scrub lands and strong black soil are not so well adapted for the plant as lands of a poorer description.

THE number of visitors to the South Kensington Museum during the week ending September 18, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,467; Meyrick and other galleries, 1,894; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,723; Meyrick and other galleries, 128; total, 15,212. Average of corresponding week in former years, 12,543. Total from opening of Museum 8,808,067.

OLD Paris, in 1852, was lighted by 12,579 street lamps, of which 12,494 were gas, and 85 oil lamps. This part is now lighted by 21,061 lamps, of which 20,781 are gas, and 280 oil lamps, being an increase of 8,482 lights. The suburban zone, in 1850, was lighted by 2,484 gas and 434 oil lamps; there are now 11,539 gas and 1,252 oil lamps, being an increase of 9,880 lights. The total number of lamps used for the illumination of the city, including the suburban zone, is 33,859, of which 32,320 are lighted by gas, and 1,539 by oil.

ANOTHER case of living cochineal insects (presented by Messrs. Wetherell, Quintas, and Co., of Grand Canary and London) has just arrived at the Botanic Gardens, Regent's Park. The insects, as well as the cactus plants on which they are feeding, appear to be in good health, but it is doubtful whether the change of climate will agree with either. It has been found exceedingly difficult to keep in good health the insects imported last year from Madeira; a few, however, remained alive during the winter, and have this year produced young.

A VALUABLE discovery of bismuth ore has been made on a section belonging to Mr. Camac, near Balhannah, South Australia. Mr. Ey, whilst overlooking some workmen engaged in opening up the hillside in search of a copper lode, believed from surface indications to exist there, had his attention directed to the weight of the stuff dug up. A number of specimens were brought to town, and further examination has proved them to be bismuth ore of a very rich description, and only impregnated with copper to a very slight extent.

THE "New York Herald" understands there is a new and remarkable invention, an automatic system of self-telegraphing power, which will multiply eight or ten times the facilities of telegraphic communication over the present system. There is reason to believe this is one of the most astonishing inventions of the age, and destined to produce a great revolution in the commerce, financial affairs, intercourse, and social conditions of the world. We learn, also, that the United States Government will be asked to test this invention and to take the control of and use it for the public good.

THE latest advices with regard to the progress of the Suez Canal are to the effect that the Bitter Lakes had on the 5th inst. about 3.20 metres wanting to bring them up to the level of the Mediterranean. Hence as they wanted on August 15 5 metres to bring them up to that level, it appears they have risen 1·80 metres in 21 days, being at the rate of about 9 centimetres a day. It therefore now seems highly probable that the lakes may be filled before November 17. The completion, however, of the rest of the works in time for the proposed opening on that day is still considered in some degree uncertain.

THE inhabitants of Gibraltar were lately gladdened by the discovery of an unexpected source of water supply at the north front of the garrison. A specimen was carefully analysed by Dr. Power, of the 74th Highlanders, and the water was pronounced to be of a satisfactory character. Since that time specimens have been forwarded to several eminent chemists in this country, and the results of their analyses are corroborative of those obtained by Dr. Power. There is abundance of water from this new source, and the importance of the discovery is manifest when we consider the character of the Rock, and the requirements made upon it by shipping, garrison, and residents.

A SECOND bronze statue was successfully cast on the 6th inst., at Messrs. Holbrook and Co.'s works, Chelsea, of Marshall Wood's much-admired figure of the Queen. The casting of the first statue, which was sent to Montreal, was described in the MECHANICS' MAGAZINE for April 30 last. The work for the present casting was commenced on June 7, so the formation of the mould has occupied exactly three months. Very great care appears to have been taken in the moulding, for notwithstanding the rapidity with which the work has been executed we find the casting very sound and the outlines remarkably sharp. The statue, weighing upwards of two tons, was cast entire in one piece, although, according to the present system of statue founding, it is unusual to do so in figures of these dimensions.

THE Hatcham Ironworks, well known as the property of Mr. George England, have just been taken on a lease for fifty years by a company, consisting of Mr. Robert Fairlie, Mr. George England, jun., and Mr. John Simpson Frazer, late of the Great Western Railway. Mr. George England has retired from ill health. The works will be carried on with spirit and enterprise, we have no doubt, the assistance of so able an engineer as Mr. Frazer being a matter of no small importance. The principal business done will consist in the construction of the Fairlie double-bogie engine and light steam carriage, with which our readers must be familiar. The plant and machinery at the Hatcham Ironworks are very valuable and extensive, and the place possesses remarkable facilities for turning out good work.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—586, 597, 603, 630, 633
BUILDINGS AND BUILDING MATERIALS—331, 585, 627, 633, 646, 651
CHEMISTRY AND PHOTOGRAPHY—291, 600, 612
CULTIVATION OF THE SOIL, including agricultural implements and machines—625
ELECTRICAL APPARATUS—288
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—347, 590, 596, 608, 610, 613, 619, 638, 650
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—470
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—109, 268, 269, 290, 584, 588, 593, 601, 629, 631
GENERAL MACHINERY—583, 594, 602, 604, 605, 642, 644, 647, 648, 649
LIGHTING, HEATING, AND VENTILATING—647, 648, 649
METALS, including apparatus for their manufacture—28, 598, 616, 632
MISCELLANEOUS—222, 255, 582, 529, 607, 614, 615, 618, 620, 621, 626, 628, 637, 640, 641, 643, 653
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—286, 365, 580, 587, 589, 592, 606, 609, 634, 636, 639, 652
SHIPS AND BOATS, including their fittings—584, 595, 654
STEAM ENGINES—298, 312, 623
WARFARE—591, 611, 617, 624

28 E. FOX, Sheffield. *Iron and steel.* Dated January 5, 1869.

This consists in melting and refining, in an ordinary cupola or otherwise, any or all descriptions of cast and wrought-iron scrap or pig metal or certain quantities of each, and when melted, in running them into pigs, or they may be used in the molten state to be worked in the puddling furnace in such proportions as may be found desirable for the production of various descriptions of iron and steel.—Patent abandoned.

109 R. WATSON, Birmingham. *Stop work in chronographs.* Dated January 14, 1869.

Hitherto in order to stop and start the pieces several actions of a complicated nature have been required, but in this invention the starting is effected by providing a toothed wheel having contrate or upright teeth or pins, acted upon on one side by a spring click, which being pressed by the push-piece drives the toothed wheel one space. On the other side a spring detent acts on the upright teeth or pins of the wheel, and this detent carrying a small spring is allowed to descend on the balance by means of the revolution of the toothed wheel.—Patent abandoned.

222 J. M. MERRICK, Massachusetts. *Composition for ornaments.* Dated January 25, 1869.

This composition is termed diatite, and the ingredients are gum shellac or its equivalent and finely powdered silica, the latter being prepared in any proper manner well known to chemists or mineralogists, or existing in nature in the form of a diatomaceous deposit or infusorial earth.—Patent completed.

255 T. BROOM, Newgate-street. *Water hose.* (A communication.) Dated January 27, 1869.

The inventor employs a strong and tight metallic vessel enclosing a smaller vessel or tube, the latter extending nearly to the bottom of the main vessel. The tube opens at bottom into the main vessel, and is closed at the top by a screw cap, this cap being outside the top of the main vessel. The main and smaller vessels are united at the top. The tube has an aperture through it about one-fourth of its length from the top, and just above this aperture is a wire or open partition for supporting the combustible charge, whereby the gas is evolved. The main vessel may be of the proper size to hold any desired quantity of water, and is made preferably tight. The vessel is provided with a waste cock and an ejecting tube. The screw cap is inserted into the top of the tube and has an aperture through it, which is tightly closed by a screw plug.—Patent abandoned.

268 C. D. ABEL, Southampton-buildings. *Washing apparatus.* (A communication.) Dated January 28, 1869.

A row of beaters or stampers guided in a framing are arranged to act upon the surface of a long horizontal revolving cylinder partially immersed in a trough containing soap-water or other fluid, round which cylinder the textile fabric is caused to pass in a helical direction, being guided for this purpose by a number of stationary guiding bars arranged along the cylinder, and the fabric is furthermore held against the cylinder by one or more pressing rollers.—Patent abandoned.

269 C. A. L. HOELSCHER, Geneva. *Musical seat.* Dated January 28, 1869.

The inventor hinges the seat to the frame at the back front on either side, but he prefers to hinge it at the back; in the first case, he simply retains the musical works (already wound up) by a detent, and allowing a slight downward motion of the side of the seat opposite the hinge to take place as the weight of the body comes upon it. He employs this motion to release the detent, and thus allow the action of the mechanism to commence.—Patent abandoned.

286 A. MALLARD, Moorgate-street. *Horseshoes.* (A communication.) Dated January 29, 1869.

This consists in roughing the surface of the shoe next the ground by forming channels or grooves therein, in any suitable manner, thus producing ridges or ribs on the surface of the shoe, which enables the animal to obtain a firm hold of the ground at all times.—Patent abandoned.

288 T. E. LUNDY and T. HOOD, City-road. *Driving sewing machines by electro-magnetism.* Dated January 30, 1869.

The inventors fix an armature to an ordinary electro-magnet by means of a real magnet at the bottom (or in any other suitable position) of the electro-magnet, and by this means the poles of the upper magnet become permanently magnetised. When a current arrives it demagnetises the electro-magnet, and the armature at once rises, but so soon as the current has passed through the coils and completed its work in the apparatus, the power of the real magnet again acts upon the electro-magnet, and the armature is again fixed.—Patent abandoned.

290 P. J. WIELEINAUS, Lisle-street, Leicester-square. *Ovens.* Dated January 30, 1869.

This consists in constructing ovens for baking and other purposes with an inner and outer case, such inner case being so constructed as to leave a space or passage way all round the sides, top, and bottom (or nearly so) of such inner box or case, and between it and its receptacle or outer case, such space or passage way, when the oven is in use, being filled or nearly so with steam of a sufficient temperature for the purposes intended, and, by the means and application of steam in such manner, baking or cooking bread and other articles of food.—Patent abandoned.

291 W. WELDON, Park-villa, Highgate. *Regenerating manganese compounds.* Dated January 30, 1869.

This consists, first, in adding to a mixture of hydrated protoxide or other oxide or oxides of manganese with either water or a suitable saline solution, or to a mixture containing other substances in addition to hydrated oxide or oxides of manganese and either water or a saline solution, when either such mixture is to be treated with gaseous oxygen as contained in atmospheric air or otherwise, in order to the production of a highly oxidised compound of manganese, and either before the commencement of such treatment with oxygen, or at some stage during the progress thereof, any salt containing oxygen and capable of imparting oxygen to the oxide or oxides of manganese contained in the mixture to which it is added, and of then absorbing oxygen to replace that with which it has thus parted from the gaseous oxygenating agent with which such mixture may be afterwards or simultaneously treated, in such wise that a comparatively small quantity of such salt may carry oxygen to a comparatively large quantity of oxide of manganese.—Patent abandoned.

298 R. WOOD, Halifax. *Steam engines.* Dated January 30, 1869.

This consists in the application of a separate small steam cylinder and piston with an ordinary slide valve. The piston rod thereof is connected with another rod in communication with and giving motion to the spindle of the cut-off valve. The valve rod is provided with two collars or shoulders, between which are two cams mounted upon a hollow spindle, within which works a slidable rod connected to the governor by a bell crank lever and connecting rod.—Patent abandoned.

312 A. BARCLAY, Kilmarnock. *Ejector condensers.* Dated February 2, 1869.

This consists in leading a steam pipe supplied with steam from a boiler down through the centre of the nozzles of the ejectors or condensers or ejector condensers, under which various names these instruments are known. By means of this pipe a small supply of steam can be carried through the instrument at such times as may be required to ensure its operation.—Patent abandoned.

331 F. VANDERAEY, Uccle, Belgium. *Brick-making machinery.* (A communication.) Dated February 3, 1869.

This consists of a pug mill of the ordinary construction mounted above a series of moulds, which are placed in a circular or rectangular framing. The clay or other material is forced down to the lower part of the pug mill, where it enters moulds carried upon a circular table, which has a rotary motion communicated to it in any suitable manner. Beneath the table a wheel or drum is placed, upon which the bottoms of the moulds are brought to bear in their rotation. This wheel causes the moulds to rise so as to bring the upper surface against the under side of a fixed table or plank. In this operation the clay becomes compressed within the mould. The moulds with the materials within them then pass on towards a second wheel or drum, by which the bottom of the mould is lifted so as to cause the moulded article to project beyond the top of its mould. It can then be removed to a drying stack, or if the clay is sufficiently free from moisture it can be stacked or otherwise treated for burning.—Patent completed.

347 R. W. KNOWLES, Tong, Bolton. *Finishing muslins.* Dated February 4, 1869.

This consists in imparting to the endless chains or belts which carry the pins for holding the selvages of the muslin or other fabric a continuous progressive motion, but alternately fast and slow, being quick at one side whilst it is slow on the other, and *vice versa*, which is effected by the following means:—Instead of driving the pulleys round which the chains or belts pass by means of gearing which is alternately thrown into and out of gear, which is liable to get out of order, and is expensive and objectionable on various other grounds, the inventor drives the pulleys by means of a pair of elliptical spur wheels at or near each end of a shaft, the wheels being so placed that their longer axes are at right angles to each other.—Patent abandoned.

365 D. D. KYLE, Victoria-street, S.W. *Railway signalling.* Dated February 5, 1869.

Tubes are attached to the engine and carriages of a train so as to form along the train or any portion thereof one or more continuous tube or tubes when connected together. Stopcocks or other apparatus are arranged in connection with these tubes, to be acted on by the passengers, guards, or drivers, or by agency mechanically arranged in or external to the train, so as to destroy the continuity of the bore or channel of the tubes. Exhausting or pumping apparatus on the engine, guards' van, or other part of the train, wrought by power obtained from the engine or motion of the carriages, or by independent motion, is placed in connection with these tubes.—Patent abandoned.

470 V. A. HONDAILLE, Paris. *Metallic bungs.* Dated February 16, 1869.

The bung consists of two parts, that is to say, the body, which is screw cut at its shank, and is fixed into the bung-hole after being previously dipped in resin or other glutinous matter; and, second, the plug, whose shank also terminates in a screw for fitting into the interior of the

body, which is furnished with screw threads for the purpose.—Patent completed.

580 W. ANYON, Manchester. *Velocipedes.* Dated February 25, 1869.

The wheels, instead of being placed one behind the other, as in the vehicle known as the "French velocipede," are placed parallel or face to face on the same axle, and at any suitable distance apart, so as to suit the nature of the machine or the requirements of the operator. The shaft is provided with two cranks throwing in opposite directions. Upon each end of this shaft is a wheel, one or both of the wheels being fixed, and all the rest of the apparatus being suspended from or working loose upon the shaft in suitable bearings and below the centre of motion. The seat is slung from journals or bearings, through which the shaft passes, oil cups are provided for lubricating the shaft, a handle is fastened on each side of the seat rising from the bearings, and furnished with cross handle passing through the head.—Patent abandoned.

581 H. LOEWENBERG, Berlin. *Hat compound.* Dated February 25, 1869.

The inventor takes any suitable hat, bonnet, or other article of wearing apparel, and casts or presses thereon gum, or any other resinous or gelatinous substance, or sulphur or other mineral product, after which the hat or other article is removed and an exact fac-simile or mould thereof obtained. He then covers the inner or outer surface of the mould thus obtained with a layer of glue, or other gelatinous substance, or such substance in combination with glycerine or oily or fatty matters, either with or without any desired colouring matter, and when cold the hat shape thus formed is taken from the original mould, by which means the exact fac-simile of straw plait or any other pattern or design may be accurately impressed thereon.—Patent abandoned.

582 B. P. WALKER, Wolverhampton. *Abrasion shaping machinery.* Dated February 25, 1869.

This consists partly in the adaptation of the copying principle employed in the machines in use for the shaping of the wood stocks of guns, lasts for shoes, and such like articles, to the production of surfaces other than flat in articles of metal, and partly in special machinery and apparatus for grinding and polishing the edges and surfaces of the metal heels of boots and shoes, the edges of iron washers for machinery, and similar articles.—Patent completed.

583 W. TURNER, Dublin, and J. W. GIBSON, Dundalk. *Friction rollers.* Dated February 25, 1869.

This consists in the employment of an endless chain of rollers, in cast or wrought iron or other hard substance, passing round an iron or other block or bracket of an elliptical or oblong form having the upper surface perfectly straight for a distance equal to the length of an arm or link (each end of which serves as an axis to a roller), so that in any position of the rollers one, at least, will always be on the level or straight surface of the block.—Patent abandoned.

584 J. MOODY, York. *Mooring vessels.* Dated February 25, 1869.

In order, when mooring, to take the weight of a cable from the vessel or floating body, the inventor provides a cable made of iron or any other material divided in o short lengths of from, for instance, 30 to 40 or any number of fathoms, according to the nature of the cable used, or the form of the vessel or body, and the waters in which such mooring is to take place.—Patent abandoned.

585 W. PARKINSON, Gloucester Grove, Brompton. *Wood cutting.* Dated February 25, 1869.

This consists in combining in one machine a circular saw, a band saw, a machine for cutting mouldings or for planing, grooving, tonguing, edging, and thicknessing boards at one operation, and for cutting single or double tenons, and also scribing them at the same operation, and also for cutting curved or irregular mouldings.—Patent completed.

586 W. E. NEWTON, Chancery-lane. *Oxidizing furnaces.* (A communication.) Dated February 25, 1869.

This consists in arranging above the smelting point of a blast furnace pipes and tuyeres for the admission of water, steam, and air (either separately or combined) into the hot stock during the smelting operation, whereby sulphur or other impurities contained in the ore may be expelled and a better quantity of metal thereby obtained than heretofore.—Patent completed.

587 E. D. BARKER, Weston-super-Mare. *Railway brakes.* Dated February 25, 1869.

This consists, first, in transmitting a sufficient force to act on the brake blocks to skid or stop the wheels of an entire train in the shortest possible time so as to avoid collision. Second, in the power of adjusting the force with which the brake blocks are applied according to the state of the weather so as at all times in ordinary stoppages to be able to avoid skidding the wheels. Third, in having an equal pressure on all the brake blocks, and the pressure exerted against the brake blocks unaffected by unequal wear of the wood blocks. Fourth, in doing away with all the strains on the axles, axle guides, and framing incidental to the ordinary methods of applying the brake blocks.—Patent completed.

588 L. ENGEL, Mumford-court, E.C. *Parasols, umbrellas, &c.* Dated February 25, 1869.

The inventor connects together the two portions or lengths of the stock of a parasol, or umbrella, or sunshade by means of two tubes which are connected together, end to end, by a hinge-joint, and are at their opposite ends fixed the one on to the end of one length of the stick and the other on to the end of the other length of the stick. One of the tubes also contains a circular bolt capable of being slid out endwise from the tube so that its end may project therefrom. Through this tube is a slot through which a pin is passed into the bolt, and by this pin the bolt can be slid to and fro like the bolt of an ordinary door bolt.—Patent abandoned.

589 F. BRADY, St. John's-terrace, Regent's-park. *Switch apparatus.* Dated February 25, 1869.

The inventor applies alongside of one of the rails just in front of the points of the switches a bar of iron about seventeen feet long, two inches wide, and half-inch thick. This bar is secured to brackets at intervals of about four feet. These brackets are keyed on and turn with a shaft placed on standards or bearings parallel to the rail along side of which the bar is to be. The shaft is turned by the action of the switches, so that when the switches are either fully opened or fully closed the bar shall be out of the way of the flanges of the wheels. The bar is to be long enough to always have one wheel of a passing train over or at the side of it. The curved bar may be cut into sections in its length so as to avoid chairs or fish plates, or cheek chairs securing the rail with bolts counter sunk into the rib of the rail may be used where the curved bar is applied.—Patent completed.

590 W. R. HARRIS, Paris. *Weavers' harness.* Dated February 25, 1869.

This relates to healds made with a metallic eye attached to two threads or inserted in the strands of a single thread, and consists, first, in attaching the eyes at any regular distances within continuous threads or thread, and, second, in weaving such threads or yarns thus prepared in convenient lengths for mounting in the loom.—Patent completed.

591 W. T. ELEY, Gray's Inn-road. *Cartridge cases.* Dated February 26, 1869.

This relates to improvements in the construction of cartridge cases for breechloading fire-arms in which the charge is ignited by means of a pin projecting laterally from the cartridge. This pin is so arranged as to enter a metallic recess or cap chamber secured in the paper base or packing of the cartridge case. In this metallic recess the detonating mixture is placed in a cap or otherwise, so that upon the pin being struck the detonating substance is exploded and the charge ignited. This cartridge is well-known as "Lefaucheaux" or "pin-fire" cartridge. Now, according to this invention, the inventor arranges a metallic cup in front of the paper base or racking of cartridge cases of the description above referred to, such metallic cup having an aperture of suitable form for the insertion of the metallic cap chamber or recess. With the metallic cap he combines an annular coil of metal so formed as to extend a suitable distance along the interior of the cartridge case. The end of the annular metallic coil is partly closed and fits within the metallic cup. There is an aperture for the insertion of the metallic cap chamber or recess, formed in the end of the metallic coil similar to the apertures formed in the metallic cap for the same purpose. After the paper base or packing has been placed within the paper cartridge case provided, an external metallic cap as hitherto practised, the metallic cap and coil with the metallic cap chamber are introduced and pressed into the cartridge case. By the application of pressure the parts are consolidated and the metallic cap and coil securely held down by the flanges of the metallic cap-chamber. When applying pressure to the combined cartridge case the metallic coil is enlarged so as to fit the interior of the case at that part where the metallic coil extends beyond the paper lining of the cartridge case.—Patent completed.

592 H. J. LEDGER, Manchester. *Railway signals.* Dated February 26, 1869.

This consists in providing a thoroughfare of ample dimensions through the whole length of the carriages, and from one carriage to another if necessary, by forming a doorway and fitting a door in each division or partition which now separates carriages into compartments and if necessary in the ends of the carriages. These thoroughfares and doors by preference are situated above the seats, and the doors are made to slide up and down in grooves behind the seats, so that when closed such doors give all the privacy to each compartment which at present exists. When closed such doors are fastened by means of a self-acting hook, which is acted upon by a lever or series of levers connected to a rod running along the whole length of the roof of the carriage. In each compartment a chain is suspended which is connected to an arm branching from the longitudinal rod, turns partially in its bearings, and thus the hooks are caused to release all the doors in such carriage so as to open up a communication through the sliding doorways, between all the compartments; one of such doors in falling comes in contact with the longer arms of two levers, thereby depressing them and causing their shorter arms to be raised up, these latter, having peculiar clutches connected to chains attached to them, in rising push out a semaphore signal, and at the same instant pull the ordinary rope which passes from one end of the train to the other, and thus actuate the hammer of a gong situated either in the guard's van or on the engine, or both, or if connected with a steam whistle cause it to sound an alarm.—Patent completed.

593 H. HARBURG, Hatton Garden. *Musical boxes.* Dated February 26, 1869.

The inventor provides, in such a position as to be clearly within view, a plate, dial, or appliance on which are marked numbers or words, or both, indicating the various tunes played by the musical box. These being disposed in the proper order, the inventor fits or mounts a pointer or indicating contrivance close to this plate, dial, or appliance, and works the same by the working parts of the musical box, so that when the barrel moves or is shifted in order that a new tune may be played, the pointer will be moved accordingly, and will point on the plate or dial to the number, name, or indication of the particular tune corresponding with the particular position of the barrel. If the barrel be set at "repeat," that is to say if it repeats its tune, the pointer remains in the same position.—Patent abandoned.

594 T. MOORE, Stockton-on-Tees. *Applying power.* Dated February 26, 1869.

This refers to a patent dated 3rd April, 1867 (No. 990). To a frame which supports the whole apparatus the inventor forges or casts bosses on which two lifting wheels are free to resolve loosely. A spindle passes through the bosses, to the outer end of which he keys a hand chain wheel; between the lifting wheels he places a frame also keyed or forged to the spindle, and this frame carries pinions at its outer end, by preference four, but one or more may be used. The pinions are free to revolve on their own axes, and at the same time to gear into teeth formed on the lifting wheels.—Patent completed.

595 W. R. LAKE, Southampton-buildings. *Ships for liquid cargoes.* (A communication.) Dated February 26, 1869.

This consists in making the tanks closed on all sides and separate from the sides of the ship, but placed centrally therein, and of such size and shape that when entirely filled with the liquid cargo the centre of gravity of the same will bear such a relation to the centre of gravity of the ship and centre of displacement that the cargo will properly trim the ship.—Patent completed.

596 J. CHEETHAM, Chadderton. *Winding yarns.* Dated February 26, 1869.

Instead of winding the yarns or spools which need to be conveyed as well as the yarn, the inventor makes the bobbins in two or more parts, so that when the material has been wound upon them they may be removed and the yarn transmitted without them. The form in which he prefers to wind the yarn constitutes, when finished, a cylinder solid in every respect except the part which was filled by the bobbin, being so frequently crossed in the building that it will retain its bulk and form as well without the spool or bobbin as with it.—Patent completed.

597 J. A. F. SUTER, Hereford, and T. C. HINDE, Fownhope. *Furnaces.* Dated February 26, 1869.

The inventors construct the furnace of two or more principal parts, namely, of a gas-generating chamber, a combustion chamber, and a superheating chamber. In the first, or gas chamber, the coil peat or other solid fuel is converted into gaseous fuel by being ignited and supplied with a sufficient quantity of air to convert the carbon of the fuel into carbonic oxide. The second chamber of the furnace consists of a reverberatory or other chamber into which gaseous fuel produced in the first chamber, mixed with the requisite quantity of air for combustion, is burned. In the third or supplementary chamber, the gaseous fuel may be heated prior to being burned in the combustion chamber.—Patent completed.

598 G. J. HINDE, Wolverhampton. *Coating with copper.* Dated February 26, 1869.

The inventor cleans the sheets or articles to be coated by any of the well-known pickling or other processes ordinarily employed for that purpose, and he plunges the sheets or articles into a bath of melted zinc containing copper in alloy with zinc, the quantity being so large compared with that of the copper as not to materially affect the colour of the zinc. From 5 to 6 parts by weight of zinc to 1 part by weight of copper is found to answer well in practice. After a short immersion of the iron or steel sheets or articles in the bath, they are withdrawn and exposed to heat in a muffle or heating chamber sufficiently hot to volatilise the zinc, and the sheets or articles are allowed to remain in the muffle or heating chamber until so much of the zinc has been volatilised as to leave brass upon the sheets or articles, or when a coating of copper is required the sheets or articles are allowed to remain in the muffle or heating chamber until the whole, or nearly the whole, of the zinc has been volatilised. In order to prevent the sheets or articles from adhering together or receiving any injury to their coating, the inventor prefers, before putting them in the muffle or heating chamber, to coat them with a mixture of finely ground calcined flint and water. This coating, when dry, protects the surface of the metal, and does not prevent the volatilisation of the zinc. After the sheets or articles are removed from the muffle or heating chamber, the coating of powdered flint is removed. The articles are finished by burnishing or otherwise, and it is preferred to pass the sheets that have been coated according to this invention through a pair of plain rolls in order to give smoothness to the coating.—Patent completed.

599 J. T. H. RICHARDSON, Tutbury. *Glass cutting.* Dated February 26, 1869.

The apparatus made use of consists, principally, of an upright or other standard screwed or otherwise fixed to another standard sliding vertically, and capable of being fixed at any required position in a socket secured to the bottom of the plate, so that the cutter may be inserted and adjusted in the glass to the required height. The standard is lowered after cutting to allow the removal of the glass. There is a bottom plate provided underneath with castors, so that it is capable of being turned round and of running in any direction. At any convenient height of the standard two arms project, and between these arms a curved lever is fixed at or about its centre by screws or otherwise. The bottom of this lever is pressed outwards by means of a spring or other suitable contrivance which is fixed to the standard. At the back of the standard a thumb screw is placed which allows of the spring being pressed or relieved, thus causing the diamond or hard cutting material at the top of the lever to press against the glass with more or less force. At the top of the standard two arms project. These arms have a mouth or cavity formed in them, and are each fitted with a small disc or circular piece of steel, which discs are allowed to turn on a pivot securing them between the jaws of the arms. The top of the curved spring lever is formed of a head through which a rectangular or other conveniently shaped orifice is made. In this orifice the piece of steel which contains the diamond or hard cutting material is placed.—Patent completed.

600 J. TOWNSEND, Glasgow. *Oil refining.* Dated February 26, 1869.

Steam generated in any convenient boiler is passed through piping immersed in a bath of melted metal or alloy, or of a salt or salts in solution, or fused, which superheats it and keeps it at a uniform temperature, and it is then admitted into a retort or still containing the materials from which the oils or other products are to be extracted. The superheated steam enters the upper end of the retort, and is maintained therein at a pressure of at least ½lb. per square inch above that of the atmosphere.—Patent completed.

601 E. FALCK, Cheapside. *Distributing scent.* (A communication.) Dated February 26, 1869.

The inventor proposes to construct a vessel in the shape of a vase or urn provided with a cover which can be hermetically closed. The top of the cover is provided with an opening by which the aromatic or disinfecting liquid or perfume can be poured in, the aperture being closed by a close fitting stopper. Around the vessel, just below the cover, is a series of projecting tubes. Inside the vessel a series of other tubes are fitted, these spring from near the centre of the bottom of the vessel, and lead upwards and into the necks of the projecting tubes. A tube, larger in diameter than the two series of tubes, rises up through the liquid to near the top of the vessel, where it is bent over so as to direct the current of air downwards upon the surface of the liquid. The lower end of this tube passes through the bottom of the vessel, where it is connected by a flexible pipe with a compressible ball or other shaped receiver provided with a mouthpiece or not.—Patent abandoned.

602 J. REAP and W. H. MICHELMORE, Borough-road, Southwark. *Spring hinges.* Dated February 26, 1869.

The pin or vertical axis of the hinge is mounted in bearings so that it can turn freely through rather more

than a quarter revolution either way. The upper part of this pin is squared so as to receive a lever or shoe which is affixed to the lower angle of the door, which thus turns on and with this pin as an axis. On the pin are mounted two rollers so as to turn on vertical discs which are at some distance from the axis of the pin itself. Two curved jaws are mounted on vertical axes, one on each side of the hinge pin, and are acted on by a spring so as to make them close tightly together towards the hinge pin, and these jaws are geared together so that when either one of them is caused to move from the hinge pin, the other also moves from the hinge pin. The rollers already described bear on the inner surfaces of these jaws one upon each, and each of these faces is made of such curvature that when by moving the door the hinge pin with its roller is turned the roller running on either face causes the jaws to expand against the force of the spring, and, consequently, when the door is left free the force of the spring, tending to make the jaws close together, causes the rollers to be passed towards the middle position, and so closes the door.—Patent completed.

603 C. MARKHAM, Brimington, Derby. *Boilers*. Dated February 26, 1869.

The inventor forms the boiler of a number of sets of tubes each composed of two horizontal tubes at a distance apart from one another, and connected at intervals by vertical tubes, which are cast in one piece with them. Several such sets of cast tubes are set up side by side with the ends of all the horizontal pipes passing through two parallel brick walls which form the side walls of the boiler furnace. One end of each of the horizontal tubes is by preference closed by a cap or cover, whilst the opposite ends of all the lower horizontal tubes are connected to a pipe to which the feed water is admitted, and the opposite ends of all the upper horizontal tubes are similarly connected to a pipe which forms a steam chamber. The several sets of tubes are thus each connected to a feed water pipe and to a steam chamber, and all the joints by which they are connected to these pipes are exterior of the boiler furnace, so that they are not affected by the heat of the fire.—Patent abandoned.

604 W. A. HERRING, Chertsey. *Pumps*. Dated February 26, 1869.

The inventor employs a cylinder or pump barrel, open at both ends and supported at its centre by a ring standing out from its exterior and passing to the sides of a casing by which the pump barrel is surrounded. The casing is thus divided into two compartments, one open to one end of the cylinder while the other is open to its opposite end. The piston rod passes out through a stuffing box in one end of the casing, and has a to and fro motion given to it in any suitable manner. From opposite sides of each compartment of the casing passes a pipe or passage, the passages from one side leading to an inlet valve box, whilst the passage from the other leads to an outlet valve box.—Patent completed.

605 C. WILLIAMS, Plumstead. *Motive power*. Dated February 26, 1869.

The exhaust pipe of any engine worked by steam, air, or other gaseous fluid under pressure is passed into the reservoir or generator containing such gaseous fluid, and the exhaust steam or gaseous fluid is drawn or forced into the reservoir or generator by preference by means of a current of the steam or gaseous fluid circulating through pipes or boxes contained within the reservoir or generator, stopping its back-flow by valves, or otherwise, and ensuring its passage into the reservoir or generator by means of a small amount of power expended, if necessary. —Patent abandoned.

606 J. ADAMS, Arlington-street, Sadler's Wells. *Railway communication*. Dated February 27, 1869.

The inventor avails himself of the air generated by the progress of the train to produce an audible signal, by ringing an alarum or bell in the guard's van. To carry this into effect he places upon the roof of each carriage a length of chain hooked together between each carriage, forming a continuous chain from end to end of the train and connected to an alarm bell in the guard's van and also upon the tender of the engine. He then mounts upon the roof of each carriage a box or channel, 18in. long, containing a fan wheel or screw blades with a flange, drum, or pulley outside the box or channel, and connected to the fanwheel or screw blades inside and fastened to this pulley is a length of chain, which is hooked into the continuous chain.—Patent abandoned.

607 W. THOMAS and W. DAVIS, Aberdare. *Mine-winding machine*. Dated February 27, 1869.

This consists in placing a grooved drum and two pulleys in a vertical position upon frames erected directly over the opening to the mine or pit, and, instead of a pair of ropes, a single rope is used, which is passed over the drum or pulleys in two or more coils. To each end of this rope a cage is attached, and by this means one entire length of winding rope is dispensed with. Steam or other motive power is proposed to be applied for lifting and other purposes, directly to the spindle or shafts of the upper drum or pulley, by fixing thereto the crank of an oscillating or other engine or engines, placed immediately adjoining to or at a distance from the drum or pulley, or this may be effected by means of a single engine driving a spur wheel in gear with toothed wheels attached to the two vertical drums or pulleys.—Patent completed.

608 J. R. CROSKEY, King William-street, E.C. *Looms*. Dated February 27, 1869.

This consists, first, in the construction of an apparatus for the purpose of propelling the air after the apparatus shall have been actuated by suitable mechanical contrivances. Second, in a novel means employed for arresting the speed of the shuttle and preventing its recoil after it shall have been driven across the race. Third, in the novel combination of motions and in mechanical arrangements connected therewith, for the purpose of actuating an air propelling apparatus.—Patent abandoned.

609 R. PYNE, Wellington-street, Strand. *Railway buffers*. Dated February 27, 1869.

This consists in a buffer carriage to be attached in the front or rear of a railway engine or other carriage, so that in case of collisions in front or rear the effects of the concussion may be received by the buffer carriage, and the dangerous results may be thus more or less obviated. The buffer carriage mounted upon axles and wheels is made of two or more compartments, so arranged as to slide within each other after the manner of a telescope.—Patent abandoned.

610 J. H. JOHNSON, Lincoln's Inn-fields. *Raw silk measuring*. (A communication.) Dated February 27, 1869.

This consists, first, in measuring the exact length of silk in each skein by self-acting mechanism. Second, in obtaining by self-acting mechanism hanks or skeins of a given length. Third, in ascertaining exactly the number of skeins in a hank.—Patent completed.

611 C. MAW, Aldersgate-street. *Cartridges and torpedoes*. Dated February 27, 1869.

In manufacturing cartridges for firearms and ordnance according to this invention in place of employing gunpowder or gun cotton as the explosive material, the inventor uses gaseous explosive compounds. For this purpose he forms the case of his cartridge either of metal, paper rendered impervious to the gaseous compounds, or any other suitable substance, and to explode the cartridge, he employs a cap or percussion arrangement fitted to it similar to those now in use with many kinds of cartridges used for breech-loading weapons.—Patent abandoned.

612 T. S. BLAIR, Pittsburg, Pennsylvania. *Mixing oxide and iron*. Dated February 27, 1869.

This relates to a patent dated November 23, 1868, No. 3565. The inventor now causes both the fluid cast-iron and the granulated oxide (which can be made to flow in a manner similar to a fluid, and with which may be previously mixed any substances acting as detergents or alloys) to be received each into the upper end of a separate inclined spout, trough, or shoot, the two troughs being set opposite each other, so that their lower ends approach each other, sufficiently to cause the contents of the two to flow or dash into each other soon after leaving the troughs, but not until each has so left or cleared its trough. If the two currents meet to any considerable extent upon either trough, a dam would form from the almost instantaneous "freezing" which takes place when the contact is effected. The inventor causes the oxide to flow in a flat stream by placing a gate at the upper end of its spout, nearly as wide as the spout, and regulated by sliding the gate up and down, so as to liberate a greater or less quantity at will. He causes the molten cast iron to flow in a flat stream of nearly equal thickness by placing a dam or dams across the spout, whereby to sperad it out upon one level.—Patent completed.

613 E. CHAPMAN, Egremont. *Carding engines*. Dated February 27, 1869.

This consists in the application to carding engines of a rotating roller or rollers covered with pins or teeth working into the outer interval between the rollers of the carding engine, commonly called the workers, and the clearing rollers or strippers. These additional rollers, which may be called combers, are placed near the part where the strippers take the fibres from the workers. The fibres taken by the cylinder from the feed rollers are carried forward, and in the usual manner left upon the teeth of the various workers, which are in their turn cleared by the more rapidly revolving strippers.—Patent abandoned.

614 T. ATKINSON, Bradford. *Fire lighting*. Dated February 27, 1869.

This consists in the use of a box or chamber, by preference constructed of cast iron, but may be of other material, in which are a series of perforations or small apertures, and a larger aperture into which is inserted a pipe of any convenient length. This box is introduced into the fireplace and coal or other fuel placed upon it, an indiarubber or other flexible pipe is then applied to connect it with a gasburner in any convenient position. Then by turning on the gas it will issue through the perforations, and on being ignited, will light or ignite the fuel.—Patent abandoned.

615 R. S. NORRIS, Liverpool. *Getting coal*. Dated February 27, 1869.

At the front of the seam of coal the inventor places a bed or frame of metal carrying a sliding block, which is moved forwards and backwards along the bed by means of a screw and nut worked by hand or power. The sliding frame carries one or more cutters, and also a screw having a nut to which the cutter or cutters are connected, and when two cutters, one above the other, are used, the nut is provided with slots through which the back ends of the cutters are passed, there being small eccentrics for alternately placing the cutting edge of one cutter slightly in advance of the other.—Patent completed.

616 G. J. SNELUS, Dowlais, Glamorgan. *Reducing iron ores*. Dated February 27, 1869.

This consists in reducing iron ores by first crushing or otherwise bringing them into a state of powder, and then feeding them continuously into a vertical chamber containing a series of horizontal bearers, as in the calcining furnace known as "Gherstenofer's," such chamber being kept at a red heat by any convenient means and filled with reducing gases at a pressure slightly above that of the atmosphere.—Patent completed.

617 L. G. LYSONS, Aberdeen. *Signals for artillery practice*. Dated February 27, 1869.

Planted in the ground a little distance in the front of the butt out of the line of fire, is a pole with a socket in which a lighter pole is swung, kept erect by means of weights, but easily pulled down into a horizontal position by a cord attached to the top running along the range to the firing party; on this lighter pole a red square is stretched either of bunting or painted tin or iron perforated with holes in case of wind.—Patent completed.

618 P. S. REGNAULD, Paris. *Fixing canister lids*. Dated March 1, 1869.

This consists in giving a suitable shape to the rims of the parts of canister lids for causing them suitably to overlap and allow of their being hermetically fixed together by mere pressure and the previous interposing all round between the overlapping parts of a strip of calico, linen, paper, or other suitable thin material in combination or not with any suitable cement.—Patent completed.

619 J. LADLEY, Leeds. *Spinning and twisting machine*. Dated March 1, 1869.

This consists, first, in the application to such machinery of pairs of drawing or delivery rollers, constructed in two or more parts longitudinally, such parts being operated so as to move a slide endwise in opposite directions, as described in the specification of a patent dated April 4, 1867 (No. 1009). Second, the improvements relate to that class of frames which stop running while the doffing of the bobbin is effected, and the improvements consist in the application of means to avoid having the ends or threads to attach to each empty bobbin separately. For this purpose the inventor introduces a boss or collar under the bobbin or betwixt it and the wharle recessed or cupped to receive the bobbin, and he arranges so that the lifter rail drops below the bottom of the bobbin at the time of doffing, so that the yarn will wind upon the boss and remain there unbroken, while the frame is standing ready to be wound upon the new empty bobbin when the lifter rail is raised into suitable position for the purpose.—Patent completed.

620 R. J. GOODBODY, Tullamore, King's County and R. E. DONOVAN, Upper Rathmines, Dublin. *Tobacco apparatus*. Dated March 1, 1869.

The inventors construct metal tubes or receptacles of a cylindrical, square, or polygonal transverse section either open at both ends or closed at one end, one or more of which tubes they place inside or pass through a closed metal casing or jacket, into or through which steam, water, or other fluid, either hot or cold as the case may be, is made to flow into these tubes; they place the roll, twists, cakes, or layers of tobacco with a metal plate intervening between each roll or layer, and press them down in a tube by a screw or other suitable contrivance, while or before or after heating or cooling until the requisite degree of compression is attained, and the top plate is then screwed down so as to maintain the tobacco in the compressed state while subject to the action of heat from the steam jacket or while cooling. The requisite heat is imparted directly to the circumferences of the rolls or layers, and by conduction through the intervening metal plates to both end surfaces thereof.—Patent completed.

621 J. RUST, Lambeth. *Ornamental composition*. Dated March 1, 1869.

This composition consists of glass, enamel in powder, and caustic lime or cements, for instance, Keene's or Portland cement may be substituted for caustic lime mixed together.—Patent completed.

622 The abstract of this specification will appear in our next number.

623 W. SIMPSON and A. GARDNER, Ilford. *Steam engines*. Dated March 1, 1869.

This engine consists of two crossheads, embracing the eccentric plates at opposite points of its periphery throughout its rotation, and there are tie and guide rods for securing the crossheads at a parallel distance from each other, so as to allow the plate to rotate freely between them without play or shake. To the driving shaft of the engine the plate is keyed or otherwise fixed. The piston rod is keyed to a boss on the crosshead. The plate is formed with a boss, in which is turned a groove, which fits in between the rods to preserve the vertical or direct movement of the piston rod.—Patent completed.

624 A. H. BRANDON, 13, Rue Gaillon, Paris. *Metallic cartridge*. (A communication.) Dated March 1, 1868.

This relates to that class of metallic cartridges where the head and the shell are made of one piece of metal. To form cartridges the inventor takes a blank round piece of metal of the required thickness, and forms it under a press with suitable dies into a concave cup. He successively passes this cup through decreasing sizes of dies, so that its sides are gradually drawn out and form the shell of the cartridge, the head during this time retaining its original thickness. He then compresses the head under a press, by which he forms the rim of the recess or cavity in which the priming cap is placed, and, if requisite, pierces the hole by which the fire communicates with the charge. —Patent abandoned.

625 W. R. LAKE, Southampton-buildings. *Lawn mowing machine*. (A communication.) Dated March 1, 1869.

The frame of the machine is formed of two side plates of cast iron secured together by a bolt at the back of the large roller and by the cutter. The roller acts upon the ground and gives motion to several wheels and the revolving cutter. A train of geared wheels is used for multiplying the velocity and for conveying motion from the roller to the revolving cutter. The large wheel is upon the same axis as the roller, and is attached to the roller by a ratchet and pawl, so that it will be driven by the roller when the machine is moved forward, but will be loose when the machine is drawn backward. This arrangement prevents the turning of the cutter in moving the machine from place to place. The wheel may, however, be firmly attached to the roller. Another wheel gears into a pinion on the axis of the revolving cutter and drives it rapidly in the direction of the arrow.—Patent completed.

626 D. DAVIES, Crumlin, Newport. *Getting coal*. Dated March 1, 1869.

The inventor employs as the cutting tool a spindle carrying a number of circular saws set at a slight angle upon it, or other cutters set around the spindle might be employed in place thereof. This spindle is carried in suitable bearings by a truck or carriage in such manner that it can be set at any desired angle from the horizontal, so that when rotated the portion of the spindle which projects beyond the bearings and which carries the saws or tools, may be caused to cut grooves into the coal or mineral at any desired inclination. The spindle is also so mounted that it can be caused to sweep in a circle around the truck or carriage, so that when thus caused to sweep round it may be caused to cut a groove in the form of a segment of a circle into the coal or mineral. For this purpose it is preferred to form the framing of the truck or carriage which carries the spindle and the apparatus employed for giving motion thereto in three parts. Each of the end portions of the framing is supported by a pair of wheels, one placed on either side of it. These wheels are to be run on rail or tramways laid in front of the face of the coal or mineral that is being worked. The central portion of the framing which carries the cutting spindle and the apparatus for giving motion thereto is connected to each of the end portions by axes upon which it can be turned. The spindle carrying the cutters can thus be brought to any desired angle from the horizontal, and when the machine is at work the three parts of the frame are bolted up together so as to form one rigid frame. The bearings carrying the spindle are carried by a cylinder supported externally in suitable bearings in the central frame, so that the cylinder may be revolved on its axis by means of a worm-wheel gearing into teeth formed around it. Within the cylinder and carried by it is the cylinder or cylinders of an engine for giving a rotary motion to the spindle. This engine may be worked by compressed air or otherwise.—Patent completed.

627 J. CLIFF, Runcorn. *Substitute for fire-brick*. Dated March 1, 1869

Instead of using fire-bricks, lumps, stones, tiles, or other forms of materials or compounds in construction, burnt or unburnt, the inventor uses powdered or reduced ganister, stone, quartz, sand, mica, sandstone, or other siliceous

material, plumbago, lime, baryta, steatite, and magnesia, alone or separately, or in varied proportions with fire-clays, or with each other, or with siliceous or other solutions, mixed or not with hair, fibre, sawdust, shavings, or pulverized coke, or with other analogous materials.—Patent completed.

628 J. HADLEY, Upper Thames-street. *Decorticating apparatus.* Dated March 1, 1869.

The decorticator consists of a vertical external cylinder, within which is mounted a vertical spindle carrying friction surfaces, which work within segmental friction surfaces carried by the cylindrical case. To these rotating friction surfaces it is preferred to give the form of rings, which are separated from each other by annular plates attached to the cylindrical case of the machine, and in these plates openings fitted with sliding doors are made to discharge the grain from the upper to the lower compartments formed by the plates.—Patent completed.

629 A. H. HONEGGER, Manchester. *Portable copying press.* Dated March 1, 1869.

The inventor uses a suitable box or case of wood, metal, or other material, and he puts the actuating machinery on each side of the box or case. The necessary pressure is applied by a flat board or metallic plate, which is caused to rise and lower by the motion of the actuating machinery. The mechanism for giving motion to the board or plate consists of a rack and pinion motion, or a screw motion actuated by a worm and worm-wheel or other suitable and well-known mechanism.—Patent completed.

630 B. C. CRAWFORD, Newcastle. *Steam boilers.* Dated March 1, 1869.

The body of the boiler is a plain cylindrical vessel having two ends, which form the tube plates, and in which are inserted, in the usual manner, the ends of the tubes or flues. This cylindrical vessel is intended to be placed horizontally or slightly inclined, and to be nearly filled with tubes or small flues, a sufficient number of which are arranged to act as stays to the flat tube plates, having the requisite water spaces between them. At the upper part a certain space is left clear above the water line to allow of the ready escape of the steam from the surface of the water as it is generated. On the top of the boiler and connected to it is a large cylindrical steam chamber or receiver for collecting the steam and partially superheating or drying it. The furnace or furnaces is or are formed underneath the boiler, having their sides constructed of iron boxes with water spaces formed in them. The furnaces are lined with fire-brick or other non-conducting substance next the fire. The bottom of the boiler thus forms the top of the furnaces, and the fire-bars and grates are carried on bearers fixed to the sides, and provided with ashpits below.—Patent completed.

631 C. E. BROOMAN, Fleet-street. *Spring mattresses and beds.* (A communication.) Dated March 1, 1869.

This consists, first, in an improved construction of mattresses, and in bedsteads for the same, the improvements in mattresses being also applicable to sofas and other seats. Second, in the ties or attachments for binding the springs of mattresses together.—Patent completed.

632 J. G. WILLANS, St. Stephen's Crescent, W. *Iron and steel.* Dated March 1, 1869.

This relates to a previous patent dated March 8, 1866 (No. 702), and February 3, 1869 (No. 326). The inventor has since discovered that granules of cast iron may be made into puddled balls of either iron or steel without reference to the nature of the flame employed, whether the granules be of crude or refined metal or partially or altogether deprived of their carbon. To perform the process he has either the granule so small, say about ⅛in. diameter or substance, or the heat so low (beneath the fusing point of cast metal) that the granules cannot melt into each other before the oxide cinder has so acted upon them as to prevent their fusibility.—Patent completed.

633 W. OLLEY, Enfield. *Circular saw benches.* Dated March 2, 1869.

This consists, first, in the application to the saw spindle of a conical collar which by means of a nut is screwed into the central hole in the saw for the purpose of keeping it tight on the spindle and its cutting edge always at right angles thereto, in order to prevent the saw from working irregularly. Second, in the application to the quadrant at each side of the bench of a fixed bracket or bearing for the shaft of the revolving feeder to drop into, such shaft being held in its place by a block secured by a screw, such block being movable by the withdrawal of the screw in order to release the shaft when required.—Patent completed.

634 J. FARRINGTON, Charles-street, N.W. *Travelling apparatus.* Dated March 2, 1869.

This consists of a light but strong bearing, which is fastened to the leg and extends from the foot upwards if necessary as far as the knee, the distance being regulated by the size of wheel used. This bearing may be placed on either side of the leg. Attached to the bearing is an arm or axle, the position of which is regulated by the size of wheel used thereon, and such arm or axle may be placed on any part of the bearing or foot rest.—Patent completed.

635 The abstract of this specification will appear in our next number.

636 J. HALL, Hounslow Heath. *Horseshoes.* Dated March 2, 1869.

This consists in constructing horseshoes in such a manner that spikes or projections may readily be adapted to them in slippery weather. For this purpose, the inventor drills or bores holes into a horseshoe, and closes up such holes with a metal plug screwed into them, so that the shoe resembles an ordinary horseshoe. In slippery weather these plugs can quickly be unscrewed from the shoe, and screws carrying sharp metal points can be screwed into their place.—Patent abandoned.

637 J. TOWNSEND and P. FORBES, Glasgow. *Oil purifying.* Dated March 2, 1869.

This consists in subjecting the oil or fat to a moderate temperature, so as to expel the odorous constituents, the oil being previously treated first with acid and then with alkali or alkaline earth.—Patent abandoned.

638 J. WOODS, J. HAMPSON, and L. and G. FISH, Preston. *Temples and rollers.* Dated March 2, 1869.

This consists in having the temples on a shaft with a bar of iron or other suitable material in a parallel line or convenient angle with the front edge of the temples, and under the cloth and on the shaft is fixed a small bracket or brackets, which is also fixed to a finger that is bolted to the front carrier, or what is commonly called the breast beam with a stud finger tapped. A cam lever or levers is or are fixed to the lathe or sley, and every time the lathe or sley beats up the cloth it works on the finger or fingers, the cam-tapped lever or levers which is fixed on the front carrier moves or lifts the temples up, and gives a partly rotary or vertical motion to the temples, and causes the yarn to spread, which gives the cloth a better cover.—Patent abandoned.

639 J. HOWE, Boston. *Ships.* Dated March 2, 1869.

This consists in an arrangement of one or more pipes or steam conduits arranged within the body of the hull of the vessel at any convenient or suitable part thereof, and communicating with the steam boiler or boilers of such vessel, the outer extremity of such steam conduits extending through the sides of the hull below the water line and at the stem and stern thereof in such manner and at such an angle to her keel as to enable steam when admitted to the conduit to strike against the body of water with such force and in such a direction as to force the vessel through the water and in the desired direction, the admission of steam to either or any of the conducts being regulated by a cock or cocks suitably disposed.—Patent completed.

640 W. CLARK, Baker-street, W. *Shearing apparatus.* Dated March 2, 1869.

The inventor imparts reciprocating motion to an upper cut plate by means of a lever pivoted on the lower plate and connected with the upper plate by a pin fixed on the latter. The other end of this lever works in a zig-zag cam groove formed on the periphery of a cylinder mounted in bearings at the rear of the comb-plate, or the cam may be formed of a disc or plate bent of the zig-zag form desired.—Patent completed.

641 F. A. GATTY, Accrington. *Treating madder.* Dated March 3, 1869.

This relates to former letters patents granted to the same inventor on 31st March, 1858 (No. 679), and the 9th June, 1858 (No. 1297.) After all the earthy or other oxides have been removed from the fatty compounds by treating them with an acid according to the patents above referred to, dispensing, however, with the boiling with carbonate of soda before the earthy oxides have been removed, the inventor now takes 50lb. of the fatty compound and adds 6 gallons of water, with which it is well stirred. He then adds 9 gallons of caustic soda at 24deg. of Twaddle's hydrometer, and mixes the whole well together, raising the temperature to about 90deg. Fahrenheit, or if the temperature is raised higher a larger quantity of soda is required. The colouring matter is now dissolved, and the soap and other materials are separated from it in the following manner:—The inventor uses strong cotton or linen bags as filters, which are filled with the mixture, and pressure is applied to them in order to obtain as much of the liquid as possible. He then adds an acid (by preference sulphuric acid) until the solution is acid and the colouring matter precipitated; the colouring matter is then collected upon a filter and washed with water until it is free from acid. It may then be dried or used in the wet state for dyeing and printing. In place of soda other alkalies may be used, but it is preferred to use caustic soda. The inventor now takes the solid matter, composed of soap and other materials out of the filter bags, and boils it with from eight to ten times its own weight of a solution composed of common salt at 12deg. of Twaddle's hydrometer, containing from 1-15th to 1-20th part of caustic soda, until the soap has come to the surface. The whole is then left to cool and the soap taken from the top. The liquid still contains a certain quantity of colouring matter in the shape of a gelatinous substance, with which are also combined the impurities of the fatty compounds. The gelatinous substance is separated from the alkaline liquid by filtering, and to the solid or gelatinous portion an excess of sulphuric acid or muriatic acid is added and it is boiled for about half an hour. When cold the solid matter is collected on a filter and washed with water; it may then be used for dyeing and printing.—Patent completed.

642 J. COOKE and G. HIBBERT, Richmond, Yorkshire. *Motive power engine.* Dated March 3, 1869.

The inventor employs two boilers at different pressures. These boilers are connected by a pipe and by a force pump or its equivalent to cause the water and steam to circulate from one to the other. The engine to be driven is supplied with steam or water from the lower pressure boiler, and the exhaust pipe from the engine is connected to a chamber through which the feed and starting water passes. This chamber is connected to the pipe forming the circulation between the boilers, and in this pipe is a chamber for the exhaust steam, which is carried again into the lower pressure boiler by the current of hot water or steam passing through a jet from the higher pressure to the lower pressure boiler.—Patent abandoned.

643 J. SLOPER, Walbrook, E.C. *Perforating machines.* Dated March 3, 1869.

This consists in constructing apparatus for the above purpose, in which a hanging or vibrating lever or frame and a forcing rod or plunger are employed, which are carried and guided thereby and move longitudinally with regard thereto. The motion of the rod or plunger is caused by its action against a cam or cams or inclined surfaces or other mechanical contrivances so arranged as to produce it from the motion of the vibrating lever.—Patent completed.

644 H. W. GOLDRING, Moorgate-street, E.C. *Cotton seed cleaner.* Dated March 3, 1869.

This consists in improved machinery or apparatus for operating upon cotton seed mechanically as well as chemically, and is designed to remove the cotton adhering to the seed. The framing of the machine or apparatus supports a reservoir to contain the seed to be operated upon, a hollow axis working watertight through the ends of the reservoir, and hollow perforated arms closed at their outer ends and forced into the hollow axis. A rigger is fixed on the hollow axis for imparting rotary motion thereto by means of a strap or band suitably driven. Cylinders of sheet metal are mounted loosely on solid axles, to which are affixed brushes. These cylinders are made in two parts lengthwise, the upper part of each cylinder being capable of being moved over the under part thereof. Toothed wheels are employed for imparting rotary motion to one of the solid axles, and brushes are fixed thereon by means of the wheel, over which a chain passes and is suitably driven. A pulley is fixed on the other solid axle for imparting rotary motion to the brushes fixed upon it, which may be effected by means of a strap or band passed over the pulley and suitably driven. An endless travelling band or cloth works over rollers, to one or more of which rotary motion is to be imparted for advancing the driving band at the proper speed. A wiper is used for keeping the curved part of the reservoir clean.—Patent completed.

645. The abstract of this specification will appear in our next number.

646 F. ANDOE, Swansea. *Fire escapes.* Dated March 3, 1869.

The invention consists in constructing apparatus with a box or receptacle for one or more persons to stand or place themselves within, and having cords, ropes, or tackle for suspending it passed through gripping pulleys or rollers, one pair at either end of and near to the top, and thence by other pulleys or rollers guided and brought to pass out of the box or receptacle together, or nearly together, at or near to the bottom, and furnished with a check brake for pressing on the tackle or rollers, or some of them, to prevent too rapid a descent. In some cases the box or receptacle also has attached to it or is fitted or combined with other tackle, including a pulley block for raising the apparatus when desired.—Patent completed.

647 J. ROBERTSON and J. SHANKS, Barrhead. *Smith's bellows.* Dated March 3, 1869.

An ordinary rotary blowing fan is employed, and is driven directly and without intermediate gearing by a belt from a flywheel on a cranked shaft, which is worked by a hand lever and connecting rod. In applying the improved apparatus to fixed forges it is in one modification arranged under the hearth, and the air is led by branch pipes to the tuyeres of two separate fires, the pipes being provided with stop valves, so that either fire may be blown singly or both at once, the apparatus admitting of the two being blown together by one man quite easily.—Patent completed.

648 E. LYONS, Birmingham. *Lamps.* Dated March 3, 1869.

This consists, first, in constructing that part of the lamp called the cap, that is, the outer tube surrounding the wick tube, and delivering air to the outside of the flame, so that the upper part of it has sides parallel to one another, and parallel to the sides of the wick tube. The lower part of the cap on either side is opened outwards so as to form wing-like pieces making a considerable angle with the upper part of the cap. The air collecting under these wings passes up the space between the upper part of the cap and the wick tube, and is delivered in two parallel vertical streams on either side the flame.—Patent abandoned.

649 W. HOWES and W. BURLEY, Birmingham. *Carriage lamps.* Dated March 3, 1869.

The inventors make the chimneys of carriage lamps in two parts, secured together by pressure, the middle flange of the chimney being fixed in its place between the two parts at the same time. By this improvement the chimneys are much stronger than chimneys of the ordinary construction, and are not liable to be injured by the heat of the lamp. Instead of making the holes for the escape of the vitiated air from the lamp in the vertical sides of the chimney, as usual, the inventors make these holes in the top hollow flange of the chimney. By this arrangement the flickering of the flame in windy weather is prevented.—Patent completed.

650 H. A. BONNEVILLE, Paris. *Doubling stuffs and tissues* (A communication.) Dated March 3, 1869.

This apparatus is composed of a table upon which the stuff or article is placed supported by the frame of a metal plate placed above, the width of which progressively decreases, and upon which the stuff or article is gradually turned down and folded by the cover of the apparatus, by passing through an aperture in the length of the metal plate. The apparatus is controlled by regulators worked with screws or otherwise according to the width of the stuff or article and the width of the doubling. On issuing from the apparatus the stuff or article is caught between a series of conveniently adapted driving rollers actuated by any sort of motive power.—Patent completed.

651 W. E. NEWTON, Chancery-lane. *Waterclosets.* (A communication.) Dated March 3, 1869.

This relates to improvements in apparatus for governing the flow of water to and from the basins of water-closets. The water valve is worked automatically and regulated by a retarding cylinder.—Patent completed.

652 R. WRIGHT, Richmond. *Railway carriage doors, &c.* Dated March 3, 1869.

The object is to construct the door of railway carriages in such manner as to prevent injuries to fingers by the closing of the doors. For this purpose, in place of supporting the door on hinges, as heretofore, the inventor supports it on two pins, one at the top and the other at the bottom, and the side edge of the door near to which the pins are placed is made hemispherical, so that when a door is opened this edge is always close up to the door post, so leaving no opening for the people's clothes or fingers to get between them. The opposite edge of the door is provided with a soft or yielding edge to prevent any injuries to fingers if this edge of the door is closed upon them. It is preferred to form the horizontal rails which form the top and bottom of the door to project beyond this elastic edge to catch against the frame of the door and prevent it turning inwards.—Patent completed.

653 D. SWORD, Edinburgh. *Supplying water to cattle trucks.* Dated March 4, 1869.

This consists in connecting cattle trucks or waggons supplied with water troughs to one or more tanks or reservoirs attached to the train, so that by means of affording a continuous supply of water the cattle may drink at any time when on the journey, and the necessity of stopping the train for supplying them with water is avoided.—Patent abandoned.

654 A. A. L. P. COCHRANE, Westminster. *Marine structures.* Dated March 4, 1869.

This consists in the preparation of concrete blocks of gravel or stone chippings, lime, sand, and bitumen, which the inventor combines and incorporates together, and casts, moulds, or otherwise forms into suitable masses or blocks as may be found most applicable for the object in view, both as regards size and weight. These blocks having been deposited, with or without a base or bed of bituminous concrete, in the situation intended, he unites them together so as to form one entire and compact mass by pouring into or otherwise filling up the joints or interstices with a bituminous cement composed of bitumen

sand, and lime in suitable proportions, and rendered sufficiently plastic by the admixture of gas tar together with the application of heat, so as to enable the cement to be poured or run into the joints and to fill them.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated September 14, 1869.

2680 B. Lakin, Manchester, and J. Bayley, Heaton Norris, Lancashire. Improvements in machinery for preparing, spinning, twisting, and doubling cotton and other fibrous materials.

2681 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved appliance or apparatus for preventing accidents through the closing of doors and windows.

2682 W. E. Gedge, Wellington-street, Strand. A novel construction of vehicle for locomotion by land and water.

2683 M. Grouse, Southampton-row, Middlesex. Improvements in envelopes.

2684 J. J. Bodmer, Newport, Monmouthshire. Improvements in the manufacture of iron and steel.

2685 W. E. Newton, Chancery-lane. An improvement in pumps.

2686 W. E. Newton, Chancery-lane. Improvements in furnaces and ovens or kilns.

2687 C. C. Steenstrup, New Broad-street, City. Improvements in breech-loading and other ordinance, also applicable to other purposes.

2688 A. H. Gilmore, Edinburgh. Improvements in safety lamps for mining and other purposes.

Dated September 15, 1869.

2689 J. Holding and J. Eccles, Manchester. Improvements in looms for weaving.

2690 H. Allman, Gower-street, Middlesex. Improvements in the construction of ships' compasses, commonly called mariners' compasses, and in apparatus connected therewith.

2691 P. M. Fouque, Boulevard de Strasbourg, Paris. An improved holder for cartridges.

2692 T. Restell, Birmingham. Improvements in breech-loading firearms, and in cartridges for breech-loading firearms.

2693 G. Shaw, Birmingham. A new or improved combined buckle and buttonhole.

2694 G. Shaw, Birmingham. Improvements in stoves and furnaces for burning solid fuel.

2695 W. E. Gedge, Wellington-street, Strand. A novel, instructive, and amusing geographical game.

2696 C. G. Hill, Alfred-street, Nottingham. Improvements in the manufacture of ruches and other trimmings.

2697 W. E. Newton, Chancery-lane. Improvements in machinery for the manufacture of felt and other cloths.

2698 A. V. Newton, Chancery-lane. Improvements in steam and caloric engines.

2699 C. Mohr and S. E. Smith, Birmingham. Improvements in the manufacture of cages for birds, squirrels, and other animals.

2700 A. M. Clark, Chancery-lane. Improvements in key guards, applicable also to the shanks of knob latches.

Dated September 16, 1869.

2701 H. B. Barlow, jun., Manchester. Improvements in apparatus for preventing the incrustation and the accumulation of sediment in steam boilers.

2702 W. Bettison, Liverpool. An improved potters' glaze and seggar wash.

2703 W. Tipping, Wigan, Lancashire. Improvements in apparatus for preventing or consuming smoke.

2704 J. Hampson, Bradford, near Manchester. An improvement in apparatus used in the manufacture of pipes from lead or other metal or alloy.

2705 J. H. Johnson, Lincoln's Inn-fields. Improvements in correcting the deviations of the mariners' compass and dipping needle, and in apparatus employed therein.

2706 C. Eskrett and H. Searle, Kingston-upon-Hull. Improvements in envelopes or hairs used in extracting oil from oleaginous seeds, and oil cake making.

2707 G. A. C. Bremme, Liverpool. Improvements in machinery for breaking and softening flax and other fibrous materials, which improvements are applicable to other purposes where the same kind of reciprocating rotary motion can be usefully adopted.

Dated September 17, 1869.

2708 J. Sawyer, Alma-street, New North-road, Middlesex. Improvements in the construction of furnaces for steam boilers and other purposes.

2709 R. Stone, Liverpool. Improvements in the construction of floors and roofs.

2710 C. M. Waddie, Edinburgh. An improved construction of printing press.

2711 O. H. J. Krag, New Broad-street, City. Improvements in firearms.

2712 A. Collingridge, Moorgate-street, City. Improvements in the mode of stowing and laying submarine telegraph cables.] Dated September 18, 1869.

2713 T. and W. Wheatley, Glasgow. Improvements in fastenings for carriage doors.

2714 R. S. Burkitt, Manchester. Improved apparatus for effecting the combustion of smoke in furnaces or fireplaces.

2715 J. Belicard, Manchester. Improvements in looms for weaving.

2716 H. W. Harman and W. Lancaster, Manchester. Improvements in steam boilers or generators.

2717 M. Amberg, South Seacombe Villa, New-road, Seacombe, Chester. A new or improved instrument for obtaining samples from bales of cotton wool or other wool.

2718 T. J. Denne, Phœnix Works, Cambridge-road, Mile End, Middlesex, and H. Billingsley, Brandon-road, Victoria Park, Hackney, Middlesex. Improved means of producing transfers and blocks for lithographic and other printing.

2719 N. J. Dor, Ampsin, Liege, Belgium. A new method for manufacturing crucibles, muffles, gas retorts, &c., through the agency of hydraulic presses.

2720 C. Belier, Aldermanbury, City. An improved mode of manufacturing binding tapes.

2721 A. Lacanau, Grasse, France. An improved thermo-electric alarum.

2722 H. A. Bonneville, Sackville-street, Piccadilly. New and improved means for utilising the waste arising in spinning vegetable fibrous materials.

2723 H. J. Rogers, Chancery-lane. Improvements in weighing scales.

2724 J. G. Willans, St. Stephen's-crescent, Paddington. Improvements in the manufacture of iron and steel.

2725 W. R. Lake, Southampton-buildings, Chancery-lane. An improved process for galvanising metals.

2726 J. L. Norton, Belle Sauvage-yard, City. Improvements in looms for weaving.

2727 C. Winn, Birmingham. Improvements in machinery for cutting or shaping metals.

Dated September 20, 1869.

2728 S. A. Varley, Roman-road, Holloway, Middlesex. Improvements in electric telegraphs, and in apparatus employed in their construction, parts of which improvements are applicable to other purposes.

2729 J. N. Steiner, Rue de Saintonge, Paris. Improvements in the construction and the propulsion of velocipedes.

2730 J. Polson, Paisley, Renfrewshire. Improvements in treating grain.

2731 A. Tylor, Newgate-street, City. Improvements in water taps and cistern apparatus for preventing the waste of water and for cleanliness.

3732 W. E. Gedge, Wellington-street, Strand. An improved press bed.

2733 M. Doirior, Perigueux, Dordogne, France. Novel vehicles termed velocimanes.

2734 P. Wisdom, Brooklyn, King's County, New York, U.S.A. A machine for twisting and curling hair for use in stuffing beds, furniture, and like purposes.

2735 W. A. Gilbee, South-street, Finsbury, Middlesex. Improvements in apparatus for heating wines and other fermentable liquids, parts of such apparatus being also applicable to other purposes.

2736 C. E. Brooman, Fleet-street. Improvements in the manufacture of chains, and in the apparatus in connection therewith. (A communication.)

2737 W. E. Newton, Chancery-lane. Improved machinery for the manufacture of tape trimmings.

2738 C. E. Schoeller, South Hackney, Middlesex. Improvements in the construction of copying presses.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," September 21, 1869.

1401 E. Seyd
1414 R. and G. Cadbury and J. M. Rendall
1420 E. Field
1421 C. Lauth
1424 M. S. Wolfgang
1436 J. Hall
1438 C. Cross, A. Heywood, G. D. Wilson, and T. B. Wilson
1441 C. D. Abel
1449 O. H. Merritt
1457 J. L. Greatorex
1465 J. Timmins and J. Gayton
1473 I. and G. Battinson and T. Whitehead
1471 J. Fawcett
1472 C. Ferguson
1475 W. Cadogan
1478 J. and J. Kippax
1482 H. B. Barlow
1495 W. Wilkinson and M. Boss
1500 R. Wilson
1502 H. G. Whitehead
1519 A. M. Clark
1523 W. Benson
1530 J. H. Johnson
1558 C. C. Parker
1559 G. Perkin
1564 T. Herbert and J. C. Fowler
1569 J. G. Tongue
1573 A. Munro and W. B. Adamson
1580 J. Hudson and C. Catlow
1602 J. Dick
1678 W. E. Newton
1714 W. R. Lake
1752 W. R. Lake
1920 A. M. Clark
1958 G. C. Haswell
2276 T. Parsons
2279 W. R. Lake
2289 H. S. Heyman
2379 A. Turner
2434 S. Smith
2440 H. Pinkus
2441 J. Blyde
2483 W. Jones
2536 H. Yates
2541 O. Vivier
2570 H. E. Newton
2582 J. Shand
2599 H. Bridgewater
2600 R. Spear

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears, by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2386	2586	2594	2602	2610	2616	2624	2630
2580	2588	2596	2604	2612	2620	2626	2632
2582	2590	2598	2606	2614	2622	2628	2634
2584	2592	2600	2608				

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2356 J. H. Beettley
2367 J. Boyd, J. M'Pherson, T. K. Kerr, and J. Taylor
2378 T. Twibill
2417 H. Carter and G. H. Edwards
2382 J. Dunn
2413 C. W. Siemens
2436 I. Dimock
2386 J. H. Johnson
2416 A. B. Walker
2432 T. A. Rochussen
2503 E. B. Bigelow
2523 R. Hornsby and J. E. Phillips
2383 E. Wall
2398 H. W. Ley
2544 G. E. Searle
2403 H. S. Cropper
2415 A. B. Berard

LIST OF SEALED PATENTS.

Sealed September 21, 1869.

880 J. Macintosh
881 L. A. Israel
893 F. J. Manceaux
895 J. Nevill
907 J. R. Baillie
909 T. Champion
916 W. Meakin
926 G. Hodgson, H. Bottomley, and E. Cockroft
931 F. Parker
936 W. Riddell and T. Bletcher
977 J. A. and J. Hopkinson
1279 W. R. Lake
1329 J. Broadfoot
1467 C. E. Spooner and G. A. Huddart
1622 J. Cranston
1800 G. W. Oliver
1889 F. Forder and J. Traves
1973 R. Heyworth
2183 T. Thomas
2211 A. C. Kirk

Sealed September 18, 1869.

821 T. Martin
832 A. B. Walker
840 J. Jack
848 F. D. Nuttall
868 J. Combe and J. Barbour
879 C. Longfield
886 J. Horsley
890 R. W. Page
900 F. Baker
903 E. Peyton
917 W. R. Lake
935 E. H. Huch
939 W. R. Lake
970 J. H. Lloyd
973 B. J. B. Mills
981 T. Lippiatt
975 B., H., and J. N. Craven
989 C. D. Norton
1079 J. A. Miller
1215 W. R. Lake
1256 H. E. Newton
1287 A. V. Newton
1646 W. R. Lake
1820 W. E. Newton
2052 A. V. Newton
2091 Q. Dunlop, T. J. Martin, and W. Orr
2138 C. D. Abel
2217 H. Knight
2242 G. T. Bousfield
2311 W. R. Lake

LIST OF SPECIFICATIONS PUBLISHED

For the week ending September 18, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2119	0 6	257	0 10	284	0 8	388	0 8	412	0 4	447	0 4
2152	0 10	259	0 8	285	0 8	389	0 10	413	0 4	449	0 4
3856	0 8	260	0 8	295	0 10	391	0 4	415	0 4	450	0 4
109	0 4	261	1 4	299	0 10	392	0 4	417	0 4	452	0 4
202	1 0	262	0 6	[illegible]	0 8	393	0 4	418	0 4	453	0 4
208	0 10	264	2 2	[illegible]	0 10	394	0 4	420	0 4	454	0 4
213	0 10	266	0 6	307	1 0	397	0 8	423	0 8	455	0 8
217	1 4	270	0 6	308	1 4	398	0 4	424	0 4	457	0 4
226	0 10	272	0 8	311	0 10	400	0 4	426	0 4	459	0 4
235	1 10	274	2 2	317	0 6	405	0 6	429	0 4	460	0 4
237	1 6	276	0 8	320	0 10	406	0 4	430	0 4	461	0 4
241	0 6	278	0 10	321	1 0	407	0 6	433	0 4	467	0 4
242	0 10	280	0 8	340	0 10	409	0 4	434	0 4	476	0 10
244	0 10	281	0 6	359	0 8	410	0 4	436	0 4	477	0 4
249	0 10	282	1 2	372	0 10	411	0 4	442	0 4	517	0 8
253	0 8	283	0 8	380	0 8						

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, OCTOBER 1, 1869.

THE HARVEY TORPEDO.

THE sea torpedo, invented and perfected by Captain J. Harvey, R.N., is doubtless familiar to all our readers, as it has been frequently brought before their notice in these columns. Those who have followed the history of its development will, with us, be glad to learn that the indefatigable exertions of the inventor and of his nephew, Commander Harvey, R.N., are in a fair way of reaping the well-merited reward of their labours. Not, however, as might have been supposed, by the adoption of the torpedo into the British service, comes this reward and satisfaction to them. Oh dear no! we are too careful, too cautious, and too economical withal, to adopt any invention of national importance until we have allowed some foreign power to forestall us in the matter. It is true our Admiralty authorities made a show a few months since of doing something with the invention. They raised the inventor's hopes and expectations of seeing his torpedo adopted into that branch of the service to which he belongs by instituting a few meagre experiments, which were, however, thoroughly satisfactory. This, however, was only after the matter had been forced upon their attention from a quarter they could not conveniently disregard. But, so far as we are aware, there the matter dropped, and we have not heard of it since. Last week, however, we found Russia investigating the merits of the invention, making the necessary experiments to test its practical value, and taking a large supply of these deadly engines of warfare to Cronstadt.

Should any of our readers wish to know the precise arrangement of the Harvey torpedo they have only to turn to page 189 of our volume for 1867, where they will find a description of the apparatus. Those who are familiar with it need only to be reminded that it consists of a case containing a shell charged with 60lb. of Horsley's powder, which is found equal in disruptive power to 300lb. of common gunpowder. It is constructed to be used against an enemy at sea either by day or night. It has a larger amount of contact surface, and offers a minimum resistance in towing. Its movements are designed to be controlled from a torpedo vessel constructed for great speed. The shape of the torpedo and arrangement of the slings enable the operator to diverge the shell alongside the enemy in passing, meeting, or crossing, according to the plan of attack determined upon. By a very simple arrangement of outside levers and inside discharger, the torpedo is exploded when in hugging contact with the enemy's ship. The addition of a safety key renders the apparatus safe to manipulate. The key is not withdrawn until the shell is some yards astern of the torpedo vessel, so that there is no fear of accidental explosion.

With this deadly apparatus experiments were carried out off Spithead during last week by the Russian frigate "Askold," Captain Kaznakoff. In the first place dummy torpedoes were towed by the frigate in various ways, to satisfy the captain and officers of the certainty of the divergence of the machines, upon which point the most perfect satisfaction was given. In the next place, a smack was provided for attack by a live torpedo containing 60lb. of Horsley's original powder. This was towed under full steam at the rate of about eight knots an hour, but the frigate passing too close to the smack, the rope caught over the quarter, and the torpedo, weighing 2cwt., was whipped into the air. The levers caught in the smack's rigging and were wrenched off, fortunately having fouled the reverse way of their action. The torpedo was thus disabled, but the frigate made a second attempt for practice in handling, fouling this time against the smack, and carrying away her main brace, from again running in too close. On a third trial the frigate got the torpedo fairly to pass under the bottom of the smack, in such a way that explosion would have resulted had the machine been in order. Those who have followed us in our previous articles upon this subject will remember how we have always insisted that this invention was one requiring skilful handling and thorough seamanship, and that the proper procedure was with vessels of small size and few hands against costly and unwieldy ships of war with large and trained crews, in which case the sacrifice of life and property would be great and irreparable, with the least amount of risk in the attack. The results of the trials above recorded exactly confirm the views and opinions expressed by us, and coincide with the course laid down by the inventor for working them. It is, therefore, to be regretted that Commander Harvey, who was on board, had not charge of the experiment with the loaded torpedo for the few minutes necessary for its execution.

The lesson to be learnt from these trials is that it is preferable the tow-line should be carried low by small vessels of swift speed, instead of being triced aloft to the yards of tall-masted ships, whose momentum is very difficult and tardy to control. In enforcing this lesson—which is all important in the use of these deadly engines—we cannot do better than quote a letter which the gallant inventor wrote to his nephew, after the latter had communicated to him the result of the Spithead experiments. Says the Captain:—"The result of the experiment is certainly not such as I had expected. But when the conditions in the conducting of it to obtain a success are just the very contrary to what they should be, there is no difficulty in explaining the misadventure. I was under an impression that you were to have a vessel of some size to operate upon. Had I known that you were to have so small a thing as a smack, I should have had some fear about your tow-rope being too high out of the water to take hold of the hull of so small a craft, knowing that you were not prepared with the proper appliances for managing the tow-rope. In the case of operating upon so small a vessel, there should, I think, have been a lizard so fitted as to have brought the tow-rope down, if desired, near the surface of the water, in addition to a ready means of letting out tow-rope. But, even as it was, had the corvette not passed so close to the smack, I think you would have had an explosion that would have hoisted her out of the water. The error was in being too near, under the condition of your not being enabled to manage your tow-rope to meet such cases. In your tactics you expressly state that a reel and brake are essential to the working of the tow-rope. I quite agree with you, and have, indeed, always insisted upon the necessity of having vessels adapted to the service of the torpedo. The great merit of the arm is to fight with small vessels instead of monsters of enormous cost. A squadron of six, at any rate four, torpedo craft can be constructed for the money expended upon one of our monsters, and to keep such squadron in active service would not, I really believe, be more costly than to keep one monster. Besides which, torpedo craft, of the size proposed, could enter ports which vessels of large draft of water could not enter if in need of repair. I presume the torpedo diverged to your satisfaction. If sufficient divergence is obtained all will be accomplished."

That sufficient divergence was obtained we have already shown, and we are glad to add that, notwithstanding the mischance which occurred, the Russians fully recognise the value of the invention, the merits of which are in no way whatever impaired by the mishap. Captain Kaznakoff and his officers have expressed themselves perfectly satisfied with the results of these trials, and especially so with the principle of the torpedo. They stated that they felt fully competent to carry out other experiments without further assistance from Captain Harvey. It was therefore determined to postpone the further trials of the torpedo until after the "Askold" has reached Cronstadt. She is now on her way thither with a large supply of Harvey torpedoes, which have been manufactured by Mr. W. Nunn, who is well known as having improved the signal lamps of our navy. We cannot suppose that what has succeeded so well here will fail to succeed in Russian waters, so that we next hope to hear of the adoption of the Harvey torpedo by the Russian Government. We confess we see no hope of its adoption in our own country. That is a place wherein a prophet is never accepted.

GAS FROM SEWAGE.

A VAGUE report of some experiments which have been made in India, and which, it is said, have resulted in the production of gas of high illuminating power from sewage, has set numbers of people speculating on the possibility of lighting London from the same source. If this could be accomplished no modern application of science could equal it in importance. It would at once remove a nuisance and convert an enormous waste into profit, and besides that would in London alone save the consumption of something like a million of tons of coal a year. While we are yet in ignorance of the mode of operating which has resulted in the success reported, we can only, with the knowledge of sewage we possess, speculate on what may be accomplished by different methods of treatment. Sewage in London, now well drained and well supplied with water, means animal excreta and household refuse largely diluted with water. What sewage means in India we do not know, but, according to Sir John Thwaites, it is solid excreta. Now the only conceivable mode of obtaining gas from such a material as solid excrement is by distilling it in a retort just in the same way as we do coal; and, as we know the chemical composition of the excrement, it is not difficult to guess what the result of the distillation would be. It would, in fact, be a disgustingly offensive mixture, consisting probably of marsh gas, carbonic oxide, carbonic acid, ammonia, and some other nitrogenized vapours, which would give to the whole an odour to which the smell of burnt feathers would be a perfume. No doubt most of what might be considered impurities in this mixture could be removed, and the two combustibles, marsh gas and carbonic oxide, left alone. But in this case the bulk of the gas would probably be reduced by at least one half; and the remaining half would have no value for illuminating purposes, while it would be highly poisonous. We may say, however, that although we think it highly improbable that any olefiant gas or light-giving vapour would be produced in the process, it is quite possible that some might be present if any kind of fat were found with the excreta.

So far with the treatment of the solid matters. We may consider now how gas may be obtained from sewage diluted with a small quantity of water. Placed in close vessels and allowed to ferment, the result would be the slow production of large quantities of marsh gas, carbonic acid, ammonia, and a few other gases; but, again, the gas would give no light when burnt. If lime were added to

the slush, marsh gas would be obtained more rapidly, and in larger quantities, and no carbonic acid would be mixed with it. If we take sewage such as we have in London, and allow it to ferment, we again procure marsh gas; but neither in this case nor with the slush do we procure gas possessing any illuminating power. We are quite willing to confess our ignorance of any feasible means of obtaining gas from sewage but those we have mentioned above. We shall probably be laughed at by those no better informed than ourselves. Meanwhile, we shall wait for an exact account of the experiments made in India, in the expectation of learning that something more than sewage has been employed. In dismissing the matter until we get the information, it may be worth while to notice what changes the manufacture of gas from sewage in London would necessitate. In the first case we put the use of solid excreta; it would involve the entire discontinuance of our present system of house drainage, and a return to cesspools, or some equivalent for them. If concentrated sewage be used, it means a double system of drainage for every house and the whole metropolis. Lastly, if ordinary sewage be used, it has been calculated from the results of Dr. Letheby, who analysed the gases produced in the fermentation, that to procure the gas required for one day and night in winter it would be necessary to store in close vessels twelve hundred millions of gallons, or more than a fortnight's sewage, which is nearly double the quantity that all the reservoirs of all the London water companies put together would contain.

Some other considerations present themselves, which we may dismiss very briefly. In the fermentation of sewage there is no doubt that various morbid poisons are developed. The poison of fever is generally believed to be derived from this very source, and, according to some, cholera is spread by the same means. A leak in a gaspipe might, therefore, involve worse consequences to a household than result from untrapped drains. But on this matter it is needless to speculate. We say again we wait for information.

THE BRITISH INDIAN SUBMARINE CABLE.

Since our last communication on this subject, giving a description of the enterprise, the work has made such rapid progress towards completion as to render further details necessary. The work to be carried out consists of two long submarine cables, the one of 1,550 knots from Suez to Aden, the other of 2,050 knots from Aden to Bombay, making a total length of 3,600 nautical miles, and forming the longest submarine cable ever manufactured. The lengths we have given are the approximate lengths of cable actually required, including a fair allowance of slack. The whole of the contract for making and laying is in the hands of the Telegraph Construction and Maintenance Company; the core for the cable has been manufactured at their Gutta-Percha Works, Wharf-road, under the able supervision of Mr. Chatterton, and the sheathing of the cable is now rapidly progressing towards completion at their works at Enderby's and Morden Wharves, Greenwich, under the direction of Mr. Clifford and an able staff of assistants. A small portion of one class of cable has been manufactured by Mr. Henley, at North Woolwich. The lengths of the sections being different, two sizes of core have been used. That for the shorter length —Suez-Aden section—consists of a seven-stranded conductor, weighing 120lb. per nautical mile. This conductor is insulated with three coatings of gutta-percha alternating with three coatings of Chatterton's compound, and weighing 175lb. per nautical mile, giving a total weight of conductor of 295lb. per nautical mile. The core for the Aden-Bombay section is slightly larger, the conductor weighing 180lb., and the insulator 240lb. per nautical mile. In this section the conductor is covered with four coatings of gutta-percha alternating with four coatings of Chatterton's compound, the entire core weighing 420lb. per nautical mile. Every care is taken that the copper should possess good electrical qualities, and tests are taken especially with this view, no wire being accepted giving a resistance of more than 11·03 B.A. units when tested at 75deg. Fah. for the Suez-Aden section, and of 7·35 B.A. units for the Aden-Bombay section. This resistance is equal to a conductivity power of more than 90 per cent., as compared with pure copper, the actual conductivity of the wire used being about 93 per cent. Many coils are found to be as high as 96 per cent., and again others higher, but in these cases the extra conductivity is obtained by increased weight. After manufacture, the entire core is kept in water at a temperature of 75deg. Fah. for twenty-four hours, and carefully tested to see that the conductivity of the copper and the insulation of the gutta-percha are above the value given in the contract specification. The figure for the insulation is given at 200 millions ohms. per knot, that is to say, that the actual resistance of a knot length of the material is 200,000,000 B.A. units per knot, or, compared to the smaller conductor, of 18,000,000 to 1. The actual figures obtained during these tests are carefully recorded, for the results obtained at the temperature of 75deg. Fah. are really the most valuable and most reliable of any tests taken during the life of a cable.

After the core has been tested and passed, it is forwarded to the sheathing works, where it is served and sheathed according to the specified type. Now in the present cable, although there are only two sizes of core, as many as six types of external sheathing are adopted. This is rendered necessary by the difference of the coast and the variation in the bottom of the sea. The following list will show the different kinds of cable used:—

Aden-Bombay Section.

Cable Type	D^2	Shore end, Bombay.	10 knots.	
"	E	Intermediate cable	86 "	
"	B^1	Second ditto . .	70 "	
"	C	Main cable . .	1,874 "	
"	D^1	Shore end, Aden .	10 "	
				2,050

Suez-Aden Section.

Cable Type	D	Shore end, Aden .	10 knots.	
"	B	Intermediate cable .	325 "	
"	A	Main cable . .	1,205 "	
"	D	Shore end, Suez .	10 "	
				1,550
			Total length	3,600

Similarly to the plan adopted in the French Atlantic Cable, the different varieties of cable are called type A and so on, and as such we will describe them, thereby making the matter easier and more comprehensible. The shore ends, types D and D^1, are served and sheathed similarly; the core is covered with a serving of jute yarn, steeped in a solution of cutch or other preservative mixture, and sheathed externally with 10 B.B. galvanised iron wires of the diameter of ·375in. (No. 00 B.W.B.), and then protected externally with two servings of jute yarn wound on in contrary directions, with two coatings of Clark's silicated bituminous compound. The served core of the intermediate size, or type B, is the same as the preceding, and is covered with 10 B.B. galvanised iron wires, ·200in. diameter (No. 6 B.W.G.), and protected externally with one serving of jute with one covering of silicated compound. For the main cable, or type A, the core and serving is the same as the previous types, but the sheathing is of a lighter form, consisting of 10 B.B. galvanised iron wires, ·150in. diameter (No. 9 B.W.G.). The cable thus completed is served with two coverings of jute yarn laid on in opposite directions, and covered with Clark's silicated compound.

In the various types of the Aden-Bombay section, the core is in each type served precisely the same, with a serving of jute yarn steeped in a solution of cutch or other preservative mixture. The sheathing in type C, or main cable, consists of nine strands of wire and hemp. Each strand consists of a galvanised best homogeneous wire ·099in. in diameter (No. 13 B.W.G.), surrounded with five yarns of St. Petersburg or Manilla hemp, each strand being passed through a mixture of pitch, tar, and silica before being used for sheathing. The entire cable thus sheathed has further a whipping of seven strands of hemp outside all, but laid in an opposite direction to the wire and hemp strands. The whole is served with a good silicated covering. This form of cable differs from the ordinary type of deep-sea cable in having the outside hemp and silica covering. It is specially adapted to resist the attacks of the "teredo." The outside hemp prevents any opening of the strands, and the quantity of silica used will, it is to be hoped, prevent any attack from these small but dangerous enemies to submarine cables. The intermediate cable, or type E, has, as we stated, the same core as the main cable, but the sheathing consists of 10 B.B. galvanised iron wires ·280in. diameter (No. 2 B.W.G.), further protected with two servings of jute yarn in opposite directions, coated with two coatings of silicated compound.

The Bombay shore end, type D_2, has the same core as the others, is well served with yarn, then coated with a covering of silicated compound, and sheathed with twelve strands, each of 3 B.B. galvanised iron wires ·200in. diameter (No. 6 B.W.G.). The main deep-sea cable and the Bombay shore end show departures from the usual type of submarine cables. In the former, considering the nature of the sea, the plan is an admirable one, constituting this cable the finest specimen we have yet seen of a deep-sea cable. It has the elements of great lasting power. In the Bombay shore end, the application of a hot compound to a served core is new, and we cannot think it an improvement. It would have been better to have made the inner portion of this type similar to the intermediate cable; this, well compounded and sheathed with stranded wires, would have formed a more substantial and lasting cable.

The nature of the course taken by the cable may be briefly stated. The cable, starting from Bombay, proceeds for a little distance in comparatively shallow water; it then suddenly deepens to 900 fathoms at a distance of 140 miles; the depth then increases to about 2,000 fathoms, which is maintained for the major part of the route; at a distance of 600 miles from Aden, the water shallows to 1,500 fathoms; from that point for a distance of 350 miles the depth varies between 1,500 and 1,000 fathoms at 250 miles, and close to Aden the depth varies from 1,000 to 600 fathoms. From the most recent surveys made, the latest being by H.M.S. "Hydra" during last year, the bottom seems well suitable for a submarine cable to rest on. In laying the cable up the Red Sea, the cable will be submerged about mid-sea in the deepest water. This varies from 1,000 fathoms to 300 fathoms, with an average depth over the principal part of 700 fathoms. For the rough parts at the shore end ample provision has been made for strength and for lasting, and we cannot see any reason why the present cable should not last, when submerged, for many years. It is intended to commence paying out from Bombay towards Aden, and then from Aden to Suez; as our readers are doubtless aware, the "Great Eastern" has been engaged for the work, and another success will prove beyond doubt that her mission is the submergence of submarine cables. She will take on board (she is now engaged in shipping cable) the whole of the Aden-Bombay section and a portion of the Red Sea section, the remaining part of the

latter section being taken by the "Hibernia."

The present state of the cable is about as follows:—

Manufactured	Type A	32	knots.
,,	B	325	,,
,,	B^1	63	,,
,,	C	1,742	,,
,,	D	12	,,
,,	D^1	10	,,
,,	D^2	2	,,
,,	E	41	,,
	Total	2,227	

Shipped on board the "Great Eastern," 1,556 knots.

The manufacture has been progressing so rapidly that the "Great Eastern" has taken cable on board quicker than was expected, and in all probability she will have her portion on board and take her departure about the 24th of October. The cable has been manufactured at Greenwich with twelve machines, the whole of which have almost invariably been at work the entire time, without delay or accident, the actual work done being greatly in excess of the French-Atlantic manufacture. The electrical tests of the cable leave nothing to be desired, and the cable when submerged and completed will be one of the finest submarine cables ever manufactured.

The cable when laid is to be capable of transmitting messages at the rate of twelve words per minute on the "Mirror" system, and the contractors are to erect and provide proper and sufficient station buildings, instruments for working the line at the various stations, and deliver the whole to the company in perfect working order. In addition, one month after the completion of the line, the contractors are to hand over their ship "Chiltern" with all her machinery and appliances, so that in the event of any accident happening to the cable, the Company will then have a repairing ship on the station. It will be some months before the cable can be successfully laid, owing to the distance necessary to transport the cable, but on the departure of the expedition we shall place before our readers some details of the manufacture of the British-Indian submarine cable.

The interests of the shareholders are watched over by the engineers to the British Indian Telegraph Company, Messrs. Latimer Clark and Henry C. Forde, and their experienced staff, and these gentlemen will also superintend the laying of the cables and conduct the thirty days' tests after their final submergence. Upon the result of these tests, if found good, the contractors receive their final certificate, and the cable will then be handed over to the company to be worked for the benefit of the shareholders.

THE QUARRYING OF MARBLE.

THERE is a certain class of minerals which require a vast amount of preliminary labour, capital, and perseverance before they can be drawn from their native source and made subservient to the comfort and convenience of mankind. Coals afford an excellent illustration of our meaning. Fortunes have repeatedly been expended before the coal has been "won," as the miners term the striking of a seam that will repay the cost of working it. Tin, copper, lead, and other mines are inseparably connected with visions of long shafts, subterranean galleries, driftways, and headings, not to mention the chances of errors, "faults," and local deviations. Moreover, the majority of minerals must undergo an expensive metallurgical and refining process before they are fit for commercial purposes. The word mining naturally suggests the idea of finding the substance sought for at some depth in the earth, while quarrying evidently applies more appropriately to operations carried on near the surface of the ground. Quarrying, therefore, is free from the risks and uncertainties attendant upon mining, and a very trifling outlay of capital will suffice in the former instance. It must not be imagined that marble comes from the quarry in a condition bearing much resemblance to that in which it meets the public gaze. In many instances it would be difficult for any but a proficient to recognise its individuality. Few would recognise the pure, clean, and white substance that is never absent from the domestic board in the impure, dirty-looking amorphous mass that constitutes rock salt. Nevertheless, in the mass in the mine rock salt multiplies in infinite reflections the surrounding lights, and a salt mine presents to the visitor a scene of almost fairyland appearance. It is rather curious that coal requires no subsequent purification or treatment to render it fit for use, but arrives at the mouth of the pit in a state perfectly fit for the market. All minerals are, to a certain extent, fit for the market when brought to earth, as they are sold as ore, but they cannot be considered in a finished condition until subsequently smelted, reduced, and purified. Many parts of England, Ireland, and Scotland are rich in marbles, but very little is done in marble quarrying at home. We are commencing to ornament our public buildings with this beautiful material, but as yet we do not absolutely use it in construction.

The business of a "marble merchant," if we may coin the phrase, embraces three distinct subdivisions. The first is the quarrying or the procuring of the material, the second the sale in the bulk, and the third the conversion of the raw article into such form as will adapt it for the purposes of ornament and utility. Among the marble quarries of the continent those of the Pyrenees are celebrated both for their extent and the beauty of the article they supply, and it will be interesting and instructive to examine a little into the methods by which it is procured. These quarries are either the property of individuals or of corporations, more generally of the latter, but the usual plan is to let them out to working quarrymen, who, from their want of scientific and mechanical knowledge, are enabled to make but a very partial and imperfect use of the advantages they purchase. They, moreover, cling with that wonderful but inexplicable tenacity to the old system of working which prevailed in the days of their ancestors, and obstinately refuse to believe in the teachings of geology or mineralogy, and the experience of those more fitted to be their instructors. While on the one hand, it is evident that operations conducted almost upon the surface of the earth do not require the same amount of skill and care that must always be bestowed upon deep subterranean explorations, yet on the other it is equally plain that geological and mechanical science may be employed to great advantage.

There are three principal errors into which the ignorance and obstinacy of the quarrymen lead them in the working of the quarries. Of these the most disastrous in its results is the excessive use of gunpowder, or "shots" as they are technically called. To save themselves trouble, the quarrymen roughly trace out by a shallow cut the contours of the block they wish to dislodge, put in the shot, and the explosion gives them generally a huge mass, cracked and fissured in all directions, of the form and shape of which they had no previous idea. Having obtained the block, such as it is, the next step is to "square" it as well as its shape will permit of. To effect this it is necessary to knock off and cut away as much of the material as would form a block equal in cubical contents to that which is left. Owing to this unscientific and extravagant plan of proceeding, nearly three cubic yards of rough block are required to yield one of tolerably squared marble. The above rude method entails a great waste of valuable raw material, a general deformation of the dislodged block, and, what is of still greater importance, a rending and shaking of the whole mass in the neighbourhood of the "shot." It is extremely important here to note the distinction between the quarrying of marble and that of any other ordinary description of stone. In the latter case the more the rock is rent and torn the better, provided blocks of a certain size are obtained, and in some cases the size of the block is of no consequence. All that is required is to "get the stuff," to bring down or blow up the absolute cubical quantity, regardless of its shape and size. But with marble quarrying the very reverse is the case. Not only are blocks of large size wanted, but they must be perfectly sound and free from cracks and fissures. Manifestly if the shot be very violent, it will so shake the surrounding mass that it will be almost impossible to get a good block out of it of the size required. This is a very serious contingency, for supposing that an order is sent to the quarry for several blocks of a certain size, a large amount of labour and material may be wasted before they can be obtained. Granting that by good luck blocks of the dimensions ordered are dislodged, they may be so rent and cracked by the explosion as to be useless except for cutting into smaller pieces.

In whatever light this system of violent "shots" be regarded, it is radically wrong in theory and ruinous in practice, and ought to be at once abandoned for a better and more economical mode of proceeding. The correct method consists in almost isolating the block that has been marked for extraction by deep cuts, so that it is only attached to its parent mass by one of its sides. Its permanent dislodgement may then be accomplished either by means of iron wedges or by a series of small "shots" calculated to produce only the local effect required. If the side by which the block holds on to the rock be situated in the line of least resistance, and L be the length of the side, the charge should be proportional to L^3. By this process, blocks of almost any given dimensions could be obtained, and, moreover, so sound in all parts, that a much higher price would be offered for them than when procured by the system described above.

The second mistake continually committed by the quarrymen is one which is more excusable than that already discussed, but one, nevertheless, which old and experienced hands ought not to fall into. It is a want of judgment in selecting the direction in which the material may be most readily and advantageously quarried, and also in cutting the blocks without sufficient regard to the harmony of their colour and contexture. The extraction and squaring should be so arranged that the greatest degree of homogeneity and uniformity of colour should be in the centre of the exposed faces. The third error of the Pyrenees quarrymen comes under the category of a blunder more than anything else, and would probably never be committed where there was a proprietor or manager of sense and responsibility connected with the works. It is the habit indulged in of despatching for exportation a very inferior description of marble on the same terms as the superior kind. This arises from the want of that proper selection and supervision which would ensure the retention of all blocks that were not "up to the mark," and only allow those to pass which would reflect credit upon the source whence they were procured. Those who have had to do with quarrying, or excavation in rock of any sort, are well aware that the men delight in "big shots." It requires the greatest care on the part of the foreman and overseer in seeing to the charging of the holes, that too much powder is not put in. When the stones "fly," and the report is very loud, one of two evils has been committed. Either there has been too much powder used, or the hole has been "jumped" in the wrong direction. A great

deal depends upon the manner in which blasting operations are carried on. A railway contractor that had a heavy rock cutting to get through would find it a losing job if he entrusted the excavation of it to any but a "ganger" who was an old hand at blasting.

TELEGRAPHIC NOTES.

THE example set by England in the matter of Government and the telegraph system appears likely to be followed in America, for we learn that the Western Union Telegraph Company of New York, which has absorbed all the other leading lines of the country, is likely to press upon Congress, at its approaching session, the propriety of the Government buying them up and carrying on the business after the English precedent. This enterprise was established about twenty-three years since by Professor Morse and some other gentlemen. It commenced operations with a single wire from Baltimore to New York. Its capital stock now, however, represents a sum equal to about eight millions sterling, besides a bonded debt of nearly a million. The company, under their charter, have the power of purchasing competing lines at pleasure, and it is by issuing stock for that purpose and also to patentees that a great part of their enormous nominal capital has been created. It is stated that in past years this company has been "a source of alleged fraud and corruption, as it has been charged that parties of controlling influence have bought up the stock of comparatively valueless lines at merely nominal figures, and officially turned the same over to the company at much larger prices and often at greatly more than they were worth, to the great damage of the company and to the profit of the officers directly or indirectly engaged in the transaction." At the present time, the company's plant and stock includes 3,462 stations, 52,099 miles of poles, and 104,584 miles of wire, which traverse every State and territory in the Union except Minnesota and New Mexico. The receipts last year were equal to about £1,460,000, and the net revenue was about £550,000, or about 6¼ per cent. on the capital stock. The company contend that the terms at which the Government should buy them ought to be calculated on the assumption that a 10 per cent. stock may be considered worth par, and that their stock, paying 6¼, should be taken over at 65. It is remarked by the Philadelphia "Ledger" that this mode of valuation would be very well if the company possessed any considerable real property for its capital and indebtedness, or if the exclusive privilege for which so large a portion of this capital was expended still continued to the company. But it appears that the patents have expired, anybody may put up lines, and more cheaply, and the present poles, wires, and insulators now in use are gradually falling into decay. At the same time, while the company take an opportunity to remark that, "based on the proposed purchase of English lines, the valuation for their system would be £11,200,000," it is pointed out that the reasoning in this respect is also deceptive, since there can be no just comparison of the lines of the Western Union Company with the English or European lines, the qualities of the wire, poles, insulators, and other materials used in America being very inferior, as everyone knows who has seen them.

The collection and supply of telegraphic intelligence to the various London and provincial news-rooms, chambers of commerce, and the press has hitherto been, and at present is, effected by the various telegraph companies. In a public point of view, this is one of the most important functions of the Electric and International Telegraph Company, but, on the transference of the wires to Government, the existing arrangements for the collection and supply of news will cease. In view of this the Home and Foreign Telegraphic News Company (Limited) has been formed for the special purpose of taking up and carrying on the intelligence department of the telegraph system as at present conducted. It is intended to secure the services of a portion of the working staff of the present intelligence department, and the whole, we are informed, will be under the direct personal superintendence of a gentleman who has not only for the last thirty years been engaged in this special work, but who has been intimately connected with the intelligence department of the telegraph ever since its first establishment. Arrangements are in progress for obtaining the co-operation of several of the most important news agencies in London, Liverpool, Manchester, and New York; and for establishing agencies at each of the European capitals, and at all the other chief centres of mercantile intelligence in Europe, India, China, and the colonies; so that by the time the transference of the wires to her Majesty's Post Office authorities takes place, it is expected that this company will be in a position to supply, irrespective of all other sources, original and early news on a more extended scale, and on a system of greater efficiency, than has hitherto been attempted.

Another telegraphic company is announced under the name of the Oceanic Telegraph Company (Limited), Ireland to Nova Scotia direct. The stated object of this company is to provide cheaper and more direct ocean telegraphic communication generally; in the present case, by a direct line from the south-west coast of Ireland to Sable Island and Halifax, Nova Scotia, which is in complete telegraphic communication with New York and America generally. The company's operations are based on a system of deep-sea telegraphy, admitting the selection of that route which is free from the risks of icebergs and anchorage, and enables the line of communication to be most cheaply constructed and laid, "releasing the telegraph world from its utter dependence on a 'Great Eastern,' and effecting a saving of 40 per cent. on first cost, with extra working capacity." Another material feature in the adoption of this route is that it is a through route, and avoids the dangers to which the present is liable.

Telegraphic communication between London and Australia may be anticipated at no distant period, as there are now only one or two short sections requisite to complete the circuit between Sydney and London. It is estimated that that portion in which Australia is chiefly concerned, namely, from the Gulf of Carpentaria to the Island of Java, a distance of 1,900 miles, could be laid for £500,000. Application has been made to the Government of Dutch India for a concession to land a cable on the east coast of Java, to connect Australia, under a subsidy or guarantee. It is proposed to ask from the Governments of the Australian colonies a guarantee of 7 per cent. on a moiety of the cost of construction, and the amount which they would be asked to contribute is set down at £17,500. The proportion payable by New South Wales would simply be £4,375, in the event of the traffic not paying a dividend of 7 per cent. over and above the working expenses.

We regret to find that a fresh injury has been sustained by one of the cables of the Atlantic Telegraph Company. The accident which has caused the parting of the cable has occurred about 70 miles from Heart's Content, near the locality of the former fractures of the line. The injured cable is the one laid in 1866. Fortunately, the communication between the two countries has not been interrupted by the accident.

In the United States there are 4,126 telegraph offices, or one for every 7,549 of the population, and nearly every town and village has its office. Over 50,000 miles of line, and 100,000 miles of wire, with 265 submarine cables, are in operation.

The number of messages which passed over the French Atlantic cable for the week ending September 25, was 686, the cable charge thereon being £1,797, showing an increase of £474 over the previous week.

According to the "Russian Exchange Gazette," M. Kumbari, a merchant of Odessa, is now engaged, together with the governor-general of that town, in making preparations for the construction of a submarine telegraphic cable from Odessa to Constantinople.

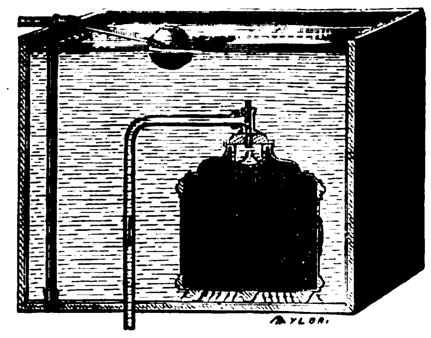
A line of telegraph has been completed from the Land's End to St. Mary's on the Scilly Islands, thirty-one miles, by which means the receipt of shipping intelligence will be much accelerated. The undertaking has been effected by a few private subscribers.

THE following statistics relating to the woollen manufactures in Italy are taken from a book recently published by Sig. Alessandro Rossi, entitled, "Dell' Arte della lana in Italia, ed all' estero guidicata all' Esposizione di Parigi, 1867." The number of persons of both sexes employed in the woollen manufacture in Italy is 25,000. The wages range from 70c. to 3f. 50c. per day. The number of spinning-frames throughout the kingdom is 673, and 6,480 looms. The following is the value of the annual consumption, production, and importation of woollen stuffs in Italy:—Consumption, 170,000,000f; production, 74,280,000f; imports, 86,685,290f.

A REMEDY FOR IMPURE WATER SUPPLY.

ALTHOUGH everyone using the London water supply can testify to its impure character, it is but just to the London water companies to state that they have done what they could towards effecting its purification. They have incurred heavy outlays in providing filter beds, and in constructing covered reservoirs for storage. By these means they succeeded in slightly diminishing the hardness of the water and in reducing the amount of organic matter held in suspension. But it is absolutely necessary to the health, both of individuals and of communities, that the organic matter should be entirely removed before the water is used for domestic purposes. It is hardly possible to effect this by any amount of filtration upon the ordinary principle adopted by the water companies, and it is a fact patent to all that the London water supplies are still contaminated by impurities. The Plumstead Company, it is true, who draw their water from the chalk formation, use Dr. Clarke's softening process, which leaves only 8½deg. of hardness. This compares well with the other waters of London, which average 20deg. to 22deg. of hardness, with 2·60deg. of organic impurity. But the Plumstead Company is the exception, whilst the other companies form the rule which has now to be dealt with. Of course a complete remedy for the evil would be a total change from the Thames to purer sources of supply, as has been done by the Plumstead Company. But, pending this, we must adopt a system of domestic filtration, by which means every consumer can purify the water required for his own use on the premises. This can only be effected by filtration through animal charcoal, which is unquestionably the best substance for the purpose.

There are various kinds of apparatus for effecting filtration, but which, for the most part, require frequent attention in filling, and even then they do not afford a constant supply for all purposes. The best plan with which we are acquainted is that advocated by the London and General Water Purifying Company, of 157, Strand, who have certainly hit upon a very perfect remedy for the impure water supply to which we have to submit. This consists in placing the filter inside the source of supply—the cistern,—and so arranging it that every drop of water must be purified before it is drawn for use. The system adopted is shown in the annexed cut; it is the Danchell filter, which is filled with animal charcoal, and operates by ascending currents. By this means the suspended



impurities are separately precipitated outside the filter, whilst those only which are held in solution pass into the filtering medium. The water becomes purified from these latter in the act of ascension through the animal charcoal. By this arrangement it will be seen that the mechanical impurities, which would otherwise clog the filtering material, are not allowed to enter the apparatus, a point of very great importance in connection with its durability. The system further affords the greatest facility for removing those impurities which are held in solution in the water, and which are intercepted within the filter. This system of filtration is not noticed here as a novelty, for the London Water Purifying Company have supplied these filters to the public for the past six years, and with very best results. But, having the experienced the inconvenience of the hardness, and having incurred danger from the impurity, of the London water, we have adopted one of the Danchell filters in our cistern. This has been followed by such excellent results that we think it only due to the public, who are subject to the same conditions of impure water supply, that they should know how the evil may be effectually remedied.

STATISTICS OF INVENTION ILLUSTRATING THE POLICY OF A PATENT LAW.*

By Henry Dircks, C.E., LL.D., &c.

THE time seems to have arrived for a closer inquiry into the policy of a patent law than the subject has hitherto obtained, for in all probability a parliamentary committee or commission will be appointed next session to take evidence in reference to the working of our present system of patent laws; and the matter has already been agitated by the working classes (particularly at a conference presided over by Sir Roundell Palmer), who consider their interests would be at stake should certain proposed measures be adopted, as suggested by a small but influential party who denounce patent law as an interference with the natural rights of man, and consequently retarding all improvement in arts, mechanical science, trade, and commerce. In fact, if we are to believe all we hear, patent laws never have had and never can have any other than an evil tendency, when considered in an enlightened point of view, for the benefit of mankind at large. The question whether patent laws are to be retained and reformed, or whether they are to be abolished, can only be satisfactorily answered by tracing historically and statistically what have been their results hitherto.

In the first place, it is quite clear that heavy patent charges act on the patent system like heavy duties on commerce—excessive fees become prohibitory duties, patents fall off, as only men of ample means can afford to procure them. Hence the history of patented inventions from the period of Queen Elizabeth to that of the present reign dating to October, 1852, is meagre in the extreme. Therefore, for no less than four hundred years Great Britain and Ireland were, if not completely, yet certainly very nearly approaching that happy state desired by the patent law abolitionists. The number of patents per annum was so exceedingly small that their influence on the arts and sciences and commerce of this country must have been infinitesimally little. But in what respect were manufactures benefited? What were the great inventions of the age thus indicated? Let an answer to such queries be given after a careful investigation of the mechanical and other treasures of the Kensington Museum.

When we consider guns and gunpowder as unpatented inventions of the thirteenth century it may be some consolation to opponents who see in unimproved inventions, in inventions in their infant state, all that man need desire. Or, in the same mood to revert to block printing, introduced by Gutenberg in the fifteenth century, a second splendid and unpatented invention. The waste period between is never considered, nor even the obvious stagnation of all improvement. Progress there was none—that is, as we consider progress, and yet, if patent law abolitionists expect to find vantage ground on such wild assumptions as these and similar instances afford them, it is very evident how indefensible their arguments are when thoroughly scrutinised. The ground was then so barren that the seeds of scientific knowledge refused to germinate on its ungenial surface. It is true the elements of modern progress were not wholly unknown—not even those of the steam engine, about the middle of the seventeenth century—but there was a decided torpor everywhere, all was stagnation, and as to inventors and inventions they were all equally reproached and stigmatised.

In October, 1852, the present improved patent laws came into operation, requiring only one process to include protection throughout the United Kingdom of Great Britain and Ireland, instead of being split into three; also reducing the patent fees, and making them payable by three instalments, namely, for three, four, and seven years, being a total of fourteen years. The result of this great change in the system of obtaining and paying for patent protection has been absolutely prodigious—so much so, indeed, that it would be impossible to point out any other than a constant increase in the trade and commerce of the country. A good invention commands capital, and capital its usual encouragement and spread of civilisation. A man need no longer be in a state of wretchedness, want, and misery, who possesses a novel, simple, and practical invention. Is he a humble working mathematical instrument maker? See how Boulton took Watt by the hand, dedicating his whole fortune to promoting the success of his steam engine, and that, too, in the face of Smeaton's declaration that he was convinced that Watt's engine "could never be generally applied as a useful agent;" for prejudice and shortsightedness always track the path of inventive genius. Mr. Young, holding in early life a very subordinate situation in a chemical establishment, now finds himself the possessor of great wealth, returning as his net proceeds in one year the immense sum of £300,000 derived from his manufacture of paraffin oil.

It is supposed that very strong arguments for the abolition of patent laws are offered by the suggestions, first, that the inventive faculty is innate in man, and so prolific and exciting that it must germinate under the most adverse circumstances. And, secondly, that, although in the infant state of arts and sciences patent laws may have served to foster inventive talent, such is their present growth and vigour that we may safely cast away all such nursery appliances. Indeed, Mr. Macfie, M.P. for Leith, thus plainly puts the case.

Now, as regards the first statement, it is quite true, so far as concerns the mere simple fact of invention, whether in literature or in science. Under every disadvantage invention will exist in some form or other, and may even slightly progress. But what kind of a crop shall we reap? Was ever any great invention brought to maturity without laborious experimental research, and without a large expenditure of capital? Next to printing, what invention has been of more utility to mankind than the steam engine? What would be the present state of society without it? And yet if we trace its history ever so briefly we perceive from what feeble efforts its present gigantic strides have arisen, permeating every class of industrial arts, and spreading far and wide the inestimable blessings of civilised life. Now if we look at an invention in its state of maturity it is like admiring a stupendous oak, and overlooking its having once been an acorn. To what can we trace the encouragement that has stimulated inventor after inventor to toil with mechanical and other inventions, amidst all the opprobrium that prejudice can cast on him, as his being a speculator, schemer, and fanatic? Undoubtedly he looks forward to fame and fortune, and no process so easily secures these to him as patent law; not that the present laws are perfect—far from it; but because any law is better than no law; and every inventor finds himself surrounded less by friends than by men ever ready to adopt his ideas (if found to be of any value) without the least compunction at leaving him to starve in adversity, as was the case with Henry Cort among wealthy ironmasters, and has been the lot of hundreds of other estimable inventors.

But as statements unsupported by facts are of little value, we select the progress of that great invention, the steam engine, as sufficiently illustrative of the importance of a patent law, merely premising that the modern term steam engine is one applied to an old invention, indicative of its progressive improvements. Thus, first, in its primitive state we find the following inventors, under the respective dates annexed to them:—1663, Marquis of Worcester; 1683, Sir Samuel Morland; 1698, Thomas Savery, F.R.S. Secondly, as an atmospheric engine: 1698, Dr. Denis Papin; 1705, Thomas Newcomen; 1718, Henry Beighton, F.R.S.; 1720, Leupold; 1736, Jonathan Hulls; 1739, Bernard Belidor; 1741, John Payne; 1751, Francis Blake, F.R.S.; 1757, Xeane Fitzgerald, F.R.S.; 1758, William Emerson; 1759, James Brindley; 1762, Dr. Joseph Black; 1765, John Smeaton, F.R.S.; 1766, John Blakey. Third, as the steam engine proper: 1769, James Watt, LL.D., F.R.S.

We have thus gone over a period of 106 years, and find that from the introduction of the first engine twenty years elapsed before a second one appeared, and from its date fifteen years elapsed before the third and fourth were made known; a fifth then follows after a lapse of seven years, a sixth in thirteen years, a seventh in two years, an eighth in sixteen years, a ninth in three years, a tenth in two years, an eleventh in ten years, a twelfth in six years, and afterwards at stages varying from one to three years. Now such was the state of invention as a national boon under what we may term the restrictive duties of high patent law fees, say from £300 to £400 for the United Kingdom, showing only eighteen inventions, all relating to one and the same object—the application of steam as a mechanical agent—spread over more than a century, when at length we arrive at the true and complete steam engine, superseding all its predecessors. Here is nothing problematical. We all know that the Marquis of Worcester spent a fortune in bringing his water-commanding engine to a sufficiently practical bearing to have it in public use for seven years raising water at Vauxhall. Unless he had been protected (in his case by an Act of Parliament) he would never by his example have stimulated, as he no doubt did stimulate, many succeeding inventors to follow in his footsteps. It is singularly absurd to presume that without the slightest legal protection inventors will give to society the suggestions they arrive at and the arduous labours necessarily imposed upon them, and it is remarkable that any one should suppose that an unworked idea is tantamount to an invention brought to a practical bearing; whereas what we see is the nature of the progress that has been made in the development of the steam engine, is precisely that which applies to all inventions whatever; and it would not be too bold an assertion to say that the principle of the steam engine proper might as well have been found out and in practice fifty years or more before the time of its great application by Watt had patent laws undergone earlier revision, and been as liberal to inventors as in our day. For at the rate of only one new engine per annum, there would have been 106, instead of only eighteen inventions for that long period; and in such cases number is absolutely indicative of the state of progress.

The second statement alluded to presumes that the present age of invention may be looked on as having arrived at maturity. Genius no longer requires nursing. Perhaps at no age of the world would mankind have felt disposed to believe otherwise than that the age was most polished and civilised, and yet age after age what revolutions take place! Are patent abolitionists who cherish such notions prepared to show that chemistry can make no further advances, that mechanical science is exhausted, and that no department of industry requires aid from inventors beyond what they have already acquired, and that for the future their services will be so light and unimportant that medals, or honourable mention, or a Government reward will sufficiently compensate them for all their mental and physical labours? As, however, it is unnecessary to dwell on arguments which only prove the weakness of the cause they are intended to support, it will be to greater advantage to point out what is really wanted for proving the impolicy of a patent law. It is always understood and believed that patented inventions introduce new manufactures, or improvements on old manufactures; also that they are labour-saving, or more productive than ordinary processes; and, finally, that in every instance they are so productive and economic that the public at large derive from them, either directly or indirectly, the greatest possible advantages. If the reverse of this representation can be shown—if trades or manufactures suffer, then nothing can be easier than to prove the facts historically and statistically. But one recommendation remains to be given to all patent abolitionists—who find inventions to be only ideas, and that ideas for improvements are the cheapest and easiest imaginable of mental processes—to turn inventors themselves, or bring up a school of inventors so as to be enabled to supersede one patented invention after another by their free gifts of such superior inventions as shall throw all patented ones in the shade, and to obtain from society their full meed of praise for their patriotic measures and thoroughly practical proceedings.

Manufacturers find that patent law fosters the decided inconvenience of introducing an amazing amount of competition; and competition, too, of a kind that even the oldest establishments cannot withstand, or the largest capital extinguish. Again, between patentees, patent laws are far from being all that they could desire, for while appearing to protect an original inventor in the matter of his invention, they afford to every petty improver an amount of protection equal in value, so that the giant and the infant are virtually placed on an equality with each other. But, as regards the public—the million—they, comparatively, know nothing about patents—they never purchase them, and scarcely ever see them, and are utterly unaware whether patents ruin, interfere with, or enrich trade; their only experience is, that the prices of all the manufactures they purchase are periodically purchased at declining prices, never concluding, however, on that account that the posperity of the country arises from the losses of their manufacturer on such patented articles of general consumption.

* British Association.

There was an eruption of Mount Etna on Sunday last, when two torrents of lava were flowing down its sides.

GUNPOWDER PILE-DRIVER.

BY MR SHAW.

FIG. 1.

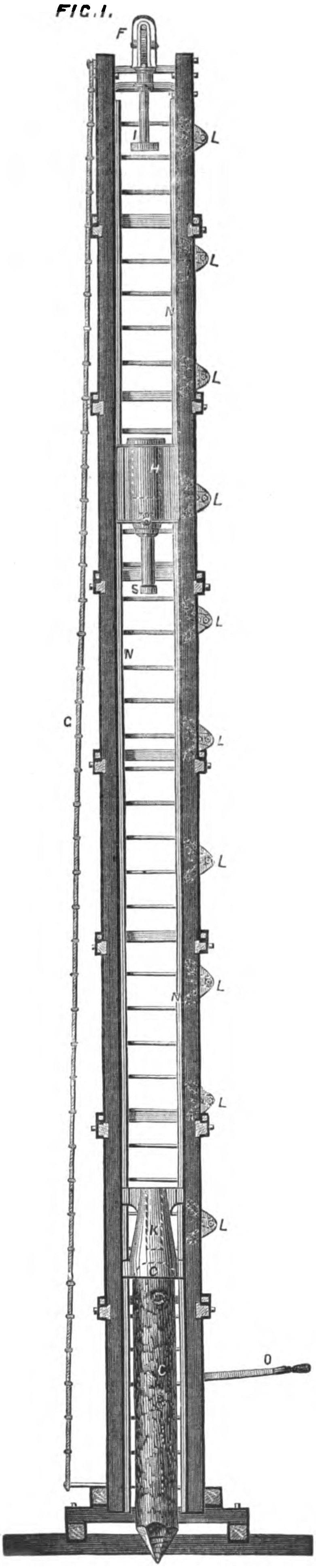
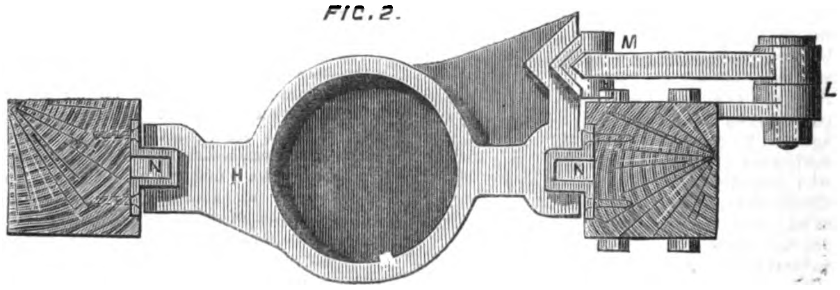
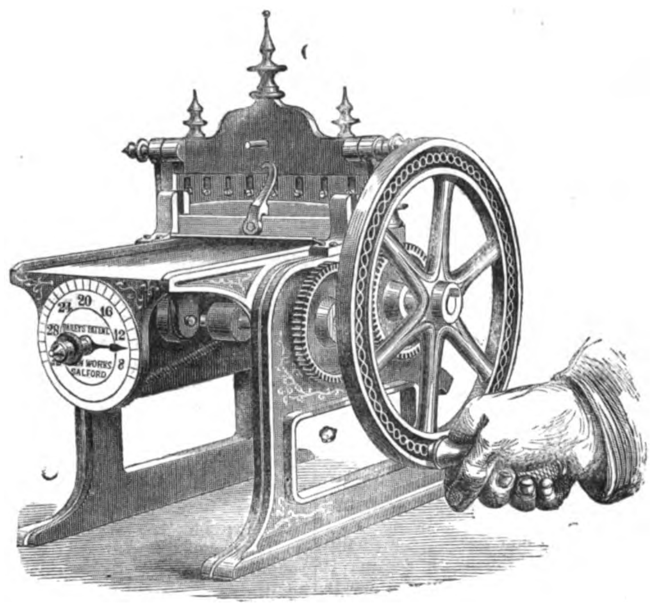


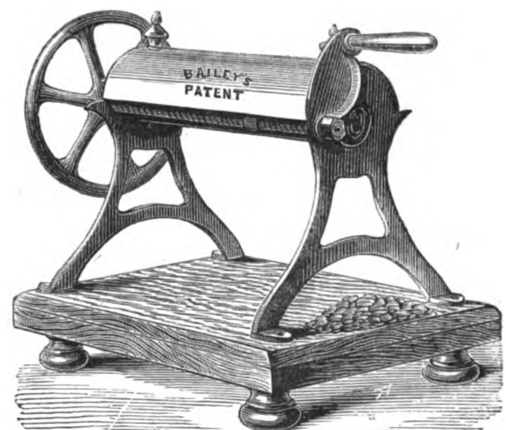
FIG. 2.



CAVENDISH CUTTERS.

BY MESSRS. J. BAILEY AND CO.





BAILEY'S PATENT CAVENDISH CUTTER.

THE annexed engraving illustrates a useful apparatus which we found at the Royal Agricultural Society's Show at Manchester. It is an adjustable and indicating feed Cavendish tobacco-cutting machine, and was exhibited by the inventor, Mr. W. H. Bailey, of Salford, Manchester. The general construction and working of this machine are seen from our illustration. The thickness of the cut may be instantly adjusted from 1-8th to 1-32nd of an inch. These thicknesses are indicated on the dial in front of the machine. The cutter is perfect in its action; the ease with which different degrees of fineness of cut can be obtained was demonstrated at the Manchester Show. Besides the above, Mr. Bailey has brought out another cutter for cavendish roll, which we also illustrate. It consists of a frame in which is a tube, having a screw on the side which, when turned, forces the tobacco to the mouth. A knife is attached to the end of the screw, and which cuts off a slice at each revolution. This machine is neat in appearance and efficient in action. It is patented in this country and America, and is manufactured by Messrs. J. Bailey and Co., of the Albion Works, Salford, Lancashire.—"Tobacco Trade Review."

SHAW'S GUNPOWDER PILE-DRIVER.

IN our issue for July 30 last, there appeared an interesting letter from Mr. Hector Orr, of Philadelphia, giving particulars of Mr. Shaw's gunpowder pile-driver and some trials of its powers. We think that letter will be well supplemented by the accompanying engraving of the pile-driver, and to which the present description refers. The machine is constructed of heavy wood framing, as in the ordinary pile-driving machine, and is provided with a cylinder head of cast iron K, resting on the top of the angle C, and guided by the iron rails N; the cylinder is bored out on its uppe end for the reception of a plunger S, of the ham mer H, and is cast concave on its lower end fo the reception of the pile C. The hammer H i guided by the rails N, and is bored on its uppe end for the reception of a piston I. It is cast wi a V-groove for the reception of a friction rod M, fi 2. The piston and rod I are connected with a cr beam, firmly fixed at the top of the frame, whe a rope pulley F is also placed for the convenie of hoisting the piles into position. The fricti

rod M is connected with the starting lever O, and also with short cast-iron arms pivoted to brackets L, figs. 1 and 2, for the purpose of pressing tightly against the V-groove in the hammer, as shown in fig. 2, whenever the hammer moves in a downward direction. A ring is made of steel and screwed on the end of plunger S; this ring, though of solid steel, expands under this pressure, the same as hydraulic packing, and makes a tight and durable packing.

The machine is operated and controlled by a man and boy; the latter is stationed at the rope ladder G, and throws a cartridge of powder into the cylinder K, when the hammer is allowed to drop by the man's pressing upon the lever Q, which elevates and releases the friction rod from the hammer and causes it to drop, forcing its plunger into the cylinder, compressing and heating the air contained therein sufficient to ignite the powder whenever the plunger comes in contact with the cartridge and tears the paper, so that the heated air may come in contact with the powder. The explosion of the powder elevates the hammer, and the recoil of the cylinder forces the pile into the ground. When the cartridges are thrown at the rate of fifty per minute, the hammer is operated without the use of the lever, except when desiring to cease operating. The object of the air cushion at the top, formed by the bore in the hammer H and piston I, is to prevent a heavy charge from injuring the machine.

The powder employed is of the most simple character, being composed of one and a half parts chlorate of potash and one part of bituminous coal, both pulverised and mixed through an ordinary sieve. This powder burns very slow in the open air; a barrel full might be ignited at once without causing any report. The charges of powder are exceedingly small, a charge of one-third of an ounce being employed to throw a hammer of 675lb. weight, and it is stated by the "Scientific American" that it exerts a force on the head of the pile equal to a dead weight of 300,000lb. for a temporary period. The pressure is exerted on the head of the pile during the presence of the plunger in the cylinder; this gives a blow and pressure of the character of the hydraulic press with the rapidity of the hammer; hence the pile can be driven more rapidly, and forcibly, and firmer, without in any way injuring or splintering it, as in the common method of driving. The usual wrought-iron ring, secured to the head of the pile preparatory to driving, is in this method entirely dispensed with, and it is estimated that even this trifling advantage will nearly pay for the powder employed.

A committee of engineers, composed of W. W. Wood, chief engineer of the United States Navy; H. L. Hoff, of the Eagle Ironworks, Philadelphia; and T. J. Lovegrove, inspector of steam boilers, Philadelphia, appointed to investigate the operation of this invention, give a most flattering report, indorsing fully all of the above statements.

THE TENTOONSTELLING.

THOSE of our readers who have not recently visited Holland and who is not familiar with the language of its inhabitants will naturally first like to be informed of the meaning of the above word. The Tentoonstelling, then, is the international exhibition now being held in the Crystal Palace at Amsterdam, and which is of the greatest interest to the manufacturing community. The time of its closing draws near, but there still remain a few weeks during which a visit can be made. But, as this is not practicable to all, we will tell them the next best thing to do. This is to go to the Polytechnic Institution, where they will find Professor Pepper, who has just returned from Amsterdam, and who has prepared a most interesting lecture upon the exhibition there, which he has been studying for that purpose. The Professor is always instructive as well as interesting, and, in the present instance, he combines both qualities in a very happy manner. He first advises those who have not yet made their holiday trip to go to Amsterdam and see the Exhibition and the city. He gives ample instructions to tourists,and is a very "Bradshaw" in the matter of routes and hotels. He then introduces his audience to the Palace itself, which is an elegant building of iron and glass. It was built some six years since from the designs of Mr. Outshoorn, a Dutch architect, Mr. Ordish, C.E., of Westminster, having worked out the engineering details of the structure. By the aid of some highly effective dioramic pictures, we have exterior and interior views of the fine building and its contents, which are all fully explained by the Professor. The costumes of the country are also illustrated in the same way, as are also some of the chief pictures in the galleries of Amsterdam. The exhibition is purely industrial, but Amsterdam abounds in rare paintings, and the introduction of these adds an agreeable feature to the lecture. Besides all this, we obtain a very good insight into the city itself, its buildings, its manners, and its customs, by the same means of illustration and description. Altogether Professor Pepper's new lecture gives an excellent idea of the Exhibition, the country, and the people, and should be attended by everyone who has a shilling and an hour to spare any morning or evening. We may add that the other lectures continue to be equally attractive. The Great Lighting Inductorium, upon which Mr. Thomas Tobin, the indefatigable secretary to the Institution, is now lecturing, always commands a crowded theatre, whilst the mysterious hand—taught by the same gentleman to answer in writing questions put by the audience—has constant demands upon its caligraphic powers.

THE FRANKLIN EXPEDITION.

THE week before last we announced in our naval items the publication in an American paper of a letter respecting Sir John Franklin's expedition. Later intelligence supplies the following further particulars in the shape of a telegram dated San Francisco, September 13. A party, vouched for as reliable, writes to the "Bulletin," from San Buenaventura, that a document had been found on the beach at that place on August 30, very badly mutilated. On the document was found a request for the finder to forward it to the Secretary of the Admiralty at London, or the British consul at the nearest port, the request being written in six commercial languages on the margin. Every vacant portion was filled with writing relative to Sir John Franklin and his party. The document was evidently cast in the water in lat. 69deg. 37min. 42sec., and long. 98deg. 4min. 5sec. It gives an account of the desertion from the ships "Erebus" and "Terror." The party numbered 105 at the time of the desertion, under the command of F. R. M. Crossier. They had succeeded in reaching the above latitude and longitude, where they had found relics of the late Sir John Ross. The document states that the party had wintered at Beechy Island in 1846 and 1847, and that Sir John Franklin had died on June 11, 1847. It contains many interesting incidents connected with the expedition.

COOPER'S METHOD OF STREET WATERING.

MR. NEWMAN, the superintendent of street cleansing, &c., of Liverpool, has just issued his report to the Health Committee upon the trials made during the past season of Mr. Cooper's street watering salts. The main thoroughfare along Lord, Church, and Bold streets, chiefly macadamised, is considered to have afforded as severe a test as possible from the heavy traffic over it during the hottest period of summer. It is stated in the report that the use of these salts has been entirely successful, and beyond comparison superior to plain water. In practical results two water carts with the weak solution were found equal to seven under the old system upon the macadamised road; but in paved streets one may be expected to do the work of five where the traffic is only ordinary. Financially, notwithstanding the saving of horses and carts, it appears that, at the price of £3 per ton hitherto charged for the salts, no economy can be effected; but then the supply has so far been in experimental quantities, and it should be stated that the patentee is now prepared to deliver in quantity at forty shillings. It is further considered that a reduction of 70 per cent. would be effected in water wasted in the streets, and that there is the collateral advantage of the surface of the roadways being maintained in superior condition, a saving of 20 per cent. in the cleansing being due to this effect. The system has also been tested in Greenock, and is reported upon equally favourably by Mr. Barr, C.E., the master of the works.

A TELEGRAM from Suez announces that the water having been admitted into the Bitter Lakes, the required level was obtained throughout the entire length of the Suez Canal, and that a steamer with M. de Lesseps on board has made the passage from Port Said to Suez in fifteen hours.

COAL IN PENNSYLVANIA.

THE coalfields of Pennsylvania supply nearly all the anthracite coal produced in America. They have been worked only for a comparatively short time; so late as 1812 they were unknown except by a few geologists. The coal region is divided into three sections—viz., the Schuylkill or southern district; the Lehigh or middle district, and the Wyoming or northern district. The product of these regions last year amounted to 13,405,016 tons. The bituminous coalfields of Pennsylvania, Maryland, and Virginia yielded over 2,000,000 tons more, so that altogether the quantity of coal mined in 1868 was upwards of 15,000,000 tons. In mining this amount, upwards of 35,000 people were employed. These are chiefly English, Welsh, and Irish, the last being mostly unskilled labourers, and the first two those more or less acquainted with mining. These operatives live generally in houses belonging to the companies, have their fuel for nothing, and, before the present strike commenced, earned as miners from 5dol. to 6dol. a-day, and, as labourers, from 15dol. to 19dol. a week. There are about fifty companies engaged in this coal business, with an aggregate capital of 100,000,000dol.

EXPLOSIVE COMPOUNDS.

WHEN a powdered nitrate, whether it be a nitrate of potash, soda, baryta, or lead, is intimately mixed with coal or any substance containing carbon or hydrocarbon, such as rosin, sugar, or starch, a combustible mixture is produced, which unless enclosed or confined under strong resistance burns too slowly to form what is usually called an explosive mixture. But a slight addition of nitro-glycerine intimately mixed therewith, so as to form a thin coating over every separate grain, admits of effecting the instantaneous combustion of the whole, owing to the intense heat developed by the explosion in immediate contact with every grain of nitre which it causes to melt. Taking advantage of these circumstances, Mr. Alfred Nobel, the inventor of nitro-glycerine and dynamite, proposes to manufacture an explosive compound on this principle, his invention having been patented in England. From the nature of the mixture it will be evident that the proportions of nitre and carbon or hydrocarbonated substances, as well as nitro-glycerine, may be greatly varied with no other difference in result than an increase or decrease of explosive power; it will, therefore, be unnecessary here to do more than give the composition of mixtures which will serve as a type of the strongest and safest of such compounds. Take, for instance, sixty-eight parts of nitrate of baryta, and mix therewith twelve parts of pulverised coal—that kind which contains the greatest proportion of hydrogen being best for use. To these ingredients add twenty parts of nitro-glycerine. As a modification of this combination take seventy parts of nitrate of baryta and ten of rosin, and add thereto twenty parts of nitro-glycerine. An addition of from five to eight parts of sulphur to either of the above mixtures somewhat increases the explosive effect of the mixture, but is less safe in use. To effect the explosion of the above compounds, a tube or cap containing fulminate of mercury is affixed to the end of the fuse, the cap then being inserted into the powder. Or instead of a fuse the cap may be fired in the usual manner by electricity. In either case it is the fulminate in the cap which causes the explosion of the nitro-glycerine, which in its turn carries off the mixture of nitre and coal or analogous compound.

THE large model of Captain Moody's razed floating fort has been moored off Southend during the late severe storms. The piermaster thus writes of its perfect endurance of wind and waves:—"The model here is quite safe. We have had some terrible weather, with heavy sea. I watched it on Monday, the 13th inst., when the gale was at its highest. It rode it out with perfect safety, and with little or no strain on its cable. I wish you and some scientific gentlemen had been here to witness it." This testimony is the more welcome as it is important: the only objection really brought against this novel class of vessel having been the possibility that mooring might be difficult; an opinion which it was only possible to combat on theoretical grounds in the absence of the practical proof to be afforded by the actual mooring of a construction of considerable dimensions. Captain Moody's system will be found described and illustrated at p. 420 of our last volume.

MACHINERY FOR CUTTING VENEERS.

BY MESSRS. LYMAN AND SQUIRES.

FIG. 1.

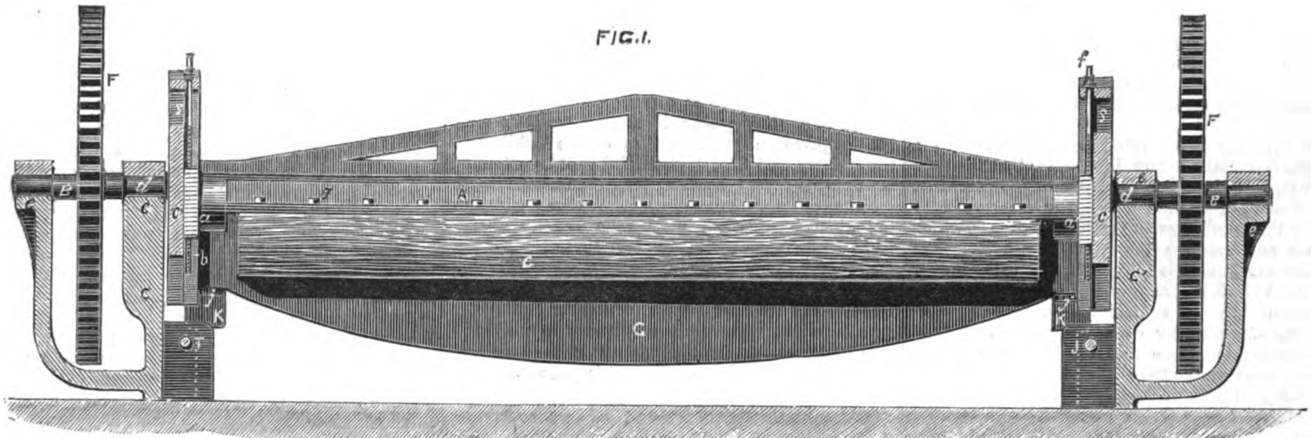


FIG. 2.

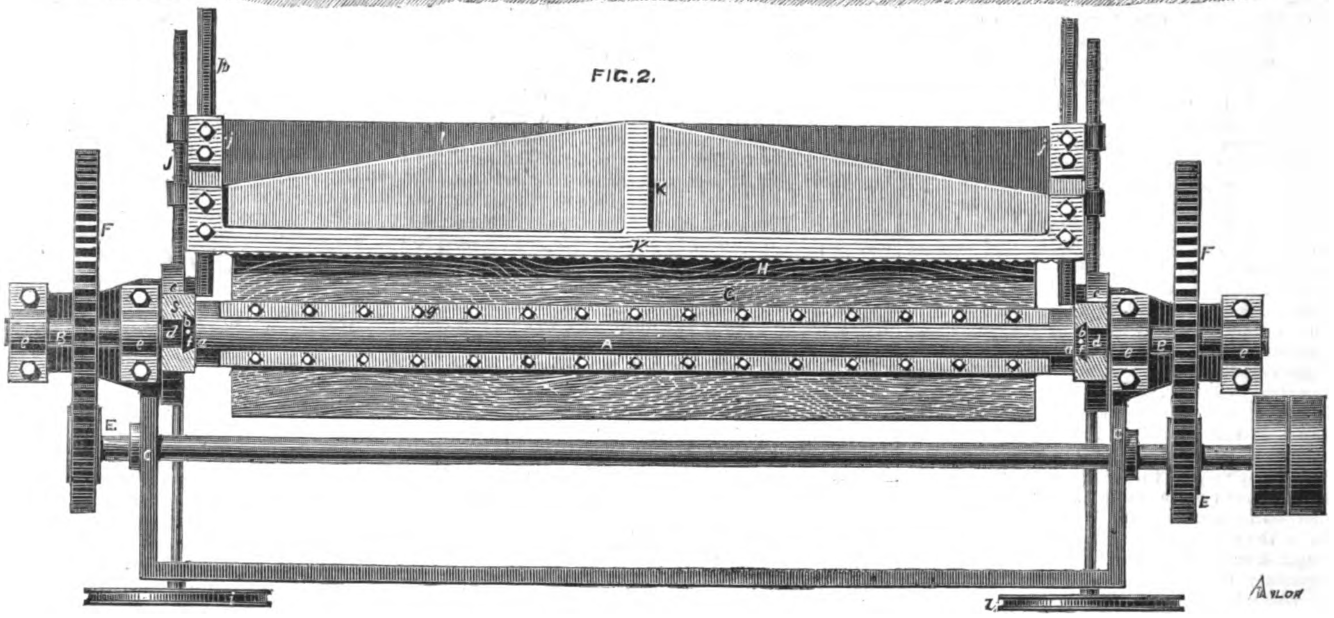
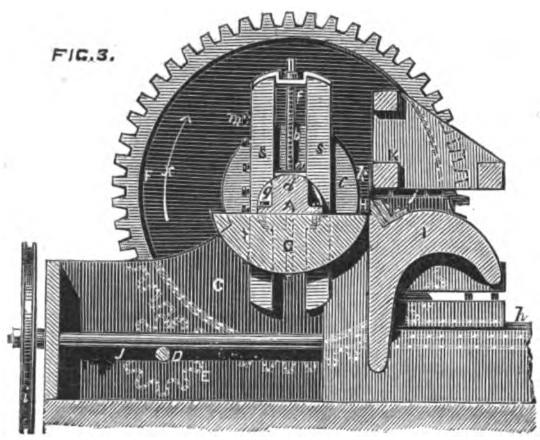


FIG. 3.



MACHINERY FOR CUTTING VENEERS.

A NOVEL construction of what is called the "stay log" of a veneer-cutting machine has been invented by Messrs. Lyman and Squires, of New York, and has been patented in England. The stay log, carrying a log, is made to revolve and present, as it rotates, the log to the action of a cutter so as to cut in curvatures corresponding to the rings of the tree. In the new construction the portion of the stay log to which the timber is bolted is rendered adjustable relatively to its journals, so that an eccentric adjustment may be given it to suit logs or log sections of different peripherical or perimetrical curvatures, and to adapt it to avoid cutting through defective portions of the log, which, in having a complete revolution given it, each cut affords ample time and opportunity to set or feed up the cutter without stopping or checking the motion of the machinery.

In the accompanying engraving fig. 1 represents a sectional longitudinal elevation of the machine, taken mainly through the centre of the revolving mechanism; fig. 2 is a plan, partly in section; and fig. 3 is a transverse section through the line *x x*, in fig. 1. The stay log represented is in its general features of the ordinary form and construction, excepting that the holding bar A is provided at its extremities with dovetail pieces *a a*, which are fitted to slide vertically within grooves *b b*, formed by ways *s s*, fast to flanges *c c* on the shoulders of journals *d d* of shafts B B, that rotate in bearings *e e* of the main frame C. These end pieces *a a* are secured within the grooves *b b* by means of set screws *f f*, locking or set screws *m m* serving to steady and hold the slides when adjusted. D is a shaft passing lengthwise of the machine, and to which the driving power is applied, and by which the same is imparted to the holding bar A by means of pinions E E, secured upon the ends of the shaft and gearing with cog wheels F F upon the shafts B B, that drive or rotate the holding bar A. By this application of power to both ends of the holding bar torsion of the latter is prevented.

In the operation of the machine the timber or log is first divided longitudinally into sections, and the flat surface of a section G of the divided log is secured by screw bolts *g g* to the flat surface of the holding bar A, substantially as in stay logs of ordinary construction. The veneer is cut as the log rotates in the direction of the arrow *x*, fig. 3, by the contact and passage of the log over a cutter H, carried by a stout metal frame I, which is adjustable horizontally on ways *h h* by means of screw shafts J J, turned by wheels or pulleys *i i*, to adjust the knife relatively to the log, and to give it feed for cutting a succession of veneers from the latter as it is rotated. K is a stout metal frame, seated and made vertically adjustable by means of screws *j j* on the knife frame or holder I, and carrying in front at its lower end a plate *k* for guiding the log to and steadying it during its cut. After the log has been secured to the holding bar A and the knife set or fed to effect a cut the section is adjusted relatively to the journals *d d* by the sliding of the end pieces *a a* inwardly or outwardly within the grooves *b b* to or from the axial centre of the journals, so that the outer or convex surface of the log may revolve at a uniform distance from the cutting edge.

By this radial adjustment of the holding bar to the journals *d d* the cuts may be made with grain or in conformity with the rings of the tree when working timber cut from trees of different size or girth, and consequently different curvatures on the side or surface exposed to the cut. By means of this adjustment of the holding bar any desired deviation from such lines of cut may be made to avoid defects or flaws in the wood. In thus adjusting the log section relatively to the journals *d d*, much timber is saved which otherwise would be lost. When the log section has been rotated past the knife to take off a veneer from its peripherical surface the revolving motion of the timber and its holding bar is continued in the same direction to cut a second veneer, and so on in succession, the interval which takes place between the succeeding rotations of the timber past the knife affording ample opportunity to feed up the knife when the log section is clear of the latter to give to the knife the proper set to effect a succeeding cut.

MACHINERY FOR STAMPING SHEET METAL.

BY MR. W. D. GRIMSHAW.

FIG. 2.

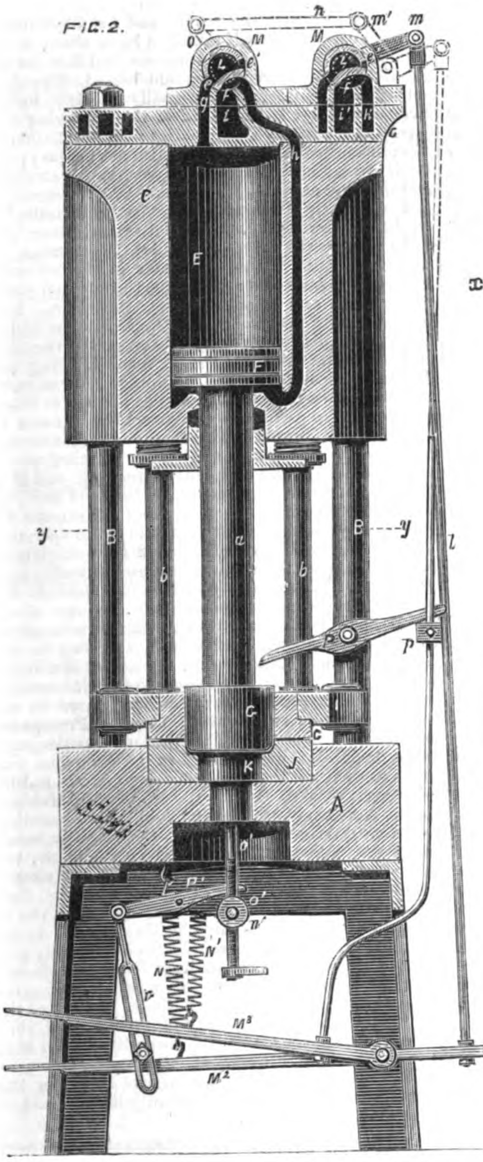


FIG. 1.

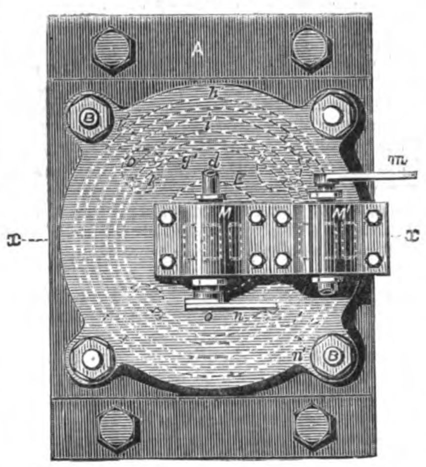


FIG. 4.

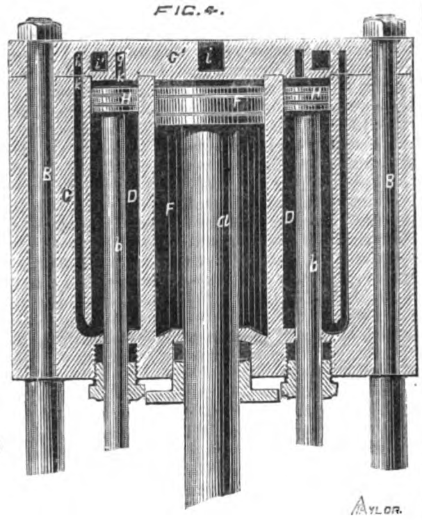
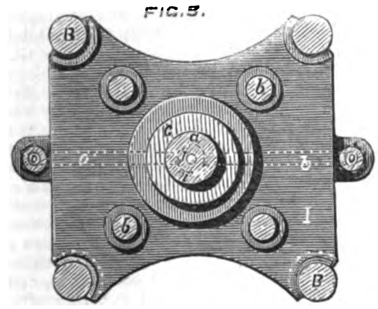


FIG. 3.



MACHINERY FOR STAMPING SHEET METAL.

THE object of the invention we herewith illustrate is the production of various kinds of sunken sheet metal work either heavy or light in a more perfect manner than has heretofore been done. The sheet metal plate is placed on and over the die, and a holding plate or block (carried by a series of pistons) is brought down to bear on the margin of the plate outside of and around the hollow of the die. The plate thus held is then subjected to the action of a stamp, operated by a main piston arranged to press the sheet metal plate into the hollow of the die. The pistons may be operated either by steam, air, or water, so that the whole apparatus forms what may be termed a steam, pneumatic, or hydraulic cylinder engine press. It will suffice here to describe the press as being worked by water under a head, and in this connection it is preferred to operate the pistons by water forced into a reservoir or reservoirs, having a compressed air space above the water therein for the purpose of giving an elastic action to the pistons. The invention is due to Mr. W. D. Grimshaw, of Newark, New Jersey, U.S., and two others, and has been patented in England.

In our engraving, fig. 1 is a plan of a machine constructed in accordance with these improvements; fig. 2 is a vertical central section taken in the line x x in fig. 1; fig. 3 is a sectional plan taken in the line y y in fig. 2, and fig. 4 is a vertical section in part through the line z z in fig. 1. A is a base block resting upon a suitable foundation, and B B are pillars serving to carry the upper castings C C ^{1}, in the lower one C of which are arranged a series of vertical cylinders D D, situated at an equal distance from each other. They surround a main cylinder E, which carries the stamp operating piston F, the rod a of which works through the lower end of the cylinder, and has the stamp G secured to it. The outside cylinders D have pistons H in them, the rods b of which project downwards, and are connected at their lower ends to a block I made up in part of a central bush c through which the stamp G works. This holding block I is guided as it is worked up or down by the pillars B B. In the centre of the base block A is a die J of the required form for the work.

The sheet metal plate to be worked into a sunken form is placed over the die J, and the pistons H are brought down so as to cause the holding block I or its bush c to bear on and hold the sheet metal plate around the hollow of the die J. The piston F then descends and carries down with it the stamp G, which pressing the sheet metal into the die gives the required form and finish to the work. After this and during the ascent of the stamp G and holding block I, a work clearer or raiser K has an upward stroke given it through the die to remove the work out of the latter.

The water to operate the pistons is drawn from a reservoir arranged to give the necessary head, and is introduced by pipes d d, and connected at their smaller ends to the interior of slightly tapering cylindrical valves L L ^{1} oscillating in chambers M M ^{1}. Each of these valves is constructed with side ports e e^1 and an exhaust passage f. The port e of the valve L serves to convey the water by a passage g to the upper portion of the cylinder E, while the port e^1 of the valve conducts the water by a passage h to the lower portion of the cylinder or beneath the piston F, accordingly as the port e or e^1 is brought in line with its respective passage g or h. The exhaust passage f of the valve L establishes communication alternately between the passages g h and an outlet or escape passage i. The ports e e^1 of the valve L ^{1} as the latter is oscillated similarly serve to conduct the water under pressure to passages g^1 h^1, while the exhaust passage f of the valve establishes communication alternately between the passages g^1 h^1, and an outlet or escape passage i^1, which is annular to serve as a general exhaust passage of the several cylinders D. The passages g^1 h^1 are also of similar character, and communicate respectively with the opposite ends of the cylinders D by openings and branches k and k^1.

To bring down the pistons and work the holding block I, the operator applies his foot to a treadle M ^{2}, which through a rod l and arm or lever m adjusts the valve L ^{1} so as to admit water to the passage g^1 to act upon the tops of the pistons H, at the same time opening the passage h^1, which connects with the bottoms of the cylinders D to the exhaust. This holds the sheet metal plate firmly down on the die J while the operator applies his other foot to a treadle M ^{3}, that through a rod l^1, bell crank m^1, rod n, and arm o operates the valve L to cause it to admit water by the passage g to the top of the cylinder E, and to open the cylinder from below by the passage h to the exhaust, which causes the piston F to descend and the stamp G (connected therewith) to press the metal plate into the die, and so form the work, as represented in fig. 2. The operator then releases his feet from pressure on the treadles, when springs N N ^{1} operate upon the latter to reverse the position of the valves L L ^{1}, so as to exhaust from above the upper faces of the pistons F and H and admit water under pressure to act upon their under sides, for the purpose of raising the holding block I and stamp G. Connected with the holding block I by side bars O and a cross rod O ^{1} and (made adjustable through a swell n^1 on the latter) is a screw rod o^1, which, as the holding block rises, serves to lift the work clearer or raiser K, that works through the die and removes the work from the latter.

To prevent waste of water by lift of the several pistons to an extent greater than is necessary for the clearance of the work from the press, and to give the pistons a variable lift (in an automatic manner) to suit work of different depths and thicknesses, the valve or treadle motions have connected with them adjustable devices, which serve to close the valves so soon as the stamp and holding block have reached their requisite elevations. Thus the stamp G when sufficiently raised is caused to act upon a trip lever P, which presses down upon a sleeve p (made adjustable on the rod l^1 to suit different lengths of stroke to the stamp) and thereby to work the valve L so as to close it, while the cross rod O ^{1} (in or by the ascent of the holding block I) similarly operates on a trip lever P ^{1} to depress the treadle M ^{2} to an extent sufficient to close the valve L ^{1}, the trip lever being connected in an adjustable manner by a slotted link r with treadle to provide for variation in the required lift of the holding block.

FLOATING TELEGRAPH STATIONS.

THERE is an instance how real merit will outlive unfavourable opinion in the scheme of floating telegraph stations. A few years ago a fierce paper war was waged on this subject, and the majority of sailors and engineers took the trouble to pronounce the scheme "impossible" and "mad." Gradually, however, one by one, some sailors and engineers, beginning perhaps both to understand the subject, came round, a few as advocates, more as well-wishers. But the public has never from the first suggestion to the last backed the hopes of the

various promoters of the scheme with substantial aid, and now we find it likely to obtain a fair trial only by the broad-minded spirit of a company already celebrated for its achievements in telegraphy.

The first scheme of a floating telegraph station which assumed a developed form was that of Captain Herbert, of the Trinity House. The ship suggested to be employed by him was a circular pontoon, to be moored from its centre of gravity, and in so far as experiments went, it gave promise of much that its inventor professed of it. It was proposed to anchor a row of light-ships on each side of the fairway of shipping, like the lamp-posts on each side of a street. Most, if not all the ships, were to have been connected by telegraph wires with the coast, and the whole would have formed, in our opinion, a most valuable, although obviously most expensive, aid to the navigation of the channels. A proposition of such ambitious pretensions was not likely to be looked upon with favour by the Trinity Board; partly because it was, in some sense, a mild reproach to that board for its own inefficient system of light-ships. Captain Herbert was an employé of that board, and such an implied reproach might have been under circumstances calculated perhaps to arouse personal prejudice rather than support. Anyhow, his scheme found no favour in that quarter, but his form of pontoon was adopted for some buoys which were placed, and gave, we believe, evidence of the correctness of the principles upon which they were constructed. The attempt made to carry out this light-ship scheme by means of a limited liability company also failed, although supported by the authority of such names as that of Mr. C. E. Varley as electrician, and Mr. E. A. Cowper as engineer.

The subject of floating light-ship stations was next taken up warmly by Mr. M. Beale, whose merit in the affair consisted in the collection of a great deal of valuable information. Mr. Beale succeeded in pushing the subject so far as to issue a prospectus of a company, with a proposed capital of £100,000, to establish telegraph light-ships off Scilly and Cape Race. The public, however, did not respond favourably, although asked in the names of a most respectable board of directors supported by the engineering authority of Mr. H. C. Forde and Mr. Jenkin. The details of the system were very carefully worked out, and a good suggestion was then, we believe, for the first time brought forward to institute a service of steam tenders to render assistance to derelict vessels and to sell stores. With the exception of Mr. Sabine's propositions to connect the Trinity House lightships with the coastguard stations by telegraph cables, and a few suggestions in the meantime from various other sources, all which came to nothing, the subject had dropped out of sight until, a short time ago, it was taken up by the Telegraph Construction and Maintenance Company. This company have, with a just appreciation of the important results which may arise from the systematic establishment of advanced telegraph stations of this nature, determined to anchor their steamship "Investigator" for a few months in the chops of the Channel, and to connect her by a telegraph cable with the shore. A small company with a capital of £150,000, of which £25,000 are called up, has been registered for carrying out this object, amongst the directors of which are Captain Sherard Osborn, the able chairman of the Construction Company, and Mr. Bevan, of the firm of Barclay and Bevan.

After the expiration of a few months the company will be in a position to judge whether the system advocated by so many authorities affords really the advantage and profit expected from it. If so, this first experiment will form the nucleus of considerable extensions; if not, the company will pick up their cable and send the "Investigator" again upon her old work of cable laying. In having thus taken the scheme in hand, the Construction Company have done what no other company is so well in a position to do, and will by this time next year either have definitely proved the soundness of the arguments brought forward in support of the scheme, or have silenced them for ever. Without some such timely aid this scheme would have slumbered on, for the public would never have subscribed capital enough to pay for the advertisements. This is amply proved by the fact that out of the £25,000 required for this experiment, the public proper, up to the day in which the share list was closed, had subscribed only £90; the shares having been taken up by capitalists whose interest had been enlisted in the scheme from previous knowledge or personal representation. The capital will be devoted thus—£1,200 to the general manager for "past expenses," his future expenses, the cost of steam tug and moorings, the hire of cable and light-ship, and the salaries and wages of the staff.—The "Engineer."

A great fire has occurred at Bordeaux from the ignition of a barge load of petroleum. Sixteen ships have been destroyed, but fortunately only one life is reported to have been lost.

EQUILIBRIUM STEAM FIRE ENGINE FOR HAMBURG.

In May last, the Fire Deputation of Hamburg issued notices for designs and tenders for a steam fire engine for service in that city. After a careful investigation of the various designs sent in by English and Continental manufacturers, that of Messrs. Shand, Mason, and Co. was selected. It has now been fully tested by the authorities in Hamburg, as will be seen by the following extract, translated from the "Hamburgeschen Correspondent" of September 24:—"The new fire engine manufactured by Shand, Mason, and Co., of London, for the Hamburg Fire Commissioners, was, for the first time, officially tried yesterday in presence of the members of the deputation. In the space of about seven minutes from lighting the fire, there was steam pressure sufficient to work the engine, but, in consequence of the prevailing strong wind, the height could not be ascertained. After this the engine was taken to a more sheltered place on the harbour where the trial was continued with the greatest success. The Fire Deputation expressed their entire satisfaction with the results obtained. At the Industrial Exhibition now being held at Altona, near Hamburg, Shand, Mason, and Co. were awarded the gold medal for the best and most efficient steam fire engine, that being the highest honour the jury had it in their power to bestow."

AMMONIA POWDER.

The following account of a new explosive material appears in the "Kolnische Zeitung," May 19, which gives the "Militar-Wochen-blatt" as its authority:—It is now some time since the proprietors of the Nora-Gyttorp Powder Mills obtained a patent in Sweden for the discovery of the so-called "ammonia powder," a substance which has hitherto been only employed in a few mining districts, but which otherwise seems wholly unknown. We are, therefore, fully justified in calling attention to the particular properties of this new explosive material. During the short time that it has been employed, it has won the approval not only of the proprietors of mines, but also of the working miners themselves. Its explosive force may be compared to that of nitro-glycerine, and, consequently, far surpasses that of dynamite. It cannot be exploded by a flame or by sparks, and the explosion is affected by a heavy blow from a hammer. Blast holes loaded with this powder are exploded by means of a powerful cap, or, better, by means of a cartridge containing common powder, for this forms a more reliable exploder. Miners who have been obliged to give up the use of nitro-glycerine, on account of the danger connected with this powerful explosive agent, have a most satisfactory substitute in the ammonia powder, as the danger of using it is so small that it surpasses in safety every other blasting material. One of the useful and important properties of this new powder is, that it does not require heating in cold weather, whilst nitro-glycerine and dynamite must first of all be warmed, and this has been the cause of many accidents. The price of the ammonia powder is the same as that of dynamite. The same paper further adds:—According to information we have received, ammonia powder was discovered by the chemist Norrbin. The German "Building News" contains extracts from a report of the Prussian architect Steenke, who makes the following remarks upon the safety of ammonia powder:—Experiments were made by fastening a lamp to a pendulum, which was caused to oscillate; gunpowder, gun-cotton, nitro-glycerine, and dynamite all took fire as the flame passed over them, but the ammonia powder did not begin to burn till it had been touched by the flame twenty times. In making experiments upon the force of the blow required to explode it, it was found that, with the apparatus employed, where the fall of a weight from 4ft. to 5ft. would explode gunpowder, nitro-glycerine only required 1¼ft. to 2ft., dynamite 2¼ft. to 8ft. fall, whilst a fall of from 12ft. to 15ft. was necessary to cause the explosion of the ammonia powder.

WHITWORTH SCHOLARSHIPS.—THE PRACTICAL EXAMINATION.

The examinations, on the results of which the first Whitworth Scholarships of £100 a year have just been awarded, deserve more than ordinary notice, as they are the first which have combined theoretical knowledge with the practical use of tools and skill in handicrafts. It will be remembered that when Mr. Whitworth offered to found a certain number of scholarships, by handing over £100,000 to trustees for that purpose, he desired that these scholarships should be awarded, in open competition, to young men, subjects of the United Kingdom, who showed the greatest amount of intelligence and proficiency in the theory and practice of mechanics and its cognate sciences. According to the regulations which were afterwards drawn up by Mr. Whitworth, it was settled that the competition should be decided by two examinations, one of which should test in a high degree the theoretical knowledge of the candidates, and the other their practical knowledge in mechanical handicrafts and the use of mechanical tools.

The endowment being vested in the Lord President of the Council, the carrying out of the founder's scheme rested with the Science and Art Department, Mr. Whitworth himself taking a large share in the arrangements required. It was decided that the two examinations referred to should be:—1. The theoretical examination, held annually in May, by the Science and Art Department, in the following subjects:—Elementary mathematics; higher mathematics; theoretical mechanics; applied mechanics; practical, plane, and solid geometry; machine construction and drawing; acoustics, light, and heat; magnetism and electricity; inorganic chemistry; metallurgy; freehand drawing. 2. A special examination, also to be held by the Science and Art Department, by which the skill of the candidates in the following tools was to be tested:—The axe, the saw and plane, the hammer and chisel, the file, the forge. And, further, their proficiency in the following under-mentioned handicrafts was to form part of the competition, viz.:—Smith's work, turning, filing and fitting, pattern-making and moulding. It was moreover laid down that none should be eligible to obtain a scholarship, under any circumstances, unless he should have passed satisfactorily in elementary mathematics, theoretical mechanics, practical, plane, and solid geometry, and freehand drawing, and in at least one of the before-mentioned classes of tools.

In order to assist in commencing his scheme for scholarships, which could only come into operation by degrees, Mr. Whitworth created sixty exhibitions or premiums, of the value of £25 each, tenable until April last. These were placed at the absolute disposal of the governing bodies of the various educational institutions and towns. Eight were given to Owen's College, Manchester, and two to the Grammar School, Manchester, the seat of Mr. Whitworth's workshops; three each to the Universities of Oxford, Cambridge, and London; three to the Society of Arts; two to the College of Preceptors, and one each to about thirty other universities, colleges, or public schools; and in addition one was given to each of the following towns, viz.:—Birmingham, Bristol, Swansea, and Cardiff, Halifax, Leeds, Northampton, and Sheffield, for presentation to the most deserving artisans. Each locality nominated the student it considered most eligible, the only conditions being that he should not exceed twenty-five years of age, and that all who were thus aided to qualify themselves were to undertake to compete for the scholarships in May, 1869. At the examination in May, 106 candidates accordingly presented themselves as competitors for these scholarships, including about fifty-five who held the exhibitions above referred to. Of these just over half, or fifty-four, failed to qualify in the essential subjects, and were consequently disqualified from further competition. Some of the successful ones showed great proficiency, the highest obtaining 122 marks, a standard which it is hardly likely could at any time be much excelled.

The details of the practical examination had next to be arranged, and, owing to the novelty and somewhat difficult nature of the scheme, it was not till September 15 that the work was completed, and the awards made known, which were published in the Mechanics' Magazine for September 17. The gentlemen appointed to the task of acting as examiners were Colonel Rich, R.E.; Mr. Marshall, secretary to the Mechanical Engineers; and Mr. Manby, hon. secretary to the Civil Engineers. As the latter gentleman was prevented from acting, his place was supplied by Mr. Hoyle, secretary to Mr. Whitworth. In order to economise the cost of the candidates' travelling as much as possible, it was found expedient to hold two examinations, one in London, and the other at Mr. Whitworth's works, in Manchester. By this arrangement, those who resided in the neighbourhood of London, and who did not wish to be examined in handicrafts, were not required to go to Manchester; and those who completely failed in the more elementary examinations were likewise saved the journey to that town, where alone there was convenient accommodation accessible for testing the various handicrafts.

For the purpose of holding the examination in the use of tools for the London candidates, Messrs. George Smith, Taylor, and Co., the Government contractors, lent their workshops at Pimlico, and these competitors, numbering twenty-one, commenced their work at 9 a.m. on August 30. Each candidate might take up one or more of the sets of tools, and two hours were allowed for each set; to those few who attempted all five sets eight hours were given to complete their work. The candidates from the neighbourhood of Manchester presented themselves on September 7, at the works of Messrs. Whitworth and Co.; they numbered twenty-five, so that altogether forty-six were in this part of the competition. The examination at both places was the same, and consisted of the programme which appears at page 138 of our present volume. As before mentioned, two hours were allowed for each

OVERHEATING OF FURNACE CROWNS AND BOILER PLATES.

BY MR. L. E. FLETCHER.

FIG. 3.

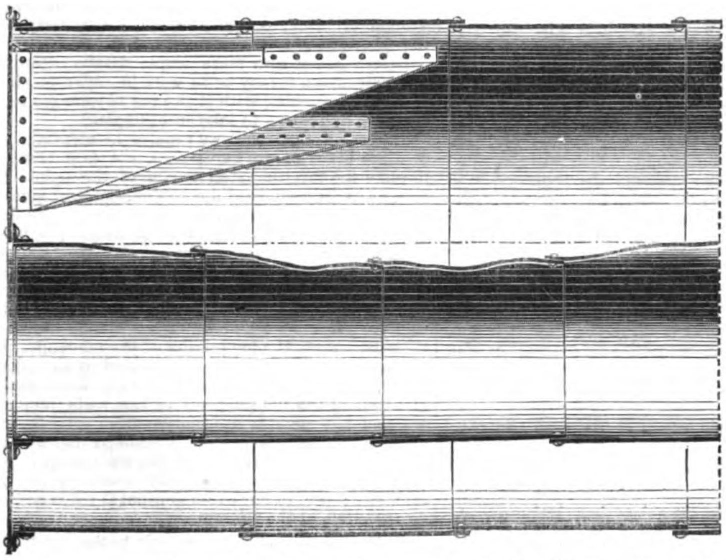
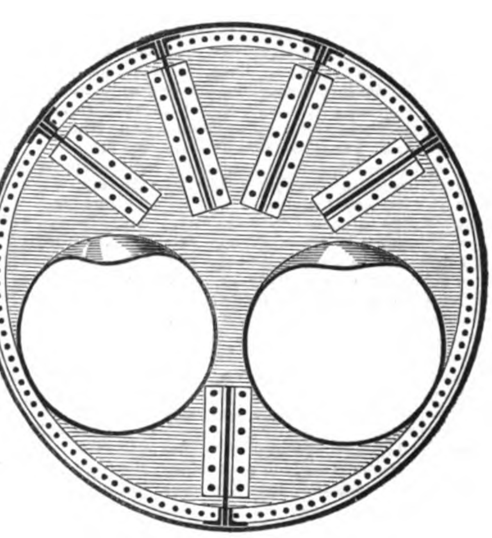


FIG. 4.



set of tools, though it was stated that, if the work were completed before that time, the time actually spent in the operation would be recorded, and taken into consideration in awarding credit. The proportion of the members who selected the different classes of tools will be seen from the following table, which appears in the "Society of Arts' Journal":—

	London.	Manchester.	Total.
The axe	9	10	19
The saw and plane	18	21	39
The hammer and chisel	19	20	39
The file	19	22	41
The forge	13	10	23
Total individuals examined	21	25	46

Such, then, was the examination in the use of tools, and it was open, to all who wished to gain additional marks in the competition, to be examined in one or more handicrafts. Those who put down their names for this examination had to present themselves at the workshops of Messrs. Whitworth and Co., on Thursday and Friday, September 8 and 9, and the nature of the tests applied to ascertain their proficiency and skill was as follows:—

Turning.—All taking up this handicraft were required to bore out a bevil-wheel to 1¼in. in the hole, using two drills and a finishing-bit, which were supplied. Also to turn up a piece of round iron supplied to them, to serve as a mandrel, to force on the wheel with the mandrel press, and turn it up on the back and face and tops of the teeth, and to scrape it up clean and smooth like the pattern.

Fitting.—All taking up this handicraft were required to key a boss upon the short shaft, cutting a key-way 7-16in. square, and letting the key half into the shaft, and half into the boss, to file up the key and fit it well in, and to let the end of the shaft project 1in. through the boss to support the head of the key.

Pattern-making.—All taking up this handicraft were required to make a pattern of a short piece of a girder, from a sketch and material given to them. The pattern was to be ready for the foundry, including the core-box for the two bolt holes in the flange of the girder.

Smith's-work.—No paper was set in this, as it was not required.

Four hours were allowed for each of these practical examination papers, and every candidate was allowed to attempt one or more, as he thought proper. Pattern-makers were required to bring the necessary tools with them, but other candidates had to work with the tools supplied to them, and were not allowed any others.

As regards the quality of the work performed at these examinations, and the amount of skill displayed, it is not possible to say anything at present, as no report has been published by the examiners of the Science and Art Department on the subject. It is, however, certain, from the lists of results issued to the candidates, that the practical examination very much altered the relative position which the candidates had attained in the theoretical. For instance, Mr. W. H. Greenwood, who stands first in the combined examination, was but eleventh in the theoretical portion; also Mr. Elgood has jumped from thirteenth to the fourth place, and Mr. J. N. Brittle from the thirty-eighth to the sixth, whereas those who stood fifth, sixth, eighth, and ninth in the theoretical, have failed to secure a scholarship at all.

In Mr. Whitworth's original scheme, he stated that he wished the number of marks obtainable in the theoretical subjects and those obtainable by the most skilled workman should be about equal; and also that he intended, by requiring a practical acquaintance with a few simple tools to be a *sine qua non*, to render the competition accessible on fairly equal terms to the student who combines some practice with his theory, and to the artisan who combines some theoretical knowledge with perfection of workmanship. Taking the experience of this year, there can be no doubt that any student wishing to compete on a future occasion would do well to pay particular attention to this practical branch of the work, which, it has been shown, will tell so decidedly in the competition; and also any artisan, having the same object, should study carefully the essential theoretical subjects which have thrown out so many. To encourage the attainment of high theoretical knowledge, combined with a practical and skilful acquaintance with the means employed in mechanics, was the chief object that Mr. Whitworth had in view when he established and so munificently endowed these scholarships, and, as a first trial, the result seems to be eminently successful, and cannot fail in a few years, when it becomes more widely known, and when the competition becomes more keen, to have a most important bearing on the mechanical industry and well-being of the country. It will, undoubtedly, in the words of the letter to Mr. Disraeli, in which Mr. Whitworth presented his endowment, "be the means of bringing science and than industry into closer relation with each other they are at present in this country."

OVERHEATING OF FURNACE CROWNS AND OTHER BOILER PLATES WHEN COVERED WITH WATER.

BY MR. L. E. FLETCHER.

THE fourth case of injury to furnace crowns through the use of a feed-water forming a fine floury deposit, came under my notice in August, 1867, and occurred in the neighbourhood of Lancaster to a range of three Lancashire boilers, measuring about 28ft. in length, 7ft. in the diameter of the shell, and 2ft. 7½in. in that of the furnace tubes, which were strengthened with T-iron hoops at each of the ring seams of rivets, while the blowing-off pressure was about 60lb. per square inch. In this case, though the feed water was drawn from a neighbouring stream, which was perfectly clear to the eye, these boilers were found to give repeated trouble at the furnace crowns, the plates bulging down, and the ring seams straining and leaking. The fault had erroneously been attributed to the construction of the boilers, in consequence of which the encircling hoops had been removed and the furnaces renewed with ordinary lap-riveted plates. This alteration was clearly in the wrong direction, and the plates soon bulged and the seams soon leaked again as badly as ever. The accompanying cuts, figs. 3 and 4, will show the nature of the distortion of the furnace crowns in this case.

At this juncture, I was requested to make an examination, and, on getting inside one of the boilers, found that it contained a considerable quantity of light floury deposit very similar to that met with on previous occasions, and already described, while, in addition, the feed-water was heated by the exhaust steam from the engines, and thus charged with grease. Though a surface blow-out apparatus was fixed to these boilers, it was quite neglected, the connection between the internal collecting trough and the scum tap being broken off, so that it was rendered useless, while the boilers altogether had been very carelessly looked after. These facts were faithfully reported to the manager of the works, coupled with the recommendation that the practice of heating the feed-water by the injection of the exhaust steam should be at once discontinued. But this view of the case by no means proved acceptable. The manager was resolved to have the boilers condemned, and not their treatment or that of the feed-water. The following analysis, however, of the feed water and sediment formed by it shows how similar they were in character to the previous cases referred to:—

SEDIMENT.

Carbonate of lime	84·210
Sulphate of lime	1·447
Carbonate of magnesia	8·991
Iron-peroxide, alumina	1·811
Silica sand	1·441
Moisture and volatile matter	7·100
	100·000

N.B.—The volatile matter seemed to be of an oleaginous nature and could not well be estimated.

WATER.

	Grains per gallon.
Carbonate of lime	11·228
Sulphate of lime	8·840
Carbonate of magnesia	2·224
Chloride of sodium	2·460
Silica	0·550

Total residue, 20·440
Hardness before boiling, 13·5de
" after " 4·5deg.

N.B.—The water was clear, slightly acid, and contained but a trace of iron.

Looking at the above analysis, there can be no question that the character of the feed water and the introduction of grease, coupled with the practice of allowing the sediment to accumulate in large quantities in the boilers, was the cause of the injury to the furnace crowns, as in the cases previously referred to, while it may be added in confirmation that, after examining these boilers, I was informed that one, if not more, of the fusible plugs had been blown out though covered with water at the time, which is a clear evidence that overheating had taken place. Trying, however, as the feed-water was in this instance, the injury to the furnace crowns would have been materially reduced, and probably avoided altogether, had the apparatus for blowing out from the surface of the water been kept in good order and regularly used.

It may also be stated that, at the time of my visit, I strongly urged that the boilers should be gently fired, since, under the circumstances, hard firing might bring the furnace crowns down in two hours. I had but just returned to Manchester when the manager wrote me that another of the boilers had failed at the furnace crowns, and the works, in consequence, were at a standstill. Hard firing is an important element in these cases of injury to furnace crowns with waters containing this fine floury deposit.

The fifth case which may be referred to occurred in Sunderland to a boiler of the patent double furnace conical water tube class, and my attention was called to it in January, 1868. This boiler had been found to fail repeatedly at the plates and seams of rivets in the furnaces, in consequence of which frequent repairs had been had recourse to, and, supposing that the injury to the boiler was due to expansion of the parts and to too much rigidity, a hoop of bridge rail or horseshoe section had been worked out of Low Moor iron, and introduced at one of the ring seams of rivets in each of the furnaces in order to give elasticity. This, however, proved of no avail, the furnaces again gave trouble and bulged inwards, when some strong stays, lashing the furnaces to the shell, were put in, somewhat as in the case of No. 2, and as illustrated in figs. 1 and 2.

At this juncture the owner of the boiler, who was a corresponding member of this Association, saw me with regard to it, and from his sketch of the shape in which the furnaces had given way, the case appeared very similar to those already mentioned, while it turned out on inquiry that the feed water contained a good deal of carbonate of lime, and that it was heated by the exhaust steam, and thus received the engine sewage. I laid the facts of the previous cases before the owner of the boiler, and on his return he had the feed water changed, when the bulging of the furnace crowns ceased, while it may be added, that he found on reference that the difficulty with the furnace crowns had commenced with the use of the feed water in question, so that this afforded a double proof of the cause of the injury.

The sixth case which may be mentioned, and to which my attention was first drawn about March, 1868, gave as much perplexity as any one of them. It occurred to an ordinary Lancashire boiler in the neighbourhood of Manchester, while the feed water, which was drawn from a well sunk on the premises, was heated by the exhaust steam from the engine. The boiler measured about 24ft. in length, 6ft. 9in. in the diameter of the shell, and 2ft. 3in. in the furnace tubes, while it was worked at a pressure of about 55lb. on the square inch. This boiler had been originally constructed for experimental purposes, in consequence of which some steam pipes from 10in. to 12in. in diameter, were carried through it from one end to the other, which thus served as longitudinal stays to the end plates. As these complicated the boiler, they were removed, and gusset stays substituted for them.

Shortly after this, the furnace crowns were observed to leak. Whether this had commenced before the removal of the pipe stays just referred to or not is difficult to ascertain; at all events the owner attributed the difficulty with the furnace crowns to the removal of these pipes and the introduction of gussets in their place. This, clearly, however, had nothing to do with it, though it was not very apparent what was the real cause. After repeated minor repairs, however, were found useless, the furnace tubes were taken out altogether, the front half of them entirely renewed and strengthened at two of the ring seams of rivets with T-iron hoops, while the front end plate of the boiler was also renewed. The manner in which the repairs were executed appeared on examination to be satisfactory, nevertheless, the boiler only worked on a few weeks before leakage again commenced. A consulting engineer was then called in, who gave it as his opinion that the fault was in the workmanship, and that the overlaps had not been well drawn up. The defective seams were therefore again repaired, the old rivets cut out, the holes rimered, and fresh rivets put in.

Just at the time that the boiler was re-started, a number of practical working boiler makers had a meeting, and discussed the cause of the continued and mysterious leakage that had occurred to this boiler. One of them strongly objected to the encircling hoops, and to these he attributed all the injury, stating that he had a similar boiler under his charge which was never out of trouble, but always leaking and needing repair, while he considered such a boiler was as good as an annuity to the boiler mender, and that the man who was charged to keep the one under consideration in order would never be in want of a job. At length the meeting unanimously resolved that encircling hoops prevented any expansion of the furnaces, and that it was against all the known laws of nature for boilers constructed in this way to keep tight, and further, that within three weeks, leakage would set in again, and the works would have to be stopped for further repairs. This decision was communicated to the owner of the boiler, and surely enough, within the appointed time the boiler commenced to leak once more. At this, the owner was quite disheartened, and regretted that he had not had the boiler entirely renewed rather than repaired.

In a long conversation with the owner at this juncture, it transpired incidentally that when his men first got into the boiler after letting off the water, they found some loose fine dusty deposit within it, when it at once occurred to me that this case might be similar to the others previously recorded in this report. This had not been suspected before, since the furnace crowns were not bulged out of shape, but merely strained at the seams of vets, while, in answer to inquiries, it had been stated that the deposit altogether was of a very inconsiderable and trivial character. I therefore explained to the owner my suspicions that all the trouble he had experienced was due to the feed water, and recommended him at all events to give the boiler a trial with the Manchester town's water, instead of that drawn from the well, a recommendation, it may be added, that had already been made, as a matter of precaution, but had not been thought worthy of adoption. Though he had no faith in the remedy proposed, it was so simple that he consented to try it. The boiler was at once washed out, and the next morning started to work with the town's water. From that day the trouble was over. The boiler worked on satisfactorily for several weeks, and after being slightly caulked so as to remove the effects of the old leakages, it was perfectly sound, and though the T-iron hoops, which were decided at the meeting of boiler makers to be "opposed to all the known laws of nature," had not been removed, the boiler has worked on to this day without giving further trouble, and promises to do so for the next seven years.

The following is an analysis of the sediment, from which it will be seen that carbonate of lime is the predominating ingredient, though it does not form so large a percentage as it did in the previous cases, which it is interesting to notice in connection with the fact that in this boiler the furnace plates were not bulged, but merely strained at the seams of rivets:—

Carbonate of lime		88·960
Copper		trace
Carbonate of lead		1·790
Sesqui-oxide of iron		5·005
Alumina		4·456
Sulphate of lime		4·490
Carbonate of magnesia		1·216
Magnesia		11·847
Phosphoric acid		trace.
Chlorine		trace.
Sand and silica acid		17·977
Fat	7·375	10·742
Other organic matter	3·367	
Moisture		2·219
		98·702

N.B.—The deficiency is partly due to the given percentage of carbonate of lead being too small, and to the traces of alkalies, copper, phosphoric acid, and chlorine.

When the boiler continued to work on satisfactorily week after week, and month after month, simply by exchanging the well water for the town's water, the owner could not entertain any further doubt on the subject, and on recollecting the changes made in his works from time to time, and remembering how the well had been deepened to increase the supply, he was able to trace a clear connection between the use of the well water and the leakage of the boiler. This shortly received a striking corroboration. In the course of the long drought that occurred in the summer of 1868, the supply of the Manchester Water Works, as all in this locality will remember, began to run short, especially for engine purposes, so that for one afternoon the owner was obliged to fall back on the well water, when, though he tried the experiment for a few hours only, the boiler at once commenced to leak as before, so that he gave up the well water once more, and resolved never to return to it again. This case, though not so severe as some of the others mentioned, is perhaps the most interesting, from the great perplexity which arose with regard to it, and the conclusive manner in which it was cleared up.

ECKHOLD'S OMNIMETER.

A NEW instrument, under this title, the invention of a German engineer, M. Eckhold, has been brought out to aid in surveying operations, such as measuring the bases of triangulation, measuring distances either inclined or horizontal, measuring altitudes, and measuring angles. The omnimeter is calculated to effect an important improvement, combining in one instrument the theodolite and the level; doing away with the necessity for tedious chain measurements, and requiring in its operation no complicated calculations.

The instrument consists of the following parts:—* First, of a graduated circle, to read off each ten seconds in the measurement of horizontal angles; second, of a powerful telescope, revolving in a plane perpendicular to the graduated circle; third, of a microscope of high power, connected with the telescope and moving with it; fourth, of a highly sensitive level lying upon it; fifth, of a rule, or plane, having a fixed length (of twenty centimetres for example); sixth, of a scale fixed vertically at the extremity of the said rule, at a distance coincident with the optical axis of the microscope, which scale is divided into half millimetres (the millimetres are indicated by the numbers between 1 and 100); seventh, of a micrometrical screw movement connected with the base of the scale and giving the 2-10,000th of a millimetre of the scale, legible on the graduated circle beneath; eighth, of a second extremely sensitive level capable of being applied to the telescope and of determining, in case of need, its horizontality; further, of all the necessary screws, keys, and other matters required to secure the efficient working of the instrument.

* This description was furnished by the inventor to the Society of Arts' Journal."

As the necessary complement of the omnimeter, there is a levelling staff, not divided, but of an invariable length (as, for example, three metres), which length is defined by two white lines on a ground of black, one at the upper extremity and the other at the lower extremity of the staff.

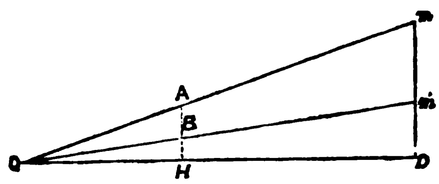
Before going into more ample details regarding the instrument, it may be as well, in order to show the way of working with it and the advantages to be obtained by its use, to take an example.

Supposing, then, that we require to ascertain the distance between any two points, the first thing is to place the levelling staff at one of the points (in this, as in all geodesical operations, the staff must of course be held in a true vertical position). We then take the omnimeter to the other point and set it up. By means of the level and its screw adjustment we place the instrument in a horizontal plane; then, directing the telescope upon the upper white line of the staff, we fix the telescope with the screw for that purpose; we read off on the scale, by means of the microscope, the inclination of the telescope. On account of the figures being magnified by the microscope, we shall be able to see only one number at a time of the 100 integrals of the scale; suppose we find the number 67 (millimetres) plus the unascertained fraction comprised between that number and the horizontal thread of the microscope. We ascertain the fraction exactly by means of the micrometer; say, in our example, that it reads as 2035 on the circle of the micrometer.

This we note down in our book to the right of the number 67 already obtained, thus	672035
We repeat this operation in every particular for the lower line of the staff, and we obtain, say	609400
The operation with the instrument is now complete, as we are in possession of the data required for calculating the distances; let us take the difference between these two quantities	62635

And divide 6000000—a constant number for all cases—by the difference we have thus obtained, and we shall have 95·79m. as the horizontal distance in question. In fact, suppose the levelling staff in position at mm', let O be the point round which the telescope revolves, AB representing the difference as found = 62635.

From the point O let us draw a horizontal line



let us produce the line AB to H, and the line mm' to D. We have then AB and mm' perpendicular to OD. In the similar triangles OAH and OmD we have the following proportions:—

$$\frac{\mathrm{OH}}{\mathrm{AB}} = \frac{\mathrm{OD}}{mm'}, \text{ then } \mathrm{OD} = \frac{\mathrm{OH} \times mm'}{\mathrm{AB}}$$

But

OH = 0·20m. (by the construction of the instrument).

mm' = 3·00m. (the invariable length of the staff).

AB = 62635 (the quantity obtained in our example by the scale).

The last quantity in fractions of the metre is 0·002635m.; if we substitute for the letters their respective values, we have—

$$\mathrm{OD} = \frac{0{\cdot}20\mathrm{m.} \times 3}{0{\cdot}0062635\mathrm{m.}} = \frac{0{\cdot}60\mathrm{m.}}{0{\cdot}0062635\mathrm{m.}} = \frac{6000000}{62635} = 95{\cdot}79\mathrm{m.}$$

In the preceding example we have supposed the staff to be placed at one point and the omnimeter at the other. This manner of operating is not, however, the only one; there are two others, one by placing the omnimeter in line with the two points, the other by fixing it at some point outside. In either case, a staff must be set up at each of the points. In the first instance the total distance is obtained directly by adding together the back and fore sights. In the second instance we obtain the distance by measuring the horizontal angle, which we read off on the great circle, and by calculating the triangle (trigonometrically) by means of the angle thus obtained and the two sides.

For the establishment of a base of triangulation, the latter mode is that which we should recommend for adoption; for, if we proceed thus by small distances from 10 to 20 metres on each side, or thereabouts, we may easily measure a base line of 1,000 metres within an approximation of 0·004m.; a result which is quite satisfactory. In fact, if for a distance of 10 metres, the scale gives us the differ-

ence 0·06m., it will give us for a distance equal to 9·99996m. the difference 0·0600002m., a quantity appreciable on the circle of the micrometer. The nature of this operation requiring extreme exactness, a staff of special construction should be employed. This staff would have the two faces similar to those already described; would be provided with supports to ensure its verticality, and, at its base, would be armed with a steel point and iron tressels. As regards the measurement of the slope or the inclined distance, the operation requires, further, the reading off of the horizontal line on the scale. We have then a new proportion:—

$$\frac{AB}{BH} = \frac{mm'}{m'D}, \text{ and } m'D = \frac{mm' \times BH}{AB}$$

Consequently,

$$Om' = \sqrt[2]{(m'D^2 + OD^2)}$$

General Observations.—The practice of the omnimeter has proved to us that in the measurement of lengths requiring extreme accuracy it is not prudent to make the points more than 200 metres apart. At that distance we are within an approximation of 0·04m.; at 500 metres, by making use of a staff 4 metres high, the approximation will be within 0·17m.; a sufficiently satisfactory result, as, by one forward and one back sight, we can determine a kilometre within 0·34m. With the chain we know, as a fact, that it is hardly possible to come nearer than within a mean of 1-700th of difference.

In levelling, the operation is identical with that we have described for the measurement of inclined distances. The quantity is given by the formula—

$$m'D = \frac{mm' \times BH}{AB}$$

that is, three (metres) multiplied by the difference of the sights, divided by the difference with the horizontal line.

The readings are obtained with the greatest precision. For distances not exceeding 100 metres, they are obtained within a fraction of a millimetre; and for greater distances (at which the instruments at present in use are inoperative) the measurement can be obtained within a millimetre. This degree of precision is attained, because:—

1. In placing the instrument, we have not to pay attention to centralising the optical axis.

2. Because the operator has always to point his telescope on the same lines of the staff, which lines denote an invariable length, viz., 3 metres.

3. Because there can be no hesitation in reading the staff as with the ordinary levelling staves, with which we have an element of guess-work not found here.

In difficult and hilly ground, levelling with the ordinary level becomes a very long and very expensive operation, because the sights are necessarily short, and because the number of them is multiplied in proportion to the rapidity of the incline. The omnimeter, as may be perceived at once from the nature of the instrument, allows of levelling points placed at great distances apart, and which make considerable angles with the horizon.

WEEKLY CHEMICAL MINERAL AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, September 30.)

Chemicals.—The chemical market during the past week has not displayed quite so much activity as in the two preceding weeks; prices, however, remain very firm and for the most part in favour of the sellers. Soda: soda ash, rather dull market, at £7 to £7 10s. for 48. Crystals inquired for at £4 5s. to £4 7s. 6d. Caustic moves off at 13s. to 13s. 6d. Nitrate of soda: being scarce is again rising and difficult to obtain under 16s. 6d. to 17s. Potash: muriates very firm, at £7 7s. 6d. to £7 10s. for 80. Saltpetre: very little doing, and prices remain the same—23s. for Bengal, and 27s. 6d. for English refined. Alum: an average business, at £7 to £7 5s. for export, and £6 5s. for home consumption. Ammonia: the demand for sulphate is still considerable, and £16 5s. to £16 10s. easily obtainable. 19 to 20 can be bought at £13. Copperas: green quoted at 52s. and 50s. for dry. Chloride of iron, 51s. per ton. Pyrites: a limited business, chiefly for Spanish, at previous quotations. Lime: sales of phosphate at 52s. for 65; bleaching powder in brisker demand at £8 10s. Disinfectants in good demand at £5 to £6 per ton for agricultural purposes.

Metals.—There is but a limited business doing in the metal market, and prices have barely maintained their previous values. An influential meeting of the North of England iron trade has taken place at Middlesborough during the past week, and the prospects of this branch of the trade were considered very encouraging. Iron: Scotch pigs are in slight demand, and the closing quotations are from 53s. to 53s. 1d. Cleveland firm, at 43s. for forge, to 48s. for No. 1. Welsh bars, £6 5s. to £6 7s. 6d; Staffordshire, £6 10s. to £7; gas tubes at 60 to 70 off list; boiler tubes, 40 to 45. Copper remains quiet, but an average business is being done, at £73 to £74 for tough ingot, and £68 to £69 for Chili slab. Tin: is rather weaker, and English is being offered under the official list. Straits £130 to £131; English £125 to £126. Lead: is in a little better demand at £19 to £19 5s. for soft English pig. Spelter: in moderate request, and English makers are all well sold forward, and look for better prices. English now selling at £20 15s. to £21; Silesian special brands, £20 5s. to £20 10s.; hard spelter for export, £16 5s. to £16 10s.

Correspondence.

SELF-RECORDING RAIN-GAUGES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

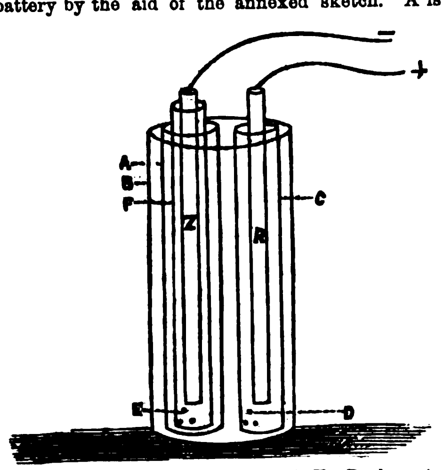
Sir,—I observe, in your last issue, a description of a rain-gauge by M. Rabache, who, in his remarks, refers to an apparatus for the same purpose by Mr. Beckley. M. Rabache finds fault with Mr. Beckley's apparatus, and as I am acquainted with the instrument to which exception is taken, I shall be glad if you will allow me to make a few remarks thereon. M. Rabache is not at all justified in putting forward his own invention (if invention it can be called) as an improvement upon Mr Beckley's. Of the latter he very justly says —"Great and minute precautions have been taken in the invention and construction of this instrument in order to render it as perfect as possible." He then goes on to urge five reasons for its imperfection, but, unfortunately, these same reasons, so far as they are sound and applicable to Beckley's, are equally so to his own instrument, which, moreover, has the additional serious defect of depending upon a reservoir of water (F in the figure). For this water, by evaporation, rapid in dry weather, will entail very erroneous indications on the register. This was, no doubt, what led Mr. Beckley to resort to mercury, very expensive, but still not appreciably affected by evaporation, so that it will not require adjustment for months. There are other particulars in which M. Rabache's instrument is much inferior to Mr. Beckley's which cannot be counterpoised by greater cheapness. I have no doubt myself that Beckley's is the best self-recording rain-gauge yet proposed, and I believe it will be adopted by the Meteorological Committee. I enclose my card.—I am, Sir, yours, &c.

September 29. A Meteorologist.

AN ECONOMICAL GALVANIC BATTERY

Sir,—In working a galvanic battery, as described in the Mechanics' Magazine, August 6, I found the copper solution within the copper cell soon became exhausted. A simple remedy is to place the zinc rod in the cell containing the platinized silver, and platinized silver in porous cell that held the zinc rod. By this arrangement the outside of copper cell receives a deposit, whilst the inside is electrically dissolved. In this new arrangement, a further improvement consists in dispensing with the porous cell holding the rod or plate of platinized silver, substituting for the latter a rod or plate of copper, which rod will receive, as well as the outside of copper cell, a deposit of copper.

I will now describe my last improved galvanic battery by the aid of the annexed sketch. A is



a porous cell containing a zinc cell F; B, the outer jar; C, a copper cell, containing a rod or plate of copper R; D, three small holes in the copper cell; E, three small holes in the zinc cell; F, a zinc cell, in which is a rod of zinc Z. The outside of the zinc cell F is coated with sealing-wax, varnish, or anything that will prevent it from being electrically dissolved. The zinc rod Z must not touch the zinc cell F; the rod of copper must not touch or be in metallic contact with the copper cell C. The porous cell contains a solution of sulphate of zinc or any other salt of zinc that will yield a reguline deposit of that metal on the inside of the zinc cell F. The outer jar holds a solution of sulphate of copper. The small holes D and E are coated with varnish to prevent them from being filled up with electro-deposit. This mode of working the zinc element is applicable to other arrangements of galvanic batteries. Other metals, when substituted for the zinc element, may be worked in the same manner. Persons familiar with electro-deposition need not be told that the deposit of zinc will vary in quality, according to the strength of the zinc solution and the relative sizes of the zinc rod and zinc cell.

I think this battery will prove to be the most economical of any yet invented. The solutions of zinc and copper will last a very long time when the various portions of the battery are nicely adjusted to each other, for each solution will be maintained at the degree of saturation commenced with if there was no loss of water by evaporation, &c.—I am, Sir, yours, &c., James Howard.

95, Cross-lane, Salford, September 24.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

G. Jones, Liverpool.—You have no remedy against any person using your invention unless it is protected either by Letters Patent or by Registration.

Received.—H. N.—E. C.—K. and G.—W. J.—F. B.—H. P.—R. S.—W. R.—B. S. and Co.—G. E. P.—J. H.—F. F.—T. P.—J. D.—P. F.—O. G. and Co.—H. W.—O. E.—T. H.—J. G. W.—J. N.—S. and Co.—J. L.—B. and Sons—S. M. and Co.—R. N.—G. B. W.—H. S.—J. B.—F. H. and Co.—E. W. M.—C. F. T.—J. H.—R. E.

Naval, Military, and Gunnery Items.

The screw steamer "Hotspur" has sailed from Lynn for the Tyne, where she will take on board a cargo of Armstrong guns, which are intended for the Greek Government.

Dr. Hall, the Arctic explorer, arrived at New Bedford on September 26, from Repulse Bay, after an absence of five years. He discovered the skeletons of several of Sir John Franklin's party at King William's Land, and he brings numerous relics of the Franklin expedition.

Messrs. Robertson and Co. have launched a twin screw for Messrs. M'Crindall, Schaw, and Co., of Glasgow, to be employed as a towing and coasting cargo vessel at Buenos. She is being fitted by Mr. D. Rowan with a pair of direct-acting twin screw engines, on the combined high and low pressure principle.

The Secretary of State for War has authorised the issue of small-arm ammunition boxes (holding 500 rounds each), for storage of service ammunition at Aldershott Camp, on the requisition of commanding officers of regiments to the Control Office. The requisitions are to show the actual quantity of service ammunition in charge, the number of boxes, if any, on charge, and the number required.

Navigation in France presents the following results:—Out-going ships, 3,400,000 tons, of which 1,936,000 were under the French flag in 1868, against 3,450,000 tons, of which 1,538,000 were under the French flag in 1867, being a diminution of 50,000 tons outward, but with an augmentation of 57,000 tons in the case of French vessels. The foreign mercantile navies, therefore, support a loss of 107,000 tons.

The Royal Engineers' camp at Wouldham, a few miles up the river Medway from Chatham, where, during the summer months, detachments of Engineers proceed in succession from the School of Military Engineering at Brompton Barracks to go through a course of instruction in pontooning—the pontoon hard being at Cuxton, nearly opposite Wouldham—has now been broken up for the season, and a large portion of the apparatus has been conveyed from Cuxton to Brompton, to be stored there for the winter.

The demands of the Australian and Indian trades have become so extensive, and the forthcoming opening of the Suez Canal being likely to do away with the use of sailing vessels to a very considerable extent, some of the enterprising shipowners of Liverpool are combining together to substitute steam for sailing vessels. Already we hear of the formation of a large company, which has given an order for a steamer of 440ft. in length, and of light draft. Shipowners are quite alive to the changes which the successful navigation of the Suez Canal will bring about, and are building steamers suitable for the traffic by that route.

During 1868, the number of arrivals from Italian ports were 521, of a total tonnage of 48,786; the number of vessels that sailed from the port of Venice for Italian ports were 687, of 52,704 tons. The number of arrivals from foreign ports were 2,578, of 308,721 tons, and the departures 2,392, of 298,581 tons; making a total of 3,099, of 357,507 tons arrived, and 3,079, of 351,285 tons sailed. In 1866, the total number of arrivals were 2,886, of 258,435 tons, and departures 2,813, of 253,883 tons. The difference in favour of 1868 is therefore, 213, of 99,072 tons, arrivals, and 266, of 97,402 tons, departures.

The wood shipbuilding in Sunderland, says the "Newcastle Journal," was never in so stagnant a condition as at the present moment. Of 58 yards, 22 are empty and to let; 9 are occupied but have no new ships building; 7 have new ships finished, for sale, ready for market, and with the men paid off, and only 20 are in work, having ships finished or in progress, and in these there are 12 ships ready for sale, but no market for them. Seventeen wood shipbuilding yards have been converted into 10 iron or composite yards. The reason is attributed to the maintenance of the union hours and wages, which make building much dearer there than in other ports.

That time works wonders was never more apparently manifest than in the rapid strides and great improvements we have made during the last few years in ship architecture. It was but the other day when the English emigrant looked with pain into the narrow, ill-ventilated berth in which he was to be incarcerated for some three or four months in a voyage to our antipodes; but since the discovery of the precious metal in Australia our shipbuilders and owners have not been backward in their efforts to make the voyage as pleasurable as possible. The new ship "Collingrove," built by Laing, Sunderland, for the Adelaide trade, is a model of what a passenger ship should be.

An interesting ceremony took place on the Clyde on Wednesday week. By the exertions of a number of local gentlemen, the use of the war vessel "Cumberland" has been obtained from the Admiralty as an industrial training ship for the destitute and houseless boys of Glasgow and the west coast; and on Wednesday the ceremony of inaugurating the vessel took place. A large number of the subscribers to the fund for upholding the "Cumberland" were conveyed on board the vessel, which has been moored in Row Bay, nearly opposite Greenock; and after lunch had been partaken of, under the presidency of the Earl of Glasgow, speeches were made in explanation of the objects of the movement for establishing industrial training ships.

Miscellanea.

A white bear in the Zoological Garden of Florence, which had for a long time past been suffering from the itch, was destroyed three days back by a dose of 40grammes of sulphate of strychnine.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending September 25, was 6,082. Total number since the opening of the Museum, free daily (May 12, 1858) 1,647,875.

The directors of the Tower Subway Company have notified that having carried their subway from the Middlesex side of the river to beyond high water mark on the Southwark side, they are prepared to receive proposals for loans upon that security.

The exports of sulphur from Sicily during the first seven months of 1868 were 142,583,914 quintals, as compared with 141,933,398 quintals during a corresponding period of the previous year. This shows an increase of 650,516 quintals in favour of the seven first months of 1868.

The number of visitors to the South Kensington Museum during the week ending September 25, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 17,029; Meyrick and other galleries, 2,681; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1,858; Meyrick and other galleries, 131; total, 21,694. Average of corresponding week in former years, 12,409. Total from opening of Museum, 8,829,761.

We are informed that baronetcies have been offered by Mr. Gladstone to Mr. Whitworth and Mr. W. Fairbairn, and that those gentlemen have accepted the honour. Our readers will rejoice with us at this recognition on the part of the Crown of the wonders achieved by these gentlemen, whom we congratulate upon the circumstance.

Mr. John Robert Seeley, Fellow of Christ's College, Cambridge, and Professor of Latin in University College, London, has been appointed to the chair of Modern History at Cambridge, vacant by the resignation of Canon Kingsley. Mr. Seeley graduated in 1857, when he was Senior Chancellor's Medallist, and bracketed senior classic with three others.

Mr. Robert Hunt estimates the annual production of the slate quarries at Delabole, near Camelford, at about 17,050 tons a year, which, at say £2 10s. a ton, would realise over £42,000 annually. The Devonshire slate quarries he estimates to produce 15,000 tons a year, value say £37,000 a year. Most of the Cornish slab is shipped either at Boscastle or Port Gavern, in Endellion.

A table which has been prepared in illustration of the production of rails in France during the last ten years presents the annexed results:—1859, 101,426 tons; 1860, 121,438 tons; 1861, 164,371; 1862, 216,175 tons; 1863, 226,948 tons; 1864, 215,983 tons; 1865, 184,131 tons; 1866, 159,061 tons; 1867, 154,351 tons; and 1868, 202,204 tons. The average price per ton in 1859 was £10 2s. per ton, while in 1868 it had fallen to £7 2s. per ton.

A considerable portion of the ruins of Kenilworth Castle having shown signs of falling, Earl Clarendon, the owner, is now repairing and strengthening the great hall, Leicester's buildings, and parts of the external walls on either side. His lordship is also restoring some of the doorways, windows, and fireplaces. In the course of the repairs excavations have been made, and underground apartments, cells, and passages revealed which had been hid for centuries.

It is asserted that one hour after the gas of London is lighted the air is deoxidised as much as if 500,000 people had been added to its population. During the combustion of oil, tallow, gas, &c., water is produced as well as carbonic acid; in cold weather we see it condensed on the windows. By the burning of gas twenty-four hours in London, more water, it is estimated, is produced than would supply an emigrant ship on her voyage from England to Australia.

Between 1852 and 1868, the Ponts Napoleon, Solferino, de l'Alma, and the Pont du Point du Jour have been built in Paris. The Ponts de Bercy, d'Austerlitz, Louis Philippe, d'Arcole, Saint Louis et Notre Dame, the Pont aux Doubles, the Petit Pont, the Pont au Change, the Pont Saint Michel, and the Pont des Invalides. The Pont Neuf has been completely restored, and the right of toll of the Pont de Grenelle has been purchased by the town.

The winter session of the South London Working Men's College, 91, Blackfriars-road, will begin to-morrow, Saturday, October 2, when a new French class will open. Among the other new classes are one in practical chemistry, under Mr. W. Rossiter, F.C.S., &c.; one in political economy, under Dr. Bithell, B.Sec.; and one in mechanics, under Mr. C. T. Mitchell, M.A. The college has also night schools for men and women and a day school of a high character under the direction of Mr. Rossiter, the honorary secretary of the college.

The following is a Turkish recipe for a cement used to fasten diamonds and other precious stones to metallic surfaces, and which is said to be capable of strongly uniting surfaces of polished steel, even when exposed to moisture. It is as follows:—Dissolve five or six bits of gum mastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In another vessel, dissolve in brandy as much isinglass, previously softened in water, as will make a 2oz. phial of strong glue, adding two small bits of gum ammoniac, which must be rubbed until dissolved. Then mix the whole with heat. Keep in a phial closely stopped. When it is to be used, set the phial in boiling water.

The "Locomotive" calls the attention of steam users to the necessity of exercising greater care in the raising of safety valves. It says, it is the practice of many to lift the valve suddenly, and then let it fall, the spindle thereby receiving a violent blow; and in numerous cases we find the spindle sprung to such an extent by this practice that the valve can lift but very little, in some instances not at all. The valve should be raised carefully and let down gently; not only for the reasons above stated, but from the fact that nothing is more dangerous than the sudden shock caused by the valve being suddenly opened and shut. Valves should be frequently raised to prevent their becoming stuck, but too much care cannot be used in the operation. During the month, several cases of this evil have come to our knowledge, in one of which it was necessary to cut the spindle out after the cap had been taken off.

The "Journal Officiel" says that a chemist has discovered a method of illuminating letters whereby the names of streets, numbers of houses, and inscriptions become more distinct as darkness increases. The process is described as very simple, and consists in the application of a particular kind of liquid to the letters.

The "Minnesotian" has an account of Mr. Eames's discovery on the north shore of Lake Superior, at the foot of the Saw-tooth Mountains, of grey copper ore, a metal never before discovered in any considerable vein in that country, most valuable as an alloy for gold and silver manufactures, and in this instance singularly pure, without admixture with arsenic, iron, or zinc. The only impurity, so to speak, is silver, of which there is an amount equal in value to 16 dollars or 18 dollars per ton of ore. The vein varies from ½in. to nearly 4in. in thickness of ore. The ore yields 75 per cent. of pure metal, and its value in Europe is about 400, dollars per ton.

A report of the French Minister of Agriculture proposes the distribution of recompenses to a number of members of the Statistical Commission, established in the cantons of France in 1852, for furnishing the Government with regular local information relative to the crops, manufactures, rate of wages, and other questions concerning rural and industrial economy. His Majesty's signature approving of the suggestion is appended to the document, which is followed by a list of 1,182 persons to be so honoured. The awards consist of four medals of gold, awarded to persons proposed for the Cross of the Legion of Honour, 24 of silver, 669 of bronze of three classes, and 485 mentions very honourable or honourable.

The following statistics of the flour mills in Italy are taken from returns made to the Minister of Finance relative to the grinding tax just introduced in Italy. The total number of mills throughout the kingdom is 69,421, of which 38,000 are exclusively employed for grinding for the proprietors. Of the total number only 20,886 are continually at work. The number of pairs of mill-stones is 94,807, of which 55,986 are driven by water, 716 by steam or by wind, and 38,105 by cattle. The quantity ground amounts yearly to:—Corn, 20,619,646, quintals; maize and rye, 15,831,902 quintals; oats 109,387 quintals; other cereals, dried vegetables, and chestnuts, 1,736,818 quintals; total 38,297,752 quintals.

A few days ago, as two quarrymen, named John and Richard Stone, were working in the Kitcraft Quarry, on the Portland Heights, they had occasion to remove some stone from the "base-bed," and at 56ft. below the surface they came upon a fissure in the rock. On exploring it about 100 yards they found an opening on each side of 30 yards. Proceeding 400 yards farther, there was an opening to the upper surface, through which the light is admitted. The cavern then extends at least 100 yards further, and is altogether 600 yards in length. From the roof depend beautiful stalactites, many of them 2ft. and 3ft. long, and of different tints, some amber and others cream colour. Some curious petrifications have also been found of very fantastic shapes.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—655, 668, 686, 693
Buildings and Building Materials—700, 704, 710, 716, 723, 736
Chemistry and Photography—720, 722, 732
Cultivation of the Soil, including agricultural implements and machines—658, 691
Electrical Apparatus—733
Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—645, 660, 675, 678, 683, 692, 696, 703, 714, 734, 735
Food and Beverages, including the apparatus for preparing food for men and animals—665, 715
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments. &c.—657, 667, 672, 673, 677, 680, 681, 685, 695, 702, 705, 706
General Machinery—656, 659, 674, 676, 679, 682, 687, 690, 707, 709, 718
Lighting, Heating, and Ventilating—661, 711, 712, 728, 730
Metals, including apparatus for their manufacture—699, 724
Miscellaneous—421, 635, 662, 664, 666, 669, 688, 693, 697, 698, 719, 727, 731
Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—663, 671, 701, 708, 717, 721, 725
Ships and Boats, including their fittings—670, 684
Steam Engines—729
Warfare—622

421 J. GREENFIELD, Down-villa, New Wandsworth, S. *Hop-scotch cloths.*
The object is to provide means in a portable manner or otherwise in the form of boards, cloths, inlaying, &c., for the purpose of playing indoor or outdoor hop-scotch or scotch-hoppers, and the invention consists in nothing.—Patent abandoned.

622 W. E. GEDGE, Strand. *Breechloaders and cartridges.* (A communication.)
The loading by the breech is effected by the aid of a main piece, termed the movable chamber. In use, this piece serves in the first place to close at the actual moment of firing the opening of the loading chamber, which is made towards the breech, while it has also for object in the contrary position to facilitate the introduction of the cartridge. It also serves, according to the position given to the lever, to determine or annul the action of the trigger. Finally, it fires the charge by the action of the striker on the cap of the cartridge.—Patent completed.

635 F. N. GISBORNE and H. ALLMAN, West Strand, W.C. *Metal tubes.* Dated March 2, 1869.
The inventors employ strips of metal coiled spirally around, so as to form a spiral tap joint. These joints or laps they either rivet, weld, solder, or braze, or they may be fastened by the process known as galvanising or tinning. By forming tubes as described, the inventors obtain a maximum amount of strength with a minimum weight of material.—Patent completed.

645 R. LAW and S. HARGREAVES, Burnley. *Warping.* Dated March 3, 1869.
This consists in warping with the heck open, that is, with the half of the "eyes" up and the others down (except when the lease is being taken), and in bringing the two sets of threads together or within about ½in. of each other at the half beer or dividing rollers by a rod plate or other suitable mechanism, arranged so as to be easily turned up or down or otherwise moved as required when taking the lease.—Patent completed.

655 W. H. TOOTH, Sen. and Jun., Greenwich. *Furnaces.* Dated March 4, 1869.
This consists in a new form and construction of the grate, or rather of the bars and bearers forming the grate, by which a peculiar and continuous motion may be given to them during the combustion of the fuel, and also in certain arrangements connected with the supply of fuel to the grate, which, while regulating the supply, also makes it self acting. The bearers or transverse bars upon which the longitudinal furnace bars rest are each formed so as to represent a series of double crank, that is to say, each bar is formed with a number of crank ends or arms on alternate sides, the number being proportioned to the number of furnace bars. A longitudinal bar having a notch or recess at each end rests with its notches upon each crank arm, so that when motion is given to the cranked transverse bearers a continuous reciprocating motion is transmitted to each of the longitudinal furnace bars.—Patent abandoned.

656 E. T. HUGHES, Chancery-lane. *Casting chains.* (A communication.) Dated March 4, 1869.
This consists in the construction of a flask divided longitudinally in quarters, and arranged so as to receive a mould board between each two of the four quarters, that is to say, so that the mould board will divide the flask both vertically and horizontally, and one half of the pattern be formed upon opposite sides of each part of the mould board, so that the links will be moulded one within the other, and when all are moulded the mould board is removed, the four parts or quarters of the flask set and locked together, and a succession of link moulds are formed in the centre into which the metal is poured to form the chain.—Patent abandoned.

657 M. G. COLE, Bexley Heath. *Watches.* Dated March 4, 1869.
This consists in placing the banking pins at the tail of the lever, and in so forming this tail as to act as a spring instead of making it rigid as heretofore, such spring being sufficiently stiff, when coming in contact with the banking pins, to limit the ordinary motion of the lever to the required extent, while it is sufficiently elastic to allow the lever to yield to the second blow of the ruby pin, and to assume its correct position after the ruby pin has passed it. In place of making the tail of the lever act as a spring, the inventor sometimes fits a spring on to the pallet staff in addition to the ordinary lever, so that the spring will act on the banking pins and yield to the second blow of the ruby pin as in the other case.—Patent completed.

658 T. HOWCROFT and A. M'GREGOR, Bedford Leigh. *Reaping.* Dated March 4, 1869.
This consists in an improved arrangement of the framework and gearing, whereby a more perfect and complete combined machine is produced, affording various great facilities for the more easy and perfect conversion of a distinct and complete mowing machine into a distinct and complete reaping machine. The invention also consists in the application of a self-acting side delivery apparatus to a two-wheeled mowing machine. The inventors prefer adopting a different arrangement of the framework and gearing, in order to admit of the better attachment of the self-delivery apparatus, and keeping the finger bar in the same relative position to the self-delivery rakes. The arrangement consists principally in giving motion to the main axle, through the two driving wheels, by means of ratchet wheels and pawls as in the combined reaping and mowing machine.—Patent completed.

659 S. MARSDEN, Manchester. *Bolts and rivets.* Dated March 4, 1869.
This consists in an arrangement whereby the pressure of the ram is enabled to be suspended or repeated at pleasure without detaching the motive power from the machine. To effect this it is proposed to connect the driving shaft to the carriage of the ram by a part which may be removed at pleasure.—Patent completed.

660 T. GREENWOOD, Leeds. *Screw gill roving frames* Dated March 4, 1869.
Instead of effecting the necessary changes of speeds as heretofore by changing the driving pulleys or the driving drum, the inventor proposes to provide a set of change wheels for varying both the speed of revolution and the transmitted speeds of the ordinary driving shaft without changing the speed of the driving pulleys.—Patent completed.

661 J. B. SPENCE, Manchester. *Purification of gas.* Dated March 4, 1869.
This consists in manufacturing muriate of iron from certain substances, whereby the said muriate is produced economically and in a suitable condition for the purification of gas. The inventor takes slag derived from the puddling furnace in the manufacture of iron or from the smelting of copper, and which are in a proto state, and grinds them by any ordinary means. He then treats with muriatic acid in a suitable vessel, using sufficient to take up the iron contained in them, and he thus obtains muriate of iron suitable for being transferred to the gas purifiers in its crude state, or it may be previously crystallized.—Patent completed.

662 T. FORSTER, Streatham, and R. TAYLOR, Kennington, S. *Printing rollers.* Dated March 4, 1869.
This consists in covering the stocks of printing rollers with vulcanized india-rubber and subsequently coating the exterior surface of the vulcanized india-rubber with gelatine or glue combined with treacle or with other analogous composition. It is preferred that the coating of vulcanized india-rubber should be in the form of what is termed sponge.—Patent completed.

663 W. MACRAE, Johnstone, Renfrewshire. *Velocipedes.* Dated March 4, 1869.
The bushes which carry the spindles of the wheels are made of brass, gun metal, or other suitable metallic substance, and a piece projects upwards from them, to which the forked part of the framing is attached by bolts, a recess being, by preference, formed in the piece projecting from the bush, and into which the end of the fork fits. The two forked bars are connected together by a bar extending from the lower end of the fork, which contains the small wheel, to the upper part of the fork, to which the larger wheel is attached. The bar is bent to the requisite form, and its lower end is also forked. The upper part of the fork of the larger wheel passes through a bush, and is mounted by a hand lever frame for guiding the velocipede.—Patent abandoned.

664 J. H. JOHNSON, Lincoln's Inn-fields. *Dyeing and printing.* (A communication.) Dated March 4, 1869.
The process consists in employing an acid bath, in which the dyed fabric is immersed, either immediately after undergoing oxidation or after the employment of an alkaline bath, the degree of concentration or strength of the acid being regulated according to the fabric under operation, and the result it is desired to obtain.—Patent abandoned.

665 W. BETTS, Wharf-road, City-road. *Marks on capsules.* Dated March 4, 1869.
This consists in the application of designs produced by what is known as the meta-chromotype process or analogous processes to the surfaces of capsules for the purpose of ornamenting the same, or for producing multi-coloured trade marks thereon. The meta-chromotype is moistened and applied to the capsule with gentle pressure, either before or after it is put on the bottle, and on removing the paper containing the design the latter will be found adhering firmly to the capsule.—Patent completed.

666 J. GOUGH, Kirby-street, E.C. *Cylinders and distributing colour.* Dated March 4, 1869.
The main feature of this invention is the construction and employment of a cylinder or cylinders in combination with a composition or other roller or rollers, whereby a uniform distribution of colour, ink, or fluid is maintained, and in the construction of the machinery or apparatus in which the cylinder is mounted. The cylinder is formed of fillets or ribs and V-shaped rings or spiral thread; it is covered with wire gauze, and distributes colour or ink placed inside on to a composition roller used in printing, with which it is used in combination. The ink is drawn through the wire gauze by the rollers in their rotation. If the cylinder is used separately it is coated with a saturable material.—Patent completed.

667 C. TIGHE, Poultry, E.C. *Studs.* Dated March 5, 1869.
The inventor forms on or fixes to the shank of the stud or button a metal plate having a number of points or projections arranged around the edge thereof, and in order to attach it to a glove or other article or garment he, by a convenient tool, makes suitable cuts or slits in the glove or other article or garment, through which slits or cuts the head of the stud or button and the points or projections, which have been previously turned up at right angles, are passed; then, by a suitable tool, the points or projections are turned over flat on to the material to which the stud or button is to be fixed, a piece of leather or other suitable material being fixed over the back of the plate carrying the points or projections.—Patent completed.

668 C. D. ABEL, Southampton-buildings. *Injectors.* (A communication.) Dated March 5, 1869.
The steam cone is provided with a regulating spindle by screwing which to a greater or less extent into the cone the supply of steam is regulated. The cold water is introduced through a branch pipe behind the combining cone while the hot water is introduced through a side aperture in a casing or chamber surrounding the combining and receiving cones. The combining cone is secured by a flange at the end thereof, being held between a shoulder on the casting containing the steam and water passages (in which casting the steam cone is screwed) and the one end of the before-mentioned casing which is screwed into such casting.—Patent abandoned.

669 F. WINDHAUSEN, Brunswick, Germany. *Ice making.* Dated March 5, 1869.
The inventor employs a single double-acting cylinder or two distinct cylinders, the double-acting cylinder being capable of compressing the air on one side of the piston and of expanding it on the other, whilst when the two cylinders are employed one is used for compressing the air and the other for expanding it afterwards. The air is first admitted into the compressing chamber and thence passes into a condenser, which forms a material part of this invention and consists by preference of a rectangular chamber divided into two portions or divisions having a parallel series of pipes in each division, the nearest series of such pipes to the compressing chamber through which the air first passes being surrounded by cold water, which is constantly running through it in an opposite direction to the current of air so as to cool the air passing through such pipes, the second series of such pipes through which the air next passes being surrounded by cold water.

670 W. E. GEDGE, Strand. *Iron ship preservers.* (A communication.) Dated March 5, 1869.
This consists in transforming the ship into a vast electric battery, nearly similar to a trough battery, which is effected as follows:—First, on the inner sides of a ship are established zinc reservoirs, either in the form of cases, the position of which will be regulated by the interior arrangement of the vessel, or in the form of a tube, making a complete or incomplete circuit round the ship. Second, these reservoirs, which may vary in form, are constructed exclusively of zinc, leaving a small section, which can be filled up either by the inner side of the ship, if it is of iron, or by a sheet or band of the same metallic nature as the sheathing to be preserved if the vessel be sheathed. Third, these reservoirs are in perfect electric communication with the metal to be preserved by means of bolts, rivets, or other contrivance, always, however, of the same nature as this metal. Fourth, various parts of the reservoirs will be connected together at certain distances by bands of zinc, crossed diagonally by other bands of the same metal, so as to render the whole body of the ship uniformly subject to the same action. These bands should be also in perfect electric communication with each other and with the metal intended to be preserved. Fifth, some sheets of zinc in communication with the reservoirs are placed on the exterior a little below the float or water line, but so that they may be easily changed or removed when required. Sixth, at the upper portion of the reservoir apertures are formed of sufficient size to give vent, if necessary, to the gases which may be disengaged in the interior. Seventh, the reservoirs are filled daily with sea water, acidulated water, or with any liquid possessing identical properties. Eighth, a clock placed upon the lowest part will serve as an escape for the waste water. Ninth, by the aid of a current of water all the apparatus may then be washed. Tenth, a movable cover of sufficient section is also placed at a certain point of the reservoir, so that from time to time a cleansing can be made by any mechanical contrivance.—Patent completed.

671 H. KNIGHT, Ryde, Isle of Wight. *Horse clipping* Dated March 5, 1869.
This apparatus consists of a flat plate of metal, one edge of which is provided with teeth arranged like the teeth of a comb. This plate, when the instrument is used, rests upon the skin of the horse, the hairs to be clipped or cut off standing up between the teeth. Upon the said toothed plate a cutter or series of cutters works, the said cutter or cutters cutting off the hairs against the edges of the teeth of the said toothed plate.—Patent abandoned.

672 H. A. BONNEVILLE Sackville-street, W. *Necktie fastening.* (A communication.) Dated March 5, 1869.
This consists in a little metal or other plate, of any convenient form, on which the article is sewn or otherwise fixed, and at the centre of which exists a slight swelling, wherein lodges the button, and which is furnished with a little slot through which passes the rod or the threads, fixing the button to the shirt collar.—Patent abandoned.

673 C. E. BROOMAN, Fleet-street. *Fur fabric.* (A communication.) Dated March 5, 1869.
This consists in introducing strips of the furs of animals or the down of birds into fabrics during the process of weaving, whereby a curved or down fabric is produced which may be of varied design, shade of colour, or thickness. The strips of fur or down employed may be thin or narrow and in different shades, and are inserted in the warp either close together or at a distance apart, whereby a regularly furred fabric is obtained, and one more or less thick, according to the quality desired.—Patent abandoned.

674 W. B. WATERLOW, London Wall. *Stamping pres* Dated March 5, 1869.
This consists in constructing the frame of such presses with a lever piece hinged or jointed to the lower part of the frame. This lever piece as it extends upwards is fitted or made with two arms, which arms extend towards the upper part of pillar of frame, such part of the pillar being curved or inclined in the direction of the arms. These arms are for the purpose of receiving a spindle, on which is carried the ink duct and surface for inking the type or die. The inking duct is carried or fitted in such manner upon this spindle that it is capable of being moved within certain limits around it, or so as to make a small portion of a revolution upon it.—Patent completed.

675 J. HOLDING, Manchester. *Looms.* Dated March 6, 1869.
This relates, first, to the "temple," and consists in extending the centres between the back and front rollers of the present two-roller "temple." Second, to a new and improved arrangement and adaptation of mechanism to be employed in connection with the "reed," for slowly raising and lowering the latter during the time the warp yarns are passing between the "reed dents," making them thereby more durable. This is accomplished by connecting the weighted levers of the cloth roller with the under frame of the reed in the "lathe" by elbow levers and connecting rods, that will allow the "lathe swort" freely to vibrate.—Patent abandoned.

676 J. LOADER, Upper Clifton-street, E.C. *Rotary engines.* Dated March 6, 1869.
The engine is constructed as follows:—Through a cylinder the inventor places a central shaft or axis, having a crank pin or eccentric formed on or carried thereby, and upon the crank pin or eccentric he fits a disc which is capable of revolving thereon, and the periphery of which fits against the inside of the cylinder. In the cylinder he cuts a slot, in which a stop or abutment slides. This stop or abutment may be in a line radiating from the centre of the cylinder or inclined thereto and such stop or abutment is connected to the disc or piston by a stud or pin, which is received into a suitable hole formed for it in the disc or piston, or it may be connected thereto in other convenient manner.—Patent abandoned.

677 R. BADGER, Sawbridgeworth Hertford. *Shears or scissors.* Dated March 6, 1869.
The object is the construction of scissors and shears, to be used by pressing downwards against the surface on which the fabric to be cut is laid. For this purpose the inventor places above the blades a handle, which upon being pressed down closes the blades, and the same can be opened by a spring (when the downward pressure is released). The handle should be so arranged that it may be attached to the upper blade, and be connected to the shank of the other blade.—Patent completed.

678 W. S. MELDRUM, Leeds. *Carding engines.* Dated March 6, 1869.
This consists in the application to carding engines of sets of rotating blades or beaters mounted on axles and made to work in the outer interval between the two rollers, commonly called the workers and the strippers. —Patent completed.

679 J. B. Spence, Manchester. *Purification of gas.* Dated March 6, 1869.

This consists, first, to the production of muriate of iron suitable for the extraction of sulphur and ammonia from gas. To effect this the inventor takes the spent oxide of the purifyers and drives off the sulphur by any method now practised. Or he takes pyrites from which the sulphur has been driven off in the ordinary manufacture of sulphuric acid, and treats them with muriatic acid, preferably with heat.—Patent abandoned.

680 A. Morrall, Studley. *Needle threader.* Dated March 6, 1869.

The needle threader consists substantially of a piece of flattened wire, having at the one end or point thereof a kind of hook or projection for the purpose of grasping and holding the thread.—Patent completed.

681 T. Ross, jun., Glasgow. *Slide for magic lanterns.* Dated March 6, 1869.

This consists in the combination of two discs or wheels, one of glass, or any other transparent substance on which pictures are painted, drawn, printed, or photographed, the other wheel being made of metal, wood, or any opaque substance, in which wheel openings or slits are formed converging to the centre. The object of this combination is to produce the effect of moving figures, chromotypes, or other objects, by placing the two wheels or discs on an axle and revolving them in contrary directions, by means of pulleys, wheels, or other means.—Patent abandoned.

682 H. and J. Ellis, Salford. *Cranes.* Dated March 6, 1869.

The inventors employ, in addition to a large pulley and endless chain, two chain pinions, one on a shaft having a handle, and the other on a lever which can be moved to and fro, and on the shaft there is a ratchet wheel, which can be held by a catch.—Patent abandoned.

683 W. G. Simon, Oakley-square. *Hanks.* Dated March 6, 1869.

This consists in applying friction rollers to hanks for hoisting and lowering fore and aft sails. The improved hank is composed of a circular disc of metal or other material, around the inside of which is arranged a series of friction rollers revolving on spindles or pins fixed in the disc, or the spindles and rollers may revolve together when required, a circular space being left between the peripheries of the rollers for the stay to pass through.—Patent abandoned.

684 R. R. Bevis, Birkenhead. *Screw propellers.* Dated March 6, 1869.

In order to be enabled to feather the blades of a screw from within the ship so that they may be brought in a line fore and aft or any intermediate angle a sliding rod is employed passing through a hole bored through the centre of the last length or lengths of shaft. The inner end of the sliding rod is fitted with a crossbar which passes through a slot in the shaft into a recess in a large nut, which embraces the shaft and works on a screw thread cut on the shaft and gives the required motion to the sliding rod.—Patent completed.

685 A. M. Clark, Chancery-lane. *Envelopes, &c.* (A communication.) Dated March 6, 1869.

The inventor makes the envelope of paper, linen, or other suitable material, and of such form that the water, wax, gum, or other substance employed for sealing will adhere both to the envelope and its contents. The envelope may be thereby firmly attached to the contents so that their separation would destroy the seal connecting them, the traces of which would remain on the contents.—Patent completed.

686 A. Dixon, Railway-place, E.C. *Steam lubricators.* Dated March 8, 1869.

This consists in fixing a stand pipe into the inside plug of the apparatus known as a hollow plug grease cock, thus enabling the apparatus when so constructed to lubricate by displacement when this inside plug is turned round so as to bring the stand pipe over, and upright, or nearly so, with the discharging hole in the outer shell or casing leading to the steam. The inside plug is further provided with one or more holes for filling, and suddenly discharging and emptying, all of which operations can be performed as desired by the same handle or hand wheel acting upon the inside plug and causing it to revolve, brings the holes to their proper positions for each operation. The holes are placed in the inside hollow plug in such positions relative to the other and to the stand pipe that no two of them can at any one time be open together.—Patent abandoned.

687 J. L. M'Elroy, Glasgow. *Pumping and measuring.* Dated March 8, 1869.

The apparatus comprises a cylindrical chamber formed by a flanged cylindrical casting, to which end covers are bolted, and which is formed with feet whereby it is bolted down to a bed frame. Inside the chamber there is an elliptical or approximately elliptical boss or drum, fixed eccentrically on a central shaft extending out through stuffing boxes in the end covers. The boss touches the cylindrical surface of the chamber, and has a strip of metallic packing pressed out by springs applied at the point of contact whilst it revolves like a piston. There are abutments or sliding stops which are opposite to each other in the same diametrical line, and which, extending out through stuffing boxes, are connected together by external crossheads and rods so as to work together, and so that as one is pushed out by the action of the eccentric boss it causes the other one to move inwards, the inner ends, or rather metallic packing strips, fitted thereto, being always in contact with the boss.—Patent completed.

688 J. B. Rowcliffe, Manchester. *Wire cloth.* Dated March 8, 1869.

This consists in weaving wire cloth so as to produce a twilled or fancy surface. In order to make the wire cloth run more evenly on the paper making machine, the inventor reverses the direction of the twill in the warp at intervals as often as may be required.—Patent abandoned.

689 W. Burr, King Edward-street, E.C. *Compressed leather.* Dated March 8, 1869.

Instead of leaving the surfaces of the compressed leather in an unprotected state, one or both of the surfaces thereof is or are coated with a composition capable of resisting the influence of moisture, and of preventing the same from being absorbed by the leather. This composition consists of a mixture of vegetable black, boiled oil, and litharge.—Patent abandoned.

690 W. A. Gilbee, South-street, E.C. *Raising water.* (A communication.) Dated March 8, 1869.

The apparatus or pump consists of a wheel furnished with one or more hollow cylinders closed or not to the water, and with a number of paddles or arms. It is suspended on its shaft, and enclosed between three walls or partitions of masonry or other suitable material, and separates directly the up water from the down water when no valve is placed before the wheel on the side of the up water. In turning on its shaft the circumference of its outer cylinder forms the movable side or partition of a pump body; the three other sides formed by the masonry are fixed, thus forming a pump with rotary pistons, which, without pipes, valves, or other accessories, raises the down water into the up water without any unnecessary elevation, whatever be the levels and the speed of the wheel.—Patent completed.

691 J. Pitt and Brothers, Cleckheaton. *Drilling.* Dated March 8, 1869.

This apparatus consists of a rotary spindle mounted in a headstock fixed upon a suitable bed or frame, and on one end of which is fixed a drill cutter or shaping instrument suitably formed for the purpose required to be effected. On this spindle are also ordinary cone pulleys for driving the same.—Patent abandoned.

692 C. Mather and W. Rossetter, Salford. *Warping.* Dated March 8, 1869.

This relates, first, to warping machines having self-stopping motions for stopping the machine when one or more of the warp threads break, and further consists in improvements upon an invention for which letters patent were granted to W. Rossetter, dated October 7, 1868 (No. 3,061). Second, the invention consists in various improvements applicable to all descriptions of power looms used for weaving, and also for further improvements upon an invention for which letters patent were granted to W. Rossetter, dated October 13, 1866 (No. 2654).—Patent completed.

693 C. Fairbairn, Edinburgh. *Furnaces.* Dated March 8, 1869.

This consists in arranging in the angle of the furnace bars perforated firebricks and hot-air passages which are led towards a hollow hanging bridge in the furnace, whereby the combustion of the unconsumed gases is rendered more complete and the formation of smoke prevented.—Patent completed.

694 L. M. Ruiz, Paris. *Clarifying oils.* (A communication.) Dated March 8, 1869.

This consists in the employment of several materials and apparatus for obtaining a proper clarification and purification of all sorts of oils, whereby the processes hitherto employed are much simplified. Thus for all mineral oils extracted from coal, or those of various natural production, called petroleums, as well as such as are extracted from vegetable or animal matter, the same result is obtained in their purification by employing a filter of whatever form, and filled with natural powder of calcined mineral coal, such as schist or lignite or tripoli clay, argil, or other minerals. By preference the inventor employs such minerals as contain either in their natural state or by admixture at the time of calcination, a carbonic principle mixed with phosphate or carbonate of lime, or of potash and sulphate of iron.—Patent completed.

695 H. Tylor, Queen-street, E.C. *Spring bottoms for bedsteads.* Dated March 8, 1869.

This consists in fitting the springs composing the bottom between a bar at the under side and a lath at the upper side of the springs. The ends of the bars are secured by pins on their ends being dropped into holes in any convenient manner in a bar or bars fitted parallel to and under the ordinary angles or side rails, while the laths are secured by studs or other connections to the angles or side rails in the ordinary way, and with which they are almost level. The springs being secured in the manner above described can be removed with the bar and lath to which they are attached without interfering with the other springs, bars, and laths.—Patent completed.

696 P. Buchan, Green Island, Belfast, and A. Guild, Belfast. *Preparing jute.* Dated March 8, 1869.

The inventors first steep the fibre in a solution of either soda, potash, or ammonia, by preference heated to 80deg. or 90deg. Fah., or it may be cold, and for such length of time and employing such strength of alkali as from the character of the fibre may be found necessary. After such steeping the fibre is exposed to a bleaching solution of either chloride of lime, soda, or magnesia, or to the action of chlorine gas, but, by preference, to that form of bleaching solution known as Jauvelle water, until the required lightness of colour is obtained. The fibre is next washed to rid it, as far as possible, of the bleaching liquor, and it is then steeped in a weak solution of sulphuric or hydrochloric acids, marking (say) 1deg. Twaddell, for from two to three hours. When removed from this solution it is placed in an oil bath prepared from a mixture of vegetable oils and carbonate of potass, from which it is taken and dried.—Patent abandoned.

697 J. A. Jaques, J. T. Oakley, and J. A. Fanshawe, Tottenham. *Grinding and surfacing.* Dated March 8, 1869.

This consists in rendering the chuck temporarily magnetic, so that when the rings, plates, discs, or other articles are placed thereon they will be held firmly against it by the magnetic attraction, which may be produced in any of the well-known ways of rendering iron temporarily magnetic.—Patent completed.

698 H. W. Cook, Ovington square. *Clocks.* Dated March 8, 1869.

This consists in the application of electrical regulators to various kinds of clocks, which are or may be worked in the ordinary manner, either by weights or springs, or by any other means except electricity, the electrical agency to be employed merely serving to regulate the action of the clocks, which are to be driven by other power.—Patent completed.

699 J. P. Budd, Ystabfera, Swansea. *Iron and steel.* Dated March 8, 1869.

The object is to subject molten cast iron to the action of nitrate of soda and soft hematite, iron ore, or other oxide of iron previous to its being subjected to the puddling process. For this purpose the inventor runs the molten cast iron into shallow pans capable of holding from 3in. to 5in. in depth of melted metal and lined with a paste composed of a mixture of the materials above mentioned, or of either of them separately. When the fluid metal is poured into the pans a violent ebullition takes place, and a large proportion of the silica, together with some of the carbon, phosphorus, and sulphur contained in the iron, is carried off in the slag, so that when the slabs of purified metal are subsequently worked in the puddling furnace the puddling operations are effected much more rapidly than with ordinary pig iron, as when puddling ordinary pig iron in a puddling furnace but a very small proportion of carbon is separated from the iron before the greater proportion of the silica is eliminated.—Patent completed.

700 R. F. Piltz and T. H. Lee, Newnham-street, W. *Paper hangings.* Dated March 8, 1869.

This consists in coating strong well sized paper with oil colours spread upon the surface of the same by an apparatus charged with the colouring matter, so that on the paper being drawn longitudinally beneath the apparatus (which is mounted horizontally upon a fixed bench or table), the colour is caused thereby to flow evenly over the surface.—Patent abandoned.

701 R. Turnbull and J. G. Piton, Cowper's-court, E.C. *Signal for trains and ships.* Dated March 8, 1869.

Steam pipes are placed underneath the framing of the carriage immediately over the centre line, to convey the exhaust steam from the cylinder or other part of the engine to the end of the train or carriage. In the centre of each carriage, placed between and connected to the pipes, is a steam whistle; pull cords or wires leading from each compartment are connected to the handle of the whistle, such whistle also forming a stopcock. When the engine first discharges the exhaust steam it enters the pipes and is conveyed through them to the end of the train, the stopcocks being all open, but in case of danger or signalling being required to be made, then by pulling a cord or wire the cock is shut and confines the steam, causing a great pressure against the whistle, giving instantaneous alarm through the whole train, and commanding the engine driver to stop, the whistle sounding so long as the engine discharges steam.—Patent abandoned.

702 T. Baker, Buckingham-villa, Stratford, E. *Umbrellas.* Dated March 8, 1869.

This consists in the use of ribs and stretchers made of metal, either rolled or twisted, or drawn spirally or plaited. For example, the inventor may take a strip of metal and pass it around a rod in such a manner that it shall form thereon spirals or convolutions, and when the rod is withdrawn, the strip of metal will retain the form thus imparted, and be, in fact, a spiral tube, from which a rib or stretcher may be made.—Patent abandoned.

703 W. B. Thompson, Dundee. *Textile fabrics.* Dated March 8, 1869.

Rollers for picking cloth which may be either made of wood or iron, and the circular surfaces of which are filled with teeth or spikes set at a tangent or nearly so to the circumference of the rollers. The spikes or teeth may be put through either leather, wood, iron, or other material, and then fixed on the rollers, or they may be driven direct into the roller itself.—Patent abandoned.

704 A. Mitchell, Leith. *Cutting and dressing stone.* Dated March 8, 1869.

The apparatus is contrived to operate with dressing tools or chisels, and to actuate these instruments in a manner closely approximating to that in which the mason works them. The chisels in connection with hammers for striking them are arranged so that they may be adjusted at any inclination to the surface of the stone to suit the varying qualities of the stone, and the motion when struck is regulated by specially arranged guides, in such a way that their points move as nearly as possible in lines coinciding with the intended surface of the stone.—Patent completed.

705 W. Saunders and C. Smith, Newgate-street, E.C. *Dressing bags.* Dated March 8, 1869.

This consists in an improved detachable frame made of two upright end pieces united at the top by a cross piece extending from end to end of the bag. The end pieces are provided at the bottom with feet, which rest on bars or plates permanently fixed inside the bag at the bottom thereof. To each of these bars is attached two sliding bolts formed with catches, which secure the feet of the end pieces, and with projections arranged to be operated upon by a vertical rod extending to the top of the same, and are provided with heads or buttons at the mouth of the bag. The sliding catches are held by springs, and are operated to release the frame by pressing the heads of the rods.—Patent abandoned.

706 W. Saunders and C. Smith, Newgate-street. *Chess and cribbage board.* Dated March 8, 1869.

The board or table top, which may be of any desired size, is like an ordinary chess board made of two parts, hinged together at the middle of the board, the interior of the board forming a tray, which may be provided with backgammon points or fitted for some other games, or if preferred left quite plain. The chess squares are preferably perforated to receive pegs, which are formed on the bottom of the chess men, and are inserted in the said holes to prevent the disarrangement or interruption of the game by the motion of a vessel or vehicle whereon the board is used.—Patent abandoned.

707 W. R. Lake, Southampton-buildings. *Reciprocating and rotary motion.* (A communication.) Dated March 9, 1869.

The invention is divisible into two parts. The first division relates to the particular construction of shackle bars or link rods, which connect the treadle with any suitable pawl and ratchet mechanism for working the shaft, and the second division relates to an improved friction pawl, particularly adapted to be used in combination with the peculiarly constructed linkrods above mentioned.—Patent completed.

708 F. F. Villepigue, Northampton-street, W.C. *Velocipedes.* Dated March 9, 1869.

This consists in the application of revolving plates or pieces, which convert the sliding or rubbing together of the parts into a rolling motion, unattended by friction, the plates or pieces being free and revolving within a box without being fixed at their extremities by any pieces which could connect them together and thereby occasion friction.—Patent abandoned.

709 W. R. Lake, Southampton-buildings. *Tilt hammers.* (A communication.) Dated March 9, 1869.

This relates to that class of machines known as power hammers, and consists in a combination and arrangement of devices for communicating the power to the hammer, also in the arrangement for hanging, operating, and controlling the hammer, and the changing of the hammer dies, both in the hammer head and in the anvil.—Patent completed.

710 R. BRIGGS, Leeds. *Regulating temperatures of rooms.* Dated March 9, 1869.

Between two parallel vertical standards secured to a suitable table, the inventor places a T cylinder upside down and charged with mercury. To the upper portion of such cylinder he connects a double-flanched joint and gland furnished with a piston. Between the connecting flanges of the cylinder and joint, he places a diaphragm of stout indiarubber, which separates the one from the other. To the upper end of the piston he connects a horizontal lever having its fulcrum upon a convenient projection from the framework.—Patent abandoned.

711 J. J. SHEDLOCK, Camden Town. *Wet gas meters.* Dated March 9, 1868.

This relates to the mode or method by which the water level is maintained at the proper height, thereby ensuring correct registration. For this purpose, a tube is provided having a partition fixed diagonally in the interior and two apertures made therein, one on either side of the partitions. The tube is held vertically at its ends by two stuffing boxes fixed on the upper and lower parts of the chamber in which the tube is placed. The upper end of the tube communicates with the square front of the meter, and the lower end with the overflow or waste water chamber. The lower part of the chamber containing the tube communicates with the drum case below the water line, and the upper part of the tube chamber with the gas passage from the inlet pipe. The float carrying the inlet valve is adjusted to the proper height by means of a nut fixed in the lower part, and a screw, on the upper part of which is fixed a valve.—Patent completed.

712 J. J. SHEDLOCK, Camden Town. *Dry gas meters.* Dated March 9, 1869.

This relates to improvements in dry gas meters, the diaphragms of which are so constructed that when distended they take the form of truncated pyramids, the sides of which are leather or other like flexible material. Metal frames forming the lower bases, and plates of metal forming the upper bases, are securely attached to the flexible sides, double hinge joints connect the plates of metal forming the upper bases to vertical rods, the lower ends of which work in studs fixed in the bottom of the meter, and the upper ends are supported by and work in stuffing boxes attached to the valve plate.—Patent completed.

713 H. A. BONNEVILLE, Paris. *Porcelain.* (A communication.) Dated March 9, 1869.

This process consists in mixing in equal quantities kaolin and gypsum, and in adding thereto pulverised charcoal or an analogous pulverised substance done away with in the baking in variable quantity according to the degree of porousness desired. The mixture of these substances is effected by the usual means, and by adding water in sufficient quantity to obtain a paste of such consistency as to be able to mould the same into any convenient form, according to the use and application for which it is intended.—Patent completed.

714 H. MASON, G. HARTLEY, and J. HINDLE, Bradford. *Looms.* Dated March 9, 1869.

The object is to obtain increased steadiness and certainty in working. For this purpose the inventors apply an extra swell, or other suitable elastic retaining means, adapted to act on the picker to steady it after picking the shuttle from one side to the other. These retaining means will admit of the picker passing it in picking, but it prevents the too free rebound, and retains it in position better to receive the shuttle from the opposite side.—Patent completed.

715 I. HUDSON, Stockport. *Cask tilts.* Dated March 9, 1869.

The casks or barrels are placed on the ordinary stillages, and above each cask or barrel a double lever or steelyard is suspended by a link to a bar or rail at the upper part of the cellar or other elevated position; on the arm there is a weight which can be adjusted and held at any required position, and the other arm is formed as a quadrant to which is linked one end of a chain, the other end of which is passed through one eye of a hook having two eyes, and then turned up and hooked to one of the ends of the cask or barrel. Through the other eye of this hook is passed another chain having at one end a hook which is hooked to the other end of the cask or barrel, and the end of this chain passed through the eye is turned back and hooked to the same chain to the length required.—Patent completed.

716 J. DICKIE, Glasgow. *Uniting parts of grates.* Dated March 9, 1869.

This consists in placing iron pins and screws in the moulds, so that the parts are cast with the holes in them, whilst the pins and screws are easily removed from the castings afterwards, the latter by unscrewing them.—Patent abandoned.

717 B. HUNT, Serle-street, Lincoln's Inn. *Locomotives.* (A communication.) Dated March 9, 1869.

This improved locomotive is similar in its general arrangement to the tender locomotives employed on railways. It is principally adapted for the transport of goods at a slow speed. By a modification consisting of a simple change of wheels easily performed, it can be transformed into a passenger engine with double speed. It is carried on a frame formed of longitudinal and transverse beams, and is suspended by springs on the driving and guiding wheels. The boiler and water tanks are completely independent of the mechanism, and easily dismounted. The mechanism placed under the boiler is within the longitudinal frames, and is provided with reversing gear and a brake. The furnace is placed at the same end as the fore carriage, which brings the engineer and conductor together; they being both covered by the same roof, and having within reach all the driving gear, can help each other if need be.—Patent completed.

718 W. R. LAKE, Southampton-buildings, Chancery-lane. *Turbines.* (A communication.) Dated March 9, 1869.

This consists, first, in constructing a waterwheel with two series of buckets, both receiving the water horizontally, one series discharging the water vertically and the other discharging the water towards the centre of the wheel. Second, in enclosing the wheel in a metallic case consisting of a crown plate with a horizontal flange and a cylinder having at its upper end a horizontal flange, a series of oscillating gates of a *cyma reversa* form placed between the parallel flanges and a series of shouldered bolts connecting the flanges. The wheel shaft has its support on a bridge tree bolted to the cylinder, and is maintained in a vertical position by a sleeve or by brackets attached to the crown plate.—Patent completed.

719 A. M. CLARK, Chancery-lane. *Umbrella coverings.* Dated March 9, 1869.

Fabrics suited for the above purposes are produced in various ways. Thus, first, two fabrics of different colours or aspects may be superposed either before or at the time of use, and united by sewing, pasting, or other means. Second, two fabrics of different colours or aspects may be superposed and united by weaving them simultaneously.—Patent completed.

720 H. W. GOLDRING, Moorgate-street. *Soap.* Dated March 9, 1869.

This consists in the use of a machine or apparatus of the following construction:—The pan, which is somewhat of the ordinary shape, with a hemispherical or dished bottom surrounded by a jacket, into which steam is admitted, as commonly practised, and at the centre of the pan an upright revolving shaft is adjusted, through which three or more horizontal rods or bars pass one above the other. These rods or bars are connected to and revolve by their ends in two upright flat bars of metal made of the same shape as the sides and bottom of the pan against which they fit nearly close and move freely. The bottoms of these bars are firmly connected together by another bar fitting the extreme bottom part of the pan, and this bar is fixed to the upright shaft and moves therewith.—Patent abandoned.

721 G. GOLDSMITH, Leicester. *Railway signalling.* Dated March 9, 1869.

Beneath the seat and either above or below or partly above and partly below the floor or other convenient situation a cylinder closed at the bottom and by preference made of metal is attached to the carriage. This cylinder is fitted with a piston and piston rod, the rod being carried up the back or partition dividing the compartments to which it is held by a spring, bolt, or other suitable contrivance. At the bottom or lower side of the cylinder an outlet is made, which by means of a metal pipe screwed or otherwise fastened thereto leads to the next cylinder. The pipes at the end of each carriage are however carried some distance up the outside of the back thereof, where they each terminate in a socket, and in order to connect the pipes of each carriage together recourse is had to a flexible pipe having metallic plugs at each end which can be inserted in the sockets before mentioned and retained in position by a bayonet catch or other appropriate fastening, such, for instance, as a short metal pipe with a stud on the exterior passing into a pipe of slightly larger diameter with a slit to receive the stud and fitted with a leather disc which will surround the interior pipe so as to make a close joint.—Patent abandoned.

722 G. H. T. FINZEL, Bristol. *Cooling charcoal.* Dated March 9, 1869.

The inventor cools and sifts animal charcoal after it has been reburnt, and at the same time raises it to the desired elevation by feeding it into a pipe or shaft up through which a current of air is caused to pass. The current of air is sufficiently rapid to carry the charcoal along with it, and the charcoal is by this means raised to the desired height at the same time that it is cooled; the upper end of the pipe or shaft opens into a chamber, and the charcoal as it issues from the shaft or pipe falls upon the floor of the chamber, whilst the dust passes off with the air into a second chamber, where it is collected.—Patent completed.

723 R. M. CAFFALL and D. MILLER, Alton. *Wall waterproofing.* Dated March 9, 1869.

The inventors prefer to take paraffin in its solid state and subject it to the action of heat by melting it in a metallic or other suitable vessel. When thoroughly liquefied they apply it by means of an ordinary brush such as is used by painters to the wall or other surface desired to be protected. Sometimes the inventors previously warm the wall or other surface with what is known as a "painter's stove" or "devil," and after the liquid paraffin as above described has been applied they again use such "stove" or "devil" to liquefy and force in any paraffin remaining visible on the exterior of such wall or surface.—Patent completed.

724 J. HENDERSON, Auchencairn. *Iron and steel.* Dated March 9, 1869.

The puddling furnace may be termed a double reverberatory furnace, as the hearths are arranged two deep, being placed back to back so as to receive their heat from one and the same fire chamber. In this chamber the inventor uses waste or small coal as fuel with a blast of air on each side which consumes all cinder and enables the heat to be kept up night and day without any stoppage whatever from cleaning or renewing the fire.—Patent completed.

725 J. EDWARDS, Hackney. *Permanent way.* Dated March 9, 1869.

This consists in applying a tube to railway trains. Into this tube the inventor inserts whistles, to be blown by passengers, the tube being open throughout. The current of air passing through the tube carries the sound of the whistles with it into the guard's van. The invention also consists in the application of a rope (or its equivalent) to railway trains with elastic connections suspending weights. This rope is coupled when necessary, and in order to give the signal it is only necessary to uncouple the rope and set the weights at liberty, which then fall, and in their fall ring a bell.—Patent abandoned.

726 W. SAUNDERS and C. SMITH, Newgate-street, E.C. *Dressing case and bag.* Dated March 9, 1869.

This consists chiefly in the peculiar construction of the parts of the case and bag, whereby the inventors are enabled to combine in one article the advantages of an ordinary separate dressing case, a compact and convenient dressing bag. The whole of the fittings and instruments are carried within the case, which is preferably made of a semicircular form in cross section, the flat side forming the base. The bag is made to contain the case, and to allow the same to be readily and conveniently placed in the bag or removed therefrom.—Patent abandoned.

727 G. SPENCER, Cannon-street, and J. BARKER, Mortlake. *Provision preserver.* Dated March 9, 1869.

This consists in placing the substance to be preserved in an airtight vessel, from which the inventors withdraw the atmospheric air contained therein, and refill by an atmosphere of nitrogen, in which decomposition cannot take place.—Patent completed.

728 T. OBACH, Manchester. *Fuel economiser.* Dated March 9, 1869.

The inventor forms upon the pipe and near the end thereof two or more studs or projections to pass when the pipe is inserted into the socket. These recesses open into a groove or grooves, and a shoulder or face is provided in the socket corresponding to the face on the end of the tube.—Patent completed.

729 W. WALKER, Newton Heath. *Expansion slide valve gear.* Dated March 9, 1869.

This consists in the method of actuating the cut-off plates of such slide valves so as to use the steam expansively by means of a novel adaptation to the purpose of the well-known archimedian screw, which is mounted in a suitable bracket or pedestal, and has a square formed upon its extremity to prevent it turning in its bearing in the bracket or pedestal, and is jointed to the governor at the other extremity, so as to move in the direction of its length by the action of the governor, but not to turn upon its axis, thereby removing all strain from, and not interfering with the correct action of the governor.—Patent completed.

730 W. R. LAKE, Southampton-buildings, Chancery-lane. *Self-lighting gas burners.* (A communication.) Dated March 10, 1869.

This consists, first, in confining a coil of platinum wire or its equivalent with a gas burner in such a manner that it will cause the re-ignition of the gas if the latter should be extinguished without shutting off the flow. Second, in supporting the said platinum coil or its equivalent upon a ring which may be cast upon the wire or secured thereto in any other manner, and is adapted to fit around the gas tip or burner. Third, in combining a cap or hood with a self-lighting gas burner or self-lighting attachment.—Patent completed.

731 B. BRITTEN, Red Hill. *Whips.* Dated March 10, 1869.

Instead of employing wood or the other material now generally used for the sticks or pliant stems of whips used for riding or driving, the inventor makes use of steel, iron, or other metal. The metal he uses in the form of light tubes, or of other shape which will give the strength, pliancy, and lightness. The thong is attached as usual, and may be of the ordinary kind. To prevent the metal from rusting he gives it a coating of japan lacquer or other varnish or paint, or by means of the electro or other process he gives it a coating of gold, silver, tin, or other metal.—Patent completed.

732 W. WELDON, Highgate. *Manufacture of chlorine.* Dated March 10, 1869.

This relates, chiefly, to the regeneration or other production, in the wet way, from residual products of the manufacture of chlorine, of certain compounds containing peroxide of manganese, and to the manufacture of chlorine by means of such compounds so regenerated or produced.—Patent completed.

733 J. SAX, Great Russell-street, W.C. *Telegraph receiving instruments.* Dated March 10, 1869.

Two metal plates are framed together by pillars, so as to be one over the other about 1¼in. in distance apart, the bottom or larger plate being about 4in. square and the top 3in. The inner side of the top plate carries a small ratchet wheel in the centre, about ½in. in diameter. This small wheel has fourteen or fifteen teeth, according to requirement, while the bottom plate is about 1in. from the top edge in a direct line with the axis of the small wheel on the top plate, and is suspended perpendicularly by an axis passing through the centre of the same. A light bar magnet has affixed to either side of it two light steel springs. These springs pass about ½in. beyond the extreme end of this light bar magnet. They are parallel to each other, but so fixed that the inside edge of each are in the same place, as the ends of these presents would have a tendency to press downwards towards each other. The bar magnet has, therefore, a small piece of brass fixed on the extreme end of it with two set screws, each screw facing one of the springs from the inside, so that by setting the screw each spring may be adjusted to the proper position.—Patent completed.

734 W. KNOWLES, Bolton. *Spinning mule.* Dated March 10, 1869.

This consists in supporting the yarns by means of a wire, distended by arms or levers, which are raised and lowered by a rail fixed to the floor, or in any other convenient manner.—Patent abandoned.

735 R. RULE, Glasgow. *Weaving ornamental fabrics.* Dated March 10, 1869.

This consists in weaving the fabric in such a way that the stripes appear to be of a texture or material quite different from that of the remainder or ground of the fabric, and this is done by making the cloth "double" at the stripes.—Patent abandoned.

736 C., W., and J. DRAKE, New Kent-road. *Breaking stone for concrete.* Dated March 10, 1869.

The inventors employ rollers with corrugated surfaces. The grooves run around the rollers with their sides parallel, and the grooves in one roller are set to correspond with the projections or ridges on the other. The rollers are mounted horizontally on parallel axes. They are caused to rotate by powerful driving gear, and the material to be broken is fed in between them. The ridges may have ratchet-like teeth or grooves cut upon them to cause the rollers to take down the materials between them with greater certainty.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated September 21, 1869.

2739 H. and F. C. Cockey, Frome Selwood, Somersetshire. Improvements in apparatus for scurfing retorts.

2740 J. Elce, Manchester. Improvements in the shape and manufacture of bobbins or spools, and in the machinery for winding rovings thereon.

2741 R. Swift, Hardy-terrace, Hounslow, Middlesex. Improvements in the manufacture of iron kegs and other metal cases.

2742 J. I'Anson, jun., Darlington, Durham. Improvements in locking apparatus for controlling railway switches and signals.

2743 P. J. Kurtz, Rippberg, near Walldurn, Baden. Improvements in chaff cutters.

2744 J. Jacobi, Kladno, Bohemia. An improved proces

for removing phosphates from ores, and for utilising these phosphates.

2745 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the spindles and fliers of spinning frames.

2746 A. V. Newton, Chancery-lane. An improvement in the treatment of spirits or alcoholic liquids for the purification of the same, and apparatus therefor, a part of which invention is also applicable to the separation of the lighter from the heavier particles of oils and other liquids.

2747 R. L. Hickes, Liverpool-street, City. Improvements in cartridges.

Dated September 22, 1869.

2748 M. Macleod, Manchester. Improvements in apparatus for sanitary purposes.

2749 J. Windsor, Pulrose Mill, Braddan, Isle of Man. Improvements in desiccating and preserving potatoes.

2750 G. H. Chatwin, Gresham-street, City. Improvements in the manufacture of umbrellas, parasols, and sunshades.

2751 E. Hill, Longton, Staffordshire. Improvements in slide valves.

2752 R. R. Gibbs, Liverpool. Improvements in pumps, vacuum pumps, and blast engines, and in lubricators for the same, which are also applicable to other lubricating purposes.

2753 W. J. Cunningham, New Oxford-street, and A. P. M'Carthy, Bloomsbury, Middlesex. Improvements in obtaining motive power.

2754 J. Tarbuck and T. Burns, Abram, near Wigan, Lancashire. Improvements in the method of pumping water from shafts, pits, or similar places, which method is also applicable for drawing gas from goaves in mines, and for ventilating pits or shafts in course of sinking.

2755 C. L. Light, Richmond, Surrey. Improvements in the construction of tram-rails, in the modes of fastening the same, and in a mode of shifting carriages from one line of rails to another.

2756 W. R. Lake, Southampton-buildings, Chancery-lane. A new method of purifying solutions of sugar and syrups.

2757 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in sewing machine and other needles.

2758 A. V. Newton, Chancery-lane. Improvements in threshing machines.

2759 H. R. Minns, Stapleton-road, Bristol. Improved mechanism for locking or securely connecting the doors of safes, strong rooms, and other like depositories, to the frames thereof.

2760 E. Hernulewicz, King William-street, City. An improved method of securing the intermediate uprights of all kinds of metal and wood fencing.

Dated September 23, 1869.

2761 W. Black and T. Hawthorn, Gateshead-on-Tyne, Durham. Improvements in locomotive engines and vehicles intended to run on railways and tramways.

2762 D. Witty, Manchester. Improved apparatus for propelling vessels.

2763 R. C. Wallace and D. Crawford, Ardrossan, Ayrshire. Improvements in pumps and mechanism connected therewith, applicable to ships and other purposes.

2764 J. Watson, Govan, Lanarkshire. Improvements in tyres for wheels.

2765 V. Chemery, Sedan, France. Improvements in the construction of apparatus for damping and pressing simultaneously the surface of cloth and felted fabrics previous to finishing.

2766 J. F. R. Badiou and F. Bernard, Paris. An improvement in shoes for horses, mules, or other analogous hoofed animals, and in apparatus for manufacturing such shoes.

2767 W. E. Gedge, Wellington-street, Strand. An improved drying machine with application of central ventilation.

2768 W. J. Turner and H. Yewdall, Bradford, Yorkshire. Improvements in machinery or apparatus for the manufacture of bisulphites, and in the application of the same to bleaching and preparing for dyeing or printing textile fabrics and fibres.

2769 F. Trench, Dublin, and E. C. Warner, Brighton, Sussex. Improvements in horseshoes.

2770 G. A. C. Bremme, Liverpool. Improvements in machinery for untwisting and unlaying threads, yarns, strands, ropes, and other spun and twisted materials, which improvements are applicable to twisting, spinning, and other analogous purposes.

2771 J. M. and J. B. Spence, Manchester. Improvements in the manufacture of disinfectants, applicable also to the preservation of manures.

2772 W. E. Newton, Chancery-lane. Improved apparatus for drying grain and other substances.

2773 J. Mackenzie, Edinburgh. Improvements in weighing machines.

2774 J. B. Spence, Manchester. Improvements in feeding steam boiler and other furnaces with fuel, and in machinery or apparatus connected therewith.

Dated September 24, 1869.

2775 J. Faulkner, Manchester. Improvements in exhausting, drawing, or draining the gas from coal and coal mines.

2776 W. H. Hewett, Great Yarmouth, Norfolk. Improvements in producing characters, inscriptions, devices, and designs on metal surfaces.

2777 B. Hunt, Serle-street, Lincoln's Inn. An improved automatic railway carriage or car brake.

2778 W. Strang, Glasgow. Improvements in apparatus for dressing, and in apparatus for beaming, warps.

2779 R. Collis, Webber-street, Blackfriars-road, Surrey. Improvements in the means of propelling velocipedes, also applicable for other purposes.

2780 J. H. Davis, Fenchurch-street, City. Improvements in ships' compasses.

2781 W. I. Palmer, Reading, Berks. Improvements in the manufacture of paper.

2782 G. L. Morton, Grosvenor Park, Camberwell, Surrey. An improved method of stoppering bottles intended to contain effervescing liquids.

2783 J. T. Greenfield, Pencester-street, Dover, Kent An improved side arm for clearing the chambers and rifling of ordnance.

2784 J. W. Morgan, Edmund-street, Liverpool. Improvements in ships' and mooring anchors.

2785 T. B. Daft, Lorn-road, Brixton, Surrey, E. Axmann, Belsize-road, South Hampstead, Middlesex, and T. W. Willin, Clerkenwell Green, Middlesex. Improvements in watches and other timekeepers.

Dated September 25, 1869.

2786 I. Farrell, Clanbrassil-terrace, Dublin. Improvements in bearings for axles, shafting, and such like.

2787 W. Harper, Bolton, Lancashire. Improvements in machinery or apparatus for suspending fabrics in drying stoves.

2788 J. T. Gaze and J. Hymas, Erith, Kent. Improvements in firebars.

2789 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved Greek firearm.

2790 J. P. Turner, Birmingham. Improvements in buckles or fastenings for braces, belts, bands, and other articles.

2791 J. W. More, Market-street, Finsbury, and J. Norman, Hoxton-square, Middlesex. Improvements in means or apparatus for clipping horses and other animals.

2792 J. Worrall, Manchester, and J. Kershaw, Wadsworth, Halifax. Improved machinery for folding piece goods.

2793 S. G. Archibald, Edinburgh. Improved machinery for carding and twisting or spinning oakum, and for balling the same.

2794 J. C. Cushion, Penrose-street, Walworth, Surrey. Improvements in mill bills or chisels and picks for dressing millstones, marble, and other stone.

2795 J. Stuart, Ropemakers' Fields, Limehouse, Middlesex. Improvements in the treatment of the ores of the metals and their products, and in the manufacture of the oxides of the metals, and of the carbonates of the oxides of the metals, and of the metals themselves, also in the manufacture of soda and its carbonates, and of potass and its carbonates.

2796 G. W. Rendel, Newcastle-upon-Tyne. Improvements in gun carriages and slides.

2797 G. W. Rendel, Newcastle-upon-Tyne. Improvements in breech-loading guns.

Dated September 27, 1869.

2798 T. Hall, J. B. M'Kerrow, and T. R. Shaw, Pendleton, Lancashire. Improved means for effecting the removal or discharge of dye wood from banks or yarns.

2799 C. de Bergue, Strand. Improved mode of, and apparatus for, utilising man's muscular power when employed in driving machinery.

2800 W. Boulderson, Strand. Improvements in coverings for the head.

2801 F. W. Fox and E. Walker, Atlas Ironworks, near Bristol. Improvements in locomotive and other engines, and their steam boilers.

2802 J. Peel, J. Sharp, and J. Walworth, Bradford, Yorkshire. Improvements in looms for weaving.

2803 G. Bennie, Kinning Park, Renfrewshire. Improvements in distilling oils from minerals, and in apparatus therefor.

2804 J. Hastie, Greenock, Renfrewshire. Improvements in applying heat and in obtaining motive power.

2805 R. Harlow, Heaton Norris, Lancashire. Improvements in valves or cocks.

2806 E. O'Brien, Liverpool. An improved self-feeding, discharging, and registering beam balance for weighing grain and other substances.

2807 G. T. Bousfield, Loughborough Park, Brixton, Surrey. Improvements in the manufacture of sized paper.

2808 J. R. Swann, Leith-walk, Edinburgh. Improvements in boiler tubes.

2809 J. R. Wigham, Albany House, Monkstown, Dublin. Improvements in the means and apparatus employed in illuminating buoys, beacons, lighthouses, and other establishments or localities, which improvements are partly applicable to other purposes.

2810 T. R. and T. W. Harding, Leeds. Improvements in leather driving bands, and in machinery employed in the manufacture thereof.

2811 W. E. Newton, Chancery-lane. Improvements in lappet or embroidering looms.

2812 W. Kendall, Newcastle-on-Tyne. Improvements in furnaces.

2813 F. Armstrong, Southampton-buildings, Chancery-lane. Improvements in knitting machines, and in the production of selvages thereby.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1638	2489	2548	2587	2644	2652	2660	2668
2011	2502	2555	2636	2646	2654	2662	2670
2369	2515	2565	2640	2648	2656	2664	2672
2436	2525	2583	2642	2650	2658	2666	2674
2465							

LIST OF SEALED PATENTS.

Sealed September 25, 1869.

937 F. B. Taylor
954 A. Barclay
956 T. E. Williams
959 T. G. Webb
967 A. F. Baird
971 H. Davey
976 J. Livesey
978 R. Jones
979 W. E. Gedge
982 J. C. Lee
983 C. Lange
985 G. Holcroft and W. N. Dack
987 E. O'Connell
991 J. Caplin
995 W. Bayne and O. E. M'Gregor
996 G. H. Smith
1000 F. Schafer
1002 W. Y. Craig and S. P. Bidder
1003 D. Osborn
1006 M. Wolfsky
1012 U. Scott
1071 D. and G. Hallas
1072 J. A. Chaufourier
1121 E. Beanes
1122 A. d'Azambuja
1131 B. J. B. Mills
1138 J. H. Johnson
1140 J. Leechman
1150 B. W. Farey
1166 F. J. Bramwell
1188 T. Amies
1326 E. Crowe
1455 T. Bullivant
1539 W. R. Lake
1708 C. Francis
1857 W. E. Newton
1890 E. H. C. Monckton
1914 R. Moreland and D. Thomson
1928 J. Brooke and J. Hirst
1946 A. Clark
1956 J. Howard
2065 T. James
2075 J. Walker and P. A. Godefroy
2136 J. J. Cousins
2287 H. A. Bonneville
2288 H. A. Bonneville
2368 W. R. Lake

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," September 28, 1869.

1477 I. and J. H. Storey, H. Lea, and T. Lane
1480 J. T. Griffin
1505 A. Dunn and A. Liddell
1506 C. E. Brooman
1515 T. and J. Fagg
1524 J. L. Clark and J. Brotherton
1527 F. Johnson and W. Hatchman
1531 E. Taylor
1535 A. V. Winkle
1538 W. Martin
1541 P. M'Gregor
1543 J. E. and A. Dowson
1545 W. Mitchell
1547 G. V. Fosbery
1555 A. L. M'Gavin
1556 A. L. M'Gavin
1570 S. Jackson
1594 R. F. Weatherdon
1595 W. A. Gilbee
1596 M. H. de Goesbriand
1598 G. Salt and W. Inglis
1617 C. E. Brooman
1632 F. A. Barrow
1661 J. M. Muteme and H. G. de Valory
1677 J. Dockray
1697 J. Fletcher
1727 J. Farmer
1799 J. G. Marshall
1812 J. H. Brown
1877 W. Topham and S. Wells
1959 C. L. V. Yon
2035 C. E. Brooman
2258 W. Crossley and J. W. Swithinbank
2264 B. Hunt
2350 B. Hunt
2420 C. E. Brooman
2444 G. Sunderland and R. J. Midgley
2481 J. Blakey
2495 A. Neill
2636 R. E. Hodges
2658 D. Colville
2674 S. Fox

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2410 G. and E. Ashworth
2419 G. O. Gooday
2420 J. W. Morgan
2425 W. Clark
2448 T. Whitaker and J. Constantine
2454 J. and A. Gamgee
2465 A. Steven
2468 W. E. Newton
2470 G. E. V. Derburgh
2479 J. C. Sellars
2480 H. A. Bonneville
2483 H. A. Bonneville
2491 W. Clark
2502 J. H. Dallmeyer
2522 J. Whitworth
2545 R. Mortimer
2561 W. E. Newton
2680 H. Kessler
2593 G. T. Bousfield

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2613 T. Kennedy
2633 H. Hutchinson
2653 J. L. Hughes

LIST OF SPECIFICATIONS PUBLISHED

For the week ending September 25, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
289	1 8	368	1 6	444	0 10	479	0 8	507	0 4	546	0 4
315	0 10	369	0 10	446	0 10	480	0 4	509	0 4	548	0 4
324	0 8	375	0 10	451	0 8	483	0 10	510	1 6	550	0 4
329	1 0	378	2 6	462	0 6	485	0 4	512	0 4	551	0 4
331	0 8	384	0 8	463	0 4	488	0 4	516	0 4	552	0 4
332	0 6	396	0 8	464	0 4	489	0 4	523	0 4	553	0 4
335	0 8	401	0 10	466	0 4	490	0 4	524	0 4	554	0 4
347	0 8	402	0 8	468	0 8	491	0 4	525	0 4	555	0 4
351	0 10	403	0 10	470	0 6	495	0 4	526	0 4	563	0 4
356	0 8	408	0 10	471	1 6	498	0 4	529	0 4	573	1 0
360	1 4	414	1 4	472	1 0	503	0 4	531	0 4	576	0 4
361	2 0	425	0 8	473	0 4	504	0 4	533	0 4	598	0 6
362	0 10	428	0 10	475	0 4	505	0 4	534	0 4	875	1 10
366	0 6	437	0 10	478	0 4	506	0 4	536	0 4	1075	1 4
367	0 8										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MEC IANICS' MAGAZINE.

NDON: FRIDAY, OCTOBER 8, 1869.

THE C LD COINAGE CONTROVERSY.

WH THER any practical results will llow the prolonged newspaper dis- cussio: to which Mr. Lowe's remarkable coinag speech has given rise is problematical. One a antage has, however, already arisen from i and that is that public attention has been gely directed to the occult and com- plex, it important, subjects of currency and banki . That those subjects are not under- stood ven by those who have been deemed auth ties upon them is evidenced by the c itradictory conclusions at which they have rrived. When such men as Lord Ove one and Sir John Lubbock dispute witl ach other, and Mr. Hubbard and Dr. Leo Levi disagree, it is not easy for the uni iated to decide as to who is right and wh wrong. That somebody is in error is cer n, and Mr. Lowe is not the Daniel wh judgment is to settle the question.

thout wishing to assume infallibility for ou lves, we venture to re-assert that the pro osition of the Minister to reduce the wei ht of the sovereign was in itself a serious mis ake. At this moment that coin stands pre eminent in all respects. Its rate of fine ess is undoubted, its intrinsic and its non inal value agree, and, artistically speaking, it is an admirable example of British minting. It circulates freely, and, without question, over a very large portion of the civilised world; and even the semi-barbarous but commercial natives of the west coast of Africa recognise the English sovereign as a perfect standard of value. Let it be tampered with in weight or in purity, and faith in the coin, now universal, will quickly vanish. No arbitrary enactment of the Legislature can ever establish an artificial or undue value for a mere token of gold, which the sovereign would become by the "Lowe" process. The coin is now a fair measure or division of the material of which it is a compound. It would not be so then. Existing Acts of Parliament recognise and ordain that the weight and value of the coin must agree, and we commend the following extract from the Coinage Act of 1816 to the notice of the Chancellor of the Exchequer, *i.e.* :—"And be it further enacted that from and after the passing of this Act no person shall by any means, shift, or contrivance whatsoever, receive or pay for any gold coin current within the United Kingdom any more or less in value, benefit, profit, or advantage, than the true lawful value which such gold coin doth, by its denomination, import; nor shall utter or receive any piece or pieces of gold of this realm at any greater or higher rate of value, nor at any less or lower rate of value, than the same shall be current for in payment, according to the rates and values set upon them by law; and that every person who shall offend herein shall be adjudged guilty of a misdemeanour, and being convicted shall suffer imprisonment for six calendar months."

It is plain that those who were responsible for this clause knew that by law 40lb. (troy) of standard gold must be coined into exactly 1869 sovereigns, each weighing 123·2744 grains (as is the case at present), and that the Mint price of the article was (as it now is) £3 17s. 10½d. per oz. They, therefore, manifestly, and very wisely, as we think, ruled that the individual sovereign should form an absolute and exact measure of the substance of which it was made. To attempt an infringement of this wholesome and simple arrangement is to invoke confusion, whilst its consummation would be fraught with the direst mischief. By Mr. Lowe's scheme practically the 40lb. weight of standard gold, instead of yielding only 1869, would be made to produce 1884 sovereigns and a fraction, and yet we are asked to believe that the depreciated pieces will be equally valuable with their full weighted predecessors.

With gold at £3 17s. 10½d. per ounce, indeed, such a change cannot be effected with any chance of success. It is not at all probable that even a West African trader would be long deceived by such a piece of legerdemain. He would inevitably diminish the quantity of ivory or palm oil to be sold for British money in accordance with the diminished value of the pieces of gold paid for those commodities. This principle would become general, and no one would receive a Lowe sovereign for more than its real worth. Thus viewed, the whole question is narrowed and becomes comprehensible. With regard to the point of seignorage, it may be well to offer a few observations, for upon this the Chancellor partially relies. He proposes to deprive every sovereign hereafter struck at the Mint of twopennyworth of gold, and still to call it a pound, but he further wishes to make a charge of twopence to the importer of the metal for every sovereign he receives in ex change for that metal. After these marvellous transactions shall have been effected, Mr. Lowe thinks that the public will have no cause of complaint. He maintains that "the charge made for coining adds as much to the value of the sovereign as the amount of metal (one grain) taken from it tends to diminish its value." Some difficulty will be experienced in inducing ordinary people to put faith in this theory, should they be fortunate enough to comprehend it.

It is not clear to us that anything would be gained by the general public if a seignorage were charged. The Bank of England is the general importer of gold to the Mint, although private individuals may send in parcels of the standard metal—in quantities of not less than £10,000 worth—and receive sovereigns in exchange for them. What advantage would follow from charging the Bank twopence for every sovereign returned in exchange for its ingots is not clear. Neither is its justice apparent. The cost of coining every sovereign produced at the Mint was set down by the late Master at one halfpenny as an average. Mr. Lowe proposes to charge this sum in order to cover the cost of manufacture, and three halfpence additional to pay for the prospective wear and tear of each coin. Is this fair to the Bank or the private importer? The public it is who will use up the coins eventually, and ought not the public treasury to be the disburser of the seignorage? In other words, is it not quite as well, and would it not be rather nearer to strict justice, to vote money year by year for the purpose of carrying on the gold coinage from the national treasury?

The truth is that, from whatever point of view the Minister's plans are regarded, they do not present a satisfactory appearance. It is unfortunate to have to differ with so eminent a statesman as the Chancellor of the Exchequer, but it is an unavoidable contingency in this instance. Some time since it was demonstrated in these columns that the selection of heavy sovereigns from the channels of circulation for the purpose of illicit gain was utterly impracticable, so that here again we are at issue with Mr. Lowe. It may be trusted that a thoroughly practical gentleman will be appointed presently to the Mastership of the Mint, and then the Chancellor will have an adviser at his elbow who will protect him from critics, or, rather, obviate the necessity for adverse criticism, and thus neutralise antagonism.

THE FALMOUTH, GIBRALTAR, AND MALTA SUBMARINE CABLE.

IT is in contemplation to have submarine telegraphic communication between England and Malta complete, about the same time that communication is established between Suez and Bombay by the British Indian Cable. The amount of work required to be done to complete the present cable is very much less than with the British Indian; the length, for example, is about one-third less, and the cable has to be submerged starting from our shores, whilst, on the other hand, the Indian cable has more than a two months' voyage to accomplish before reaching its destination. Although the actual work completed up to the present time is but small, yet, for the above fact, there is no reason why the two works should not be completed simultaneously, giving us then the possession of a submarine route from England to India, and one entirely in our own hand and worked by our own staff. The core of this cable will be of the same dimensions throughout, and of the same type as the Suez-Aden section of the British Indian line. The conductor is seven strand copper, of the weight of 120lb. per nautical mile, and of a mean resistance 11·03 B.A. units, at a temperature of 75deg. Fah. The insulator consists of three coatings of gutta-percha alternating with three coatings of Chatterton's compound, to the weight of 175lb. per nautical mile, making a total weight of core of 295lb. per mile. As usual, the core is to be tested after immersion for twenty-four hours in water at a temperature of 75deg. Fah., and at that temperature it is to give a resistance of not less than 200 millions of B.A. units per nautical mile. The total amount of cable required for the work, including the necessary slack, will be 2,462 nautical miles. This length is required for the following sections:—

Falmouth to Lisbon . . .	872 knots
Lisbon to Gibraltar . .	380 ,,
Gibraltar to Malta . . .	1210 ,,
Total	2,462

For the varieties of deep sea, shallow water, and shore end cables, five varieties or types will be required. Of the shore ends required for the three sections as much as 68 miles will be wanted. This type consists of the core well served with jute yarn, steeped in a solution of cutch or other preservative mixture. The core for each type is the same, the only difference being that according to the size of the cable a little more serving may be required. The served core is sheathed with 10 B.B. galvanised iron wires, each ·375in. in diameter (No. 00 B.W.G.). Around this are applied two servings of jute yarn in opposite directions, each serving being coated with a compound of pitch, tar, and silica. Of the intermediate cable there will be two sizes, one much heavier than the other, and being really a light shore end. Of the former type 412 knots will be made. This type is made of the served core sheathed with 10 B.B. galvanised iron wires ·200in. diameter (No. 6 B.W.G.), and protected with two servings of hemp and silicated compound. The heavier type, intended specially for passing through the Straits of Gibraltar, will be sheathed with 12 B.B. galvanised iron wires, protected with a double serving of hemp and silicated compound; of this type about 51 knots in all will be required.

The deep-sea cable—677 knots—for the Falmouth and Lisbon section will be of the usual deep-sea type. The served core will be sheathed with nine strands of wire and hemp, each wire being of the best galvanised homogeneous iron of the diameter of ·099in. (No. 13 B.W.G.) each wire to be covered with 5 yarns of St. Petersburg or Manilla hemp, each strand being passed through a mixture of pitch, tar, and silica, and with a similar mixture the completed cable is served. The

deep-sea cable for the Lisbon, Gibraltar, Malta sections—1,254 knots—will be of a different type, and consist of the served core sheathed with 16 best galvanised homogeneous iron wires of the diameter of ·099in. (No. 13 B.W.G.) and protected externally with two servings of jute and silicated compound. The total amount of cable required, therefore, according to present arrangements, will be:—

Shore end	68 knots
„ intermediate . .	51 „
Intermediate	412 „
Deep sea 1	677 „
„ 2	1254 „
	2462

The foregoing gives some details of the description of cable to be manufactured, but as the work proceeds and shipping commences we will place before our readers some further information with regard to the engineering details of a work so interesting and so important.

ON THE MANUFACTURE OF PIPES.

A MUCH greater amount of importance attaches to the material of which pipes for the conveyance of water and other liquids for domestic purposes are made than people generally imagine or admit. The pipes conducting the water supply from the mains into our houses are for the most part of lead, and this, of all others, is about the most dangerous material that can be used. Lead-poisoning is now so well known to result from the action of certain waters on the pipes that we need not stay here to insist upon the point. We will merely mention in passing that the fact that water is poisoned by being brought in contact with lead has been known for several thousand years. Vitruvius, who flourished B.C. 46, forbade its use for this reason; whilst Galen, A.D 130, condemned lead pipe for conducting water because of its injurious effects. We therefore proceed first to notice the various materials of which pipes are made, then to point out their respective defects or demerits, and finally to determine the material which should properly be employed for the purpose. Pipes, in general, are made of wood, iron, lead, copper, tin, stone, and pottery ware. To these substances we may add bitumenised paper, which has recently been introduced as a material for the manufacture of pipes, although we have had samples of this ware by us for nearly twenty years. Wooden pipes are the most economical in first cost, but their many drawbacks have long since led to their disuse, except, perhaps, in some very exceptional cases. They are wanting in strength to resist the pressure of fluids, and are liable to decomposition, decay, leakage, and infection by insects. Water, too, lying long in wooden pipes, becomes putrid from the animal and vegetable matter collected in them. Iron pipes are employed as street mains for conducting water, and sometimes for house purposes, but are troublesome from rust, difficult of repairing, and are liable to break at the joints when a settlement takes place in the surrounding soil.

The process of galvanizing iron pipes has met with considerable favour, but, in the main, we think it will be found to injure the tenacity of the iron, rendering it liable to split under pressure or during frost. It has, moreover, been found to corrode rapidly. At page 59 of the Mechanics' Magazine for July 28, 1865, we wrote as follows:—"The question of the best and safest material for the construction of water tanks for ships is being discussed in France. Galvanized iron, it seems, has been employed in the French navy, but this is condemned by M. Roux, the author of a memoir on the subject, who finds zinc in the water kept in such tanks, and in such quantities that he considers the liquid unfit for domestic use. He recommends for the Imperial navy water tanks tinned inside."

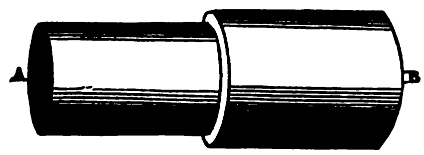
As already observed, lead pipe is commonly used for conducting water from the iron main pipes under the streets into and through buildings. The physical qualities of this pipe admirably adapt it for such use; and in this regard nothing better could be desired. It is easily bent, soldered, and repaired when damaged. These properties have influenced its adoption, notwithstanding a risk popularly understood and admitted, of injurious results to the health of those employing it. With regard to copper pipes, we need only observe that they are rarely employed except in sugar refineries, breweries, and a few other exceptional cases. Tin pipe is employed for beer, soda water, condensing worms of stills in the chemist's and pharmaceutist's laboratories, and occasionally for service pipe in dwelling houses. Stone pipes have been used, and are perfectly safe and wholesome, but difficult to manufacture, and therefore too expensive for use. Pottery ware pipes can only be made in short lengths, are very liable to be broken, and cannot be made to stand a great pressure. It appears, from some ancient buildings, that the Romans sometimes made use of them.

During the past fifty years inventors and manufacturers have bestowed much time and labour upon experiments for making a pipe which would possess the physical qualities of lead, and, at the same time, the chemical properties of tin. These experiments have been induced and stimulated by the advice of chemists and physicians respecting the want of such a pipe, as a substitute for, and to avoid the deleterious effects resulting from the use of, lead pipe. When eminent scientific and professional ability, devoted to the investigation of this subject, testifies to the existence of this evil and to the importance of its correction, it is absurd for individuals to interpose contrary opinions, entirely arbitrary, and based neither upon facts nor intelligence. These opinions are rendered still more absurd in many cases by the efforts they themselves have long been making to accomplish the same object. Among the various plans proposed, one consisted in tinning the ordinary lead pipe inside and outside by drawing it through a bath of molten tin. Another attempt was made to tin lead pipe on the inside by passing it over a hollow mandrel, through which the melted tin was supplied. The method usually employed at present to coat lead pipe is by passing the pipe as it is formed through melted tin held around the pipe above the die for the exterior coating, and supplying it for the interior from a perforated cup in the top of the core or mandrel.

This process forms a thin wash of tin which affords no protection against the lead, as an exposure to the atmosphere destroys in a few weeks all appearance of it, and the friction of water passing through the pipe removes it almost immediately. The process, when applied with the utmost care, is also extremely uncertain in the continuity of its action, often leaving spaces entirely untouched by the tin, and sometimes stopping up the pipe completely by the rapid cooling of the tin held in the cup, which then passes off in a lump, a circumstance not unfrequently discovered only when the water or gas is turned on, and thereby incurring the necessity of taking down the ceiling to remedy the fault. The cost of this pipe is from three to six shillings per cwt. more than the common lead pipe, while it possesses no advantage over it. Lead pipe has also been electro-plated with tin, but this was really no improvement upon the methods previously named. Several other plans have been tried, and more or less practised; but, while some have been attended with such difficulties in the manufacture as to make the pipe expensive, all have been imperfect up to the present time.

Now, however, we appear to have a remedy for the evil complained of in Haines' patent lead-encased block-tin pipe, which is being introduced by the manufacturers, Messrs. Walker, Campbell, and Co., of Liverpool. The pipe manufactured by these improvements differs in many respects from any other of its kind. The encased tin tube is made of any thickness desired, perfectly uniform throughout the whole of the pipe, and in coils of any required length. The two pipes are made simultaneously, and the metals are so thoroughly united at their surfaces of contact that the junction cannot be disturbed, except by the application of heat sufficient to fuse them. In this peculiarity the pipe comports itself as a homogeneous metal, and yet the two metals composing it remain quite distinct in their mechanical and chemical properties. It has all the pliability and other qualities required by plumbers, which, with its great value as a sanitary agent, warrants the recommendation of it for general use. The accompanying figures afford an idea of the character of this pipe. They show the exact thickness and proportions. Fig. 1 represents a specimen of lead-encased block-tin pipe, with a portion of the lead or outer pipe (B) removed, so as to show the tin or inside pipe (A).

Fig. 1.



Figs. 2, 3, 4, and 5 are sections of lead-encased block-tin pipe and lead pipe, tested by hydraulic pressure, and highly spoken of in a report from Mr. A. W. Craven, Chief Engineer of the Croton Aqueduct Department, in the United States. Experiments relating to the strength of these pipes have been repeatedly made, and comprise tests of all sizes in ordinary use. The pipes were subjected by hydraulic pressure to a bursting strain illustrating their comparative strength.

Fig. 2.

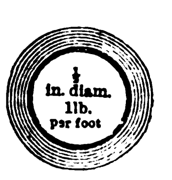
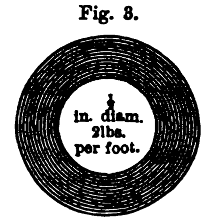
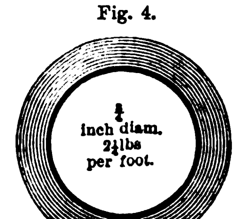


Fig. 3.



The section shown in fig. 2 burst at 1,650lb. pressure square inch, and that in fig. 3 burst at 1,200lb. pressure square inch.

Fig. 4.



The section shown in fig. 4 burst at 1,325lb, pressure square inch, whilst that shown in

Fig. 5.

fig. 5 burst at 1,150lb. pressure square inch. The heavy black line on the inside of figs. 2 and 4 represents the tin as enclosed by the lead. From a number of testimonials we

have perused it appears that for conducting gas in public and private buildings this pipe is found to be a most admirable substitute for the heavier lead pipe, or the iron tube which is so liable to corrosion. The interior surface is highly polished, and entirely free from flaws or inequalities, and thus presenting no impediment to the flow of water or gas, affords no facility for the accumulation of deposits or tendency to oxidation, which is so frequently the cause of inconvenience or expense in the pipe ordinarily employed for this purpose. With regard to the all important question of cost, as far as we have been able to ascertain there is no difference in price between the new tubing and the ordinary lead pipe. It, therefore, appears a most desirable article, and its superiority in respect of immunity from poisoning leaves no doubt but that it will rapidly come into general favour. It only requires that the public should be made fully aware of the value of the encased tin pipe to ensure that, for domestic purposes at least, none other should be used.

THE ABYSSINIAN WAR MEDALS.

THE Mint is at present engaged, in addition to its ordinary work, in striking 20,000 medals for the troops and others employed in the late Abyssinian campaign. We have been favoured with an inspection of one of these metallic decorations, and unfortunately are not able to speak very favourably of its design. The obverse, of course, comprises the head of Her Majesty as its principal device; this is shown on a plain field, and in profile looking to the left. The portrait is of comparatively small size, but it stands out in very bold relief. The royal brow is encircled by a diadem of rich workmanship, and from beneath which a veil falls in graceful folds down to the shoulder, which is partly represented. Circles of jewels encompass the Queen's neck, and it must be admitted that the features of Her Majesty, allowing a little for idealisation, are faithfully depicted. The bust is placed within an inner ring slightly raised, and engrailed, or dotted, on its inner circumference. On the outside of this ring or frame for the royal picture, a series of nine vandykes are based, their apexes touching the outer ring and protecting edge, which also is finely engrailed. The pyramidal form of the floreated vandykes gives a star-like appearance to the design, and reminds one of the brass medallets of the Virgin Mary, sometimes sold in Roman Catholic churches on the Continent at a nominal charge. In fact, the obverse, as a whole, at the first glance, suggests the idea that its design was borrowed from an original of the class of art treasures just indicated. The legend is very simple, being comprised in the one word—when you can decipher it—"Abyssinia." The letters are placed between the vandykes, and, therefore, at some distance from each other. The first and last letters, "A A," stand immediately over the head of the Queen, and make the points of commencement and termination of the legend dubious. The protecting edge, instead of being broad and bold, is narrow and meagre, and it thus confers an unfinished character on the whole work.

The reverse consists of an admirably executed wreath of laurel leaves, united at the base by a riband, and placed between the protecting edge and an engrailed inner ring. Contrary to the ordinary practice of imprinting the name of the recipient and his rank or title on the edge of the medal, the field or surface of the disc will bear that inscription in the present instance. Thus the warrior's patronymic, &c., will be encompassed by laurels, and made patent to all observers, like the words "one shilling" on a coin of that denomination. The medal is of silver slightly finer than standard, its diameter being 1¼in., its weight ⅞oz., and its intrinsic value 3s. 10½d.! From the diminished size and cost of the medal as compared with those of the Crimean and Indian rewards of valour, it might be supposed that the Chancellor of the Exchequer had interposed and lowered the standard of estimation in which British prowess was once held. It is likely that some two or three months will elapse before the Abyssinian medals are lettered, clasped, ribanded, and made ready for distribution. Every medal has to be twice, or it may be thrice struck between the dies before completion. Medal striking, as compared with the stamping of current coin, is indeed a slow process, whilst the inscribing of individual names and titles on each medal multiplies the labour and consumes much time. Claimants must, therefore, exercise that practical and essential virtue—patience. We must not omit to state that the Messrs. Wyon, of Regent-street, are the artists who designed the medal and engraved the dies for producing it.

LAND SURVEYING.

IF it be true that the art of surveying originated with the ancient Egyptians, consequent upon the effacing action exercised by the periodical inundations of the Nile, one might imagine that the subject must be pretty well exhausted at the present day. This, however, is true only so far as the principles of the art are concerned, which consist in determining an accurate delineation of the horizontal features of the earth. It is evident that the means of accomplishing this result are almost infinite, and will vary with the degree of precision necessary, and the greater or less perfection of the instruments that may be employed for the purpose. While, therefore, on the one hand, the author of a volume on the subject now before us* has to travel a good deal in a well-worn path, it is open to him on the other to strike out a few fresh branches, without actually deviating from the main line. Mr. Smith has availed himself of this opening, and also treats the whole subject in that advanced style of mathematical and geometrical investigation which it is now able to bear. In former times surveyors, as a rule, were not educated men in any sense of the term, and a book similar to the one under notice would not have been appreciated as it deserves to be. At the same time it must not be imagined that the author has plunged into the regions of abstruse mathematics. On the contrary, the formulæ and rules he gives are of a simple and practical nature, and may be easily mastered by anyone possessed of that moderate amount of algebraical knowledge which all professional students acquire as a matter of course. Mr. Smith points out clearly the cases where plain surveying, that is, surveying with the chain only, may be used, and where it is indispensable to have recourse to angular instruments. These, such as sextants, prismatic compasses, and theodolites, are in much greater favour than they were in the early days of the profession. This is owing altogether to the improvement in the education and social status of professional men. It will be easily understood that where a theodolite or other angular instrument is employed a greater degree of skill is required in the observer, and to this must be added a larger amount of mathematical knowledge. Without an acquaintance with the ordinary rules and formulæ of trigonometry, it is impossible to reduce to calculation the observations that may be taken with a theodolite. One of the most useful portions of Mr. Smith's work is that relating to the surveying of submerged districts, which, in fact, is a combination of ordinary surveying and what is nautically termed "sounding." A large number of excellent woodcuts and plates are annexed to the work as illustrations of those parts of the text which need the assistance of such elucidation. The author and the publisher may be alike congratulated upon their successful efforts to produce a volume which will form a valuable aid to all those desirous of learning how to survey and level

* "A Treatise on Land Surveying, in theory and practice, giving the best methods of surveying and levelling, for statistical, estate, and engineering purposes, together with full explanations of the construction, adjustment, and use of theodolites, levels, and other instruments required in the field and office work of surveying and levelling." By JOHN A. SMITH, Civil Engineer. London: LONGMANS, GREEN, and CO. 1869.

TELEGRAPHIC NOTES.

WE last week briefly noted the completion of a line of telegraph from the Land's End to the Scilly Isles; we now append a few further particulars. The credit of originating the undertaking is due to Mr. Buxton, of Scilly, who, since the passing of the Telegraphs Bill through Parliament, has been unremitting in his endeavours to get the Post Office authorities to lay down a wire to the island, but they having declined to take the matter in hand, it was eventually decided that it must be done by a private company. The company was formed and negotiations were entered into with the Post Office, the Board of Trade, and the Duchy of Cornwall, and with Mr. Augustus Smith, lord of the Scilly Isles; and eventually all the powers sought for were obtained, Mr. Smith granting a concession to the company of the exclusive right to lay, maintain, and work the cable for twenty-five years. Mr. Fenwick, of Gateshead, was entrusted with the manufacture of the cable, which is one of the light kind, and is about three-quarters of an inch in diameter. The core consists of three copper wires, insulated by india rubber, the work of the Silvertown Company. The outer covering is composed of six strands of the best Manilla hemp, through each of which there runs a galvanised iron wire. It weighs 17cwt. per mile, and its breaking strain is 3½ tons. The shore ends, for a mile and a half, are bound, in order to protect them from chafing against the rocks, by six strands of charcoal galvanised iron wires, each strand containing seven; and perhaps nowhere is the perfection of the workmanship so clearly visible. Thoroughly compact, the cable at these points is yet admirably flexible. The wire-coating naturally adds materially to the weight of these portions, which, instead of 17cwt. per mile, are four tons. The steamer "Fusilier," which was engaged in the work of laying the wire, and had some few passengers interested in the work on board, on her return to Penzance was received with a salvo of guns. The cable lies between Yawn Reeth, a small cave in Millbay, a mile and a half south of Land's End, and a spot close by Deep Point, beneath the high lands of Normandy, at St. Mary's, one of the Scilly Isles.

The following particulars appear in the "Eastern Budget" relative to the proposed submarine cable between Odessa and Constantinople:—The project is warmly supported by the department of commerce in Odessa, and a company in London has offered to complete the undertaking for £75,000. It is calculated that in order to obtain a return of 5 per cent. on the capital at least 50 dispatches a day, or 18,000 a year, will have to be forwarded The "New Russian Telegraph" says that the laying of this cable will be of the greatest advantage to Southern Russia, as telegrams can now only be forwarded between Odessa and Constantinople *via* Vienna and the Danubian provinces. At the station of Toultcha so many telegrams are received that they are sometimes delayed from two to eight days.

On the 1st inst. the submarine telegraph cable, lately manufactured by Mr. W. T. Henley, of North Woolwich, for connecting Grisselhamm (Sweden) and Nystad (Russia), was successfully laid by him, thereby completing the system of the Great Northern Telegraph Company of Copenhagen. The length of the cable is about 100 nautical miles.

We understand that the post of engineer in the new Department of Post-office Telegraphs will be conferred upon Mr. R. S. Culley, the present engineer of the Electric and International Telegraph Company.

The number of messages which passed over the French Atlantic Telegraph Cable during the week ending October 2, was 775, the cable charge upon the same being £1,710

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

AMMONIA EXPLOSIVE—CHLORAL AND ITS EFFECTS—A SCARLET DYE WITH ROSANILINE—IMITATION SILVER—IMPROVED MODE OF REFINING RAPE OIL.

THE "ammonia" powder, some of the effects of which we noticed in our last, excites curiosity from its name, ammonia not being recognised as an explosive. In all likelihood, the ingredient in the composition from which the name is taken is picrate of ammonia. This alone is not a very explosive compound, but when mixed with a nitrate or with a chlorate, it forms a detonating mixture of great power, perhaps of greater power than the mixture of picrate and chlorate of potash which caused the terrible explosion in the Place de Sorbonne. Such a compound may be a little safer than nitro-glycerine, since it would not be liable to spontaneous explosion, and would require greater force to set it off. But the mixture can possess no such advantages as would be likely to make a rival of gunpowder and gun-cotton.

We may notice here an English discovery, of which we learn from the proceedings of the Academy of Science of Paris. The Academy meets every week throughout the year; and though, in all probability, the communication was made simultaneously to our Royal Society, we are not likely to hear of it through this channel until about Christmas. It is true that this particular discovery is of no great importance, but if it had been ever so valuable the same delay would have occurred. Mr. Crace Calvert has found that nitrogen is obtained by the action of hypochlorite of soda on sulphate of ammonia. It ought to be borne in mind that Mr. E. Davey, of Dublin, several years ago, found that nitrogen was liberated by the action of hypochlorite of soda on urea. The reactions in the two cases will be somewhat similar; and the step from the one discovery to the other is not a wide one. As Mr. Davey's discovery enables us to estimate urea very accurately, so Mr. Calvert's process will perhaps be useful to chemists who have to value commercial sulphate of ammonia.

We have mentioned the new anæsthetic, which, however, proves to be no anæsthetic, but a sleep producer of the most gentle and agreeable quality. Chloral is a compound of chlorine, carbon, hydrogen, and oxygen in proportions which lead chemists to assign to it the formula $C^4Cl^3HO_2$. It may be prepared in two or three ways, but the most easy is by distilling together starch or sugar, hydrochloric acid, and peroxide of manganese. This process, although the most simple, is still complicated and troublesome, particularly in the purification of the chloral, which in the end is obtained in the form of a thin oily liquid which assimilates water, and becomes a solid hydrate. The value of the substance is such as will stimulate chemists to endeavour to simplify the mode of production; and we shall soon, no doubt, have chloral at a more reasonable price. As to its effects, it is not necessary to say more than that a few grains, in the course of a quarter of an hour, produces a deep refreshing sleep, lasting for several hours, from which the subject awakes without feeling any discomfort.

Attempts have been made to dye scarlet by means of picric acid and rosaniline, but only with partial success. The picrate of rosaniline precipitated upon the fabric has always a dull, tarnished shade which nobody admires. A beautiful bright scarlet may, however, be obtained by first dyeing a yellow with Persian berries or turmeric, and topping this with rosaniline, a pure colour being employed. The berries, mordanted with tin, alum, and cream of tartar, give the best ground.

Wagner and Winkler give the proportions for a new white alloy, or imitation silver, which takes a beautiful polish and does not readily tarnish. It is composed of 70 parts of copper, 23 parts of nickel, and 7 parts of aluminium.

M. Michaud has improved the mode of refining oils by means of sulphuric acid. As ordinarily employed the acid is poured among the oil, and the two are mixed together by means of an agitator. The admixture is tedious and never very complete. M. Michaud directs the acid upon the oil in very thin streams, and at the same time blows a strong current of air through the oil. In this way a very lively agitation is maintained, and the air carries the "foots" to the top, where it forms a thick scum, which may be skimmed off. The draught of air is then continued as long as a scum forms. After this a jet of steam is sent in, and the oil kept for half an hour at 212deg. Fah.; after which the mixture is allowed to settle and the oil is then run off and filtered. An oil of very superior quality is said to be obtained by this process.

SAFETY OF DR. LIVINGSTONE.

FALMOUTH, OCT. 6, NIGHT.

A MISSIONARY who has landed here to-day from Zanzibar brings important intelligence concerning the safety of Dr. Livingstone. He states that letters had been received at Zanzibar by Dr. Kirk from the great traveller himself, dated Lake Tanganika, February, 1869. At that time Livingstone was well, but short of provisions. He had been deserted by all the Europeans who had accompanied him, and was then living on rice and fruits supplied by Arabs.

THE CHEMICAL FIRE ENGINE.

ON Friday last, a series of experiments were made with Dicks' chemical fire engine, which thoroughly demonstrated its value as a perfect fire extinguisher. This apparatus, as will be seen by the annexed cut, is what is generally

known as "l'extincteur," but the details of which have been improved by Mr. Dicks. The engine is simply a huge soda-water bottle, the contents of which are allowed to escape by opening a valve-cock instead of by withdrawing a cork; in fact, it is a monster gazogene. The cylinder is filled with water, into which is emptied a given quantity of bicarbonate of soda. Tartaric acid to the required extent, in the shape of crystals, is then placed in a perforated tube, which is screwed into the top of the cylinder, and, of course, dips into the alkaline water as seen in the section. The crystals take some time to dissolve, and thus the carbonic acid gas is generated by degrees. In about four hours the apparatus is ready for use. It is, of course, always kept charged, and the inventor has found, on trying one which had been charged for three years and a half, that it was quite as active as those only recently charged. On the outbreak of a fire, the arms of the operator are put through the slings shown on either side of the elevation of the machine, and it is carried on his back. He directs the hose with his right hand whilst he regulates the valve with his left. On the occasion to which we have referred, the agent for the apparatus, Mr. J. Sinclair, of 9B, New Broad-street, City, had prepared a trough, some 10ft. square, which was filled with pitch. Upon this some petroleum was thrown and the whole was ignited. In a few seconds, Mr. Sinclair had extinguished the flaming mass, which was afterwards re-lit and again extinguished as rapidly as before. Afterwards, a structure of inflammable wood, 14ft. long, 9ft. high, and 4ft. thick, composed of barrels, split wood, and shavings, profusely sprinkled with petroleum, was set on fire, and it was allowed to burn fiercely. Two extincteurs were brought to bear upon the burning mass, and the flames were instantly subdued. A quantity of petroleum was again thrown over the structure and allowed to burn up more fiercely than before, this time the fire getting a good hold of the material used, when it was again completely extinguished in about a minute and a quarter by the two machines. The importance of the apparatus in arresting fires at an early stage, and thus preventing large conflagrations, cannot be over-estimated. We are informed that, during the four years that the machine has been before the public, seven hundred fires have been successfully arrested by them, thus saving a vast amount of valuable property, and, it may be, a number of valuable lives. Its proved efficiency is such that no one should be without such a simple and economical means of rapid fire extinction.

THE PROPOSED CHANNEL BRIDGE.

THE arrangements which are being made in Paris for testing M. Boutet's principle of bridge construction are now nearly completed. The final experiments, which will shortly be inaugurated, will be attended by the principal engineers in France; invitations will also be sent to the leading engineers in England. We may, therefore, conclude that its merits and demerits will be thoroughly investigated. The main point to be determined is the solidity of the structure, for in its construction there is really no practical difficulty. The piers will be floated into their required position, then submerged and screwed into the rocks at the bottom of the Channel by means of powerful submarine drills. The upper part of the main structure is to be composed of iron cables, carried across each pier, and united by members of the same material. The spandrels of the arches will form a sort of cross lattice bracing, and will, it is said, add considerably to the support of the whole bridge. The total cost of the bridge will not, it is estimated, exceed £3,000,000, and it is believed that in little more than two years from the date of the commencement of operations the bridge may be got into actual use. When we consider the gigantic engineering works which have been so recently and so successfully carried out, it must certainly be admitted that after all there is nothing so very impracticable in a bridge across the Channel. It is but a multiplication of large spans, the members of which, so far as we have yet seen, are by no means calculated to overstep the limits of safety by the production of injurious strains. It is simply a question of "bigness," such as has been the leading idea of engineers of late in designing roofs for railway stations. Of course storms may and doubtless will interrupt the progress of the work occasionally, and may possibly extend the time of construction beyond that anticipated by M. Boutet. But as yet we can find no valid reason why the Channel should not be bridged. However, we trust the forthcoming experiments will set at rest all doubts and fears as to the correctness of the Boutet system.

MARSDEN'S TUBE JOINT.

THE important improvements in making the joints of pipes tight, and at the same time flexible, which have been effected by Mr. C. Marsden, of 224, Kingsland-road, London, were fully described at page 279 of our last volume. Since then Mr. Marsden has put his invention to practical proof, and by various experiments has satisfactorily demonstrated it to be a perfectly air-tight, water-tight, steam-tight, gas-tight, and withal a flexible, joint. One of the comparative trials was with an ordinary 2-inch gaspipe attached to an hydraulic force pump; there were six screw joints, and a 1-inch tap was used as a blow-cock. The joints all leaked and founted, whilst the flexible joint under the same pressure remained intact, thus proving its efficiency. Mr. Marsden's plan is to have a flange on one end of each length of pipe, upon which circular projections are formed. The opposite end of each length is also made with a protuberance on the exterior, which has circular projections similar to those on the other end. The spaces between the projections are filled in with packing, and the ends of the pipes are brought together, the end of one just fitting into that of the other. The ends are then connected by being enclosed within a socket formed in two parts, which are firmly held together by rings and screws. The inner edge of the end of one pipe is chamfered, and the outer edge of the end of the other is made to fit inside the chamfer, so that a ball and socket action is secured, and the pipes will follow any undulation formed by a settlement in the ground, or arising from any other cause. Mr. Marsden has a hinge joint for steam and fire-

engines, which can be attached in a few seconds, and is, therefore, of the first importance in connection with the saving of life and property from fire.

The simple flexible jointed pipe will follow over or under any inequality of ground, and yet is perfectly air-tight; a joint is put in its proper place in a few minutes, a defective pipe can be easily removed—there is no strain on the joint as there is with rigid joints. When a pipe is wanted to be removed, all that is required to replace another is to knock out the wedges and the two rings will slide off, or press the bolt in the hinge joint, lift the top half-socket, then the pipe can be removed without any breaking of flange either of iron or stoneware. No lead or cement is required, thus a great saving of time is gained. This is a most important sanitary invention, for proprietors of houses have too often experienced the nuisance produced by the escapement from drain pipe joints damping the foundation of houses, saturating the earth with foulness, and sending the effluvia through the house, as well as often causing the foundations to sink. All this can be prevented by using Mr. Marsden's joint in stoneware, for no straight line is required, it will deviate as wanted, and keep a perfect air-tight socket.

For ships, this joint is invaluable for steam pipes, pumps, or other purposes, as it will give to the strain of the vessel without causing any leakage. For connecting locomotive steam engines to tenders it is an important improvement and advantage; in fact, this joint is for a number of purposes of great importance, for the ball and socket can be used as from the castings without grinding in. A tunnel on the same principle, but slightly altered in detail for rivers where the water is from 50ft. to 100ft. wide, instead of fords or bridges, where anchorage is not required, is proposed by Mr. Marsden for vehicles and foot passengers. It could be made in three parts, with two joints 11ft. or 12ft. in diameter, floated on barges and lowered without much difficulty, connecting land to land; a 12ft. diameter would make an 8ft. roadway and 10ft. 6in. high inside; 11ft. diameter, 8ft. road, 9ft. high. Tunnels for railways of any length from one mile to twenty or more, of any diameter, without any screws to get out of order by the vibration of trains passing, are again differently carried out in detail. One end of the pipe is fitted with a series of stepped plates, which are secured in their places by rivets, and the adjoining end of the next pipe is fitted with a bulge. Another series of plates is employed, one end of which is forced under the open end of the stepped plates. They are prevented from falling out by being guided into position by a number of rings, fitted on to the end of the pipe. Another ring is employed on the outside to hold the plates; a portion of this ring is looped or pocketed to enable the plates to be placed in position. When passed through this looped portion, they are made to slide round in succession, so as to meet each other, until the whole diameter of the pipe end is covered. They are then firmly secured in places by keys being driven in between them and the ring; the loop is then filled in with a wedge piece, and thus the whole joint is made sound, flexible, and tight. It will thus be seen that this invention is capable of application to some of the most useful and important purposes of construction.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

A VERY numerously attended meeting of members of this institution was held on Saturday, the 2nd inst., at the City Terminus Hotel. Mr. J. Newton, of the Royal Mint, presided on the occasion. The business of the evening commenced as usual with the election of new associates, and among these was Mr. Yeats, foreman of the foundry in her Majesty's dockyard, Bombay. It was next arranged that the members should pay a collective visit of inspection, on Saturday, the 16th inst., to the Abbey Mills Pumping Station of the Main Drainage Works, for which Mr. Bazalgette had kindly accorded permission.

Mr. Nicholson, of the Blackwall Ironworks, Isle of Dogs, then proceeded to read a paper on "A Continuous Expansion Steam Engine," an invention of his own. After some preliminary remarks, the author went on to say that after Watt had converted the reciprocating motion of the steam engine into a rotary motion his next step was to endeavour to effect economy by cutting off the steam at an earlier part of the stroke, and this plan was now known as the Cornish principle. This was followed by Wolff's arrangement of a double cylinder engine and certain modifications of the same by other engineers. Of the Cornish principle he (Mr. Nicholson) should observe that it was far from being perfect. It ensured the taking of all the useful effect out of the steam, but it produced a motion in an inverse ratio to its expansion, and which was therefore inapplicable for many purposes. Wolff's engine he considered to be decidedly better both as regarded economy and action. The continuous expansion engine he believed would be found superior in all ways to both. It was applicable to marine, stationary, and locomotive purposes, and more especially so to the first named. There was very little difficulty in modifying existing marine engines so as to embody in them the continuous expansion system. He proposed to employ two cylinders in all cases, and sometimes three, or even four. In this class of engine no secondary steam was used, the energy of the steam, so to speak, being eliminated in little more than half a revolution, whilst no cut off valves were needed. The defective link motion was avoided. By this arrangement, too, a better rotary motion was obtained than by any other known means, and a full practical range of expansion ensured the highest degree of economy. In the Wolff's engines the effective working area was equal to the difference of the areas of the two pistons, and if the cylinders were made of the same diameter therefore those engines would be found comparatively useless. In such case the mean pressure on the one piston would be found just equal to the mean resistance on the other. This would not be so with the continuous expansion engine, for if the pistons were made of equal area the result would be found thoroughly satisfactory. By cutting off the steam at five-eighths of the stroke in the first cylinder that cylinder did an ordinary duty, and the residue of the steam was worked up in the second or expansion cylinder, thus producing a smooth motion and a maximum of power with a minimum consumption of fuel. The most practicable and efficient way to expand steam was to terminate the stroke at a pressure that would yet do a little more work and then balance the useless resistance. If this theory were true the continuous expansion engine possessed manifest advantages, because the piston of the first cylinder or cylinders that receives the steam from the boilers were in the most powerful position, and could afford to allow of a higher rate of expansion than could be profitably effected in a single cylinder expansion engine.

The whole of Mr. Nicholson's proposed improvements in the steam engine were made more clear on Saturday by the aid of numerous diagrams, and it was also mentioned that they are embodied in the engines of the steam-tug "Era," now employed on the river Thames. Some rather sharp comments upon the extravagant (as Mr. Nicholson thought) consumption of fuel in ships of the Royal navy and the necessity of checking it brought the paper to a close.

In the lengthened discussion which followed it, Messrs. A. Watkins, Briggs, Irvine, Thorburn, Randall, Ives, Gibbon, and the Chairman took part, Mr. Nicholson replying satisfactorily to some objections raised.

In submitting a vote of thanks to the author of the paper, the Chairman took occasion to say that he, in common, he was sure, with every member of the association, felt gratified in the highest degree to find the Government recognising the eminent services of Mr. Whitworth and Mr. Fairbairn. In the conferring of baronetcies upon those gentlemen, who had risen by their own exertions and merit from humble positions in the mechanical ranks of the community to their present exalted sphere, honour had been reflected upon every engineer and mechanic in the kingdom. He wished, therefore, on behalf of the association as well as on his own account, to give expression to the pleasure and gratification they all felt at the conduct in this instance of Mr. Gladstone, and of the hope they had that Sir Joseph Whitworth and Sir William Fairbairn might long be spared to enjoy their well-earned dignities. These remarks were well received, and the vote of thanks to Mr. Nicholson having been unanimously carried, the proceedings terminated.

AMONG the "things not generally known," is that St. John's Church, Wolverhampton, contains one of the oldest and finest-toned organs in the kingdom. The instrument was built in the reign of Charles II., by Revatus Harris, the Banfield of the seventeenth century. After such a lengthened service it will surprise nobody to learn that the organ needs a "thorough repair."

IMPROVED METHOD OF OBTAINING BENZOLE.

THE gaseous products resulting from the destructive distillation of coal, commonly called coal gas, contain a variable amount of benzole and its homologues, which, as is well known, may partly be separated therefrom by submitting the gas to cold or pressure, or to a treatment with chemical reagents, such as nitric and sulphuric acids, chlorine, and bromine. An improved method of obtaining benzole and its homologues from coal gas has been recently patented in England. It is the invention of Messrs. Caro, Clemm, and Engelhorn, of Mannheim, Baden. It consists in placing coal gas in contact with such substances which act as solvents for the benzole and homologues contained therein, without, at the same time, causing them to undergo any chemical change, and, while it has been found that all known solvents of benzole will effect this purpose, the inventors place coal gas in contact with certain hydrocarbons, such as petroleum, schist, and mineral oils, and the higher boiling varieties of coal tar naphtha, as these hydrocarbons are easily procurable and interfere little, if at all, with the illuminating power of coal gas, and, by mere distillation, the benzole and its homologues may be separately obtained from their solution therein, and the solvent rendered again fit for renewed application.

In those cases in which it is essential not to injure the luminosity of coal gas by depriving it of its benzole, the inventors employ as absorbing agents the higher boiling varieties of coal tar naphtha, the boiling points of which range from 180deg. Centigrade upward, and it has been found that by placing coal gas in contact with such hydrocarbons, they will take up benzole and its homologues from the coal gas while the latter becomes charged with the vapours of the liquid hydrocarbons employed. Although any suitable apparatus may be made use of in order to effect the contact of coal gas with the absorbing agent, the inventors prefer the employment of the common coal gas purifiers or scrubbers. The gas enters at the bottom of the apparatus, and, while ascending, it meets a shower of finely-divided coal tar naphtha, which descends from the top of the scrubber, and at a rate varying (say) from 20 to 40 gallons for every 10,000 cubic feet of gas traversing the apparatus. This operation is effected after the final purification of the coal gas and immediately before its passage to the gas holders. The liquid hydrocarbon which arrives at the bottom of the apparatus charged with benzole is drawn into a still, which is heated to a temperature of about 130deg. Centigrade. The distillate or hydrocarbon obtained by this distillation, which generally amounts to 10 or 15 per cent. of the whole liquid, contains chiefly benzole and toluole, which formerly were diffused in the coal gas, while the residue in the still is again transferred to the scrubber for renewed application.

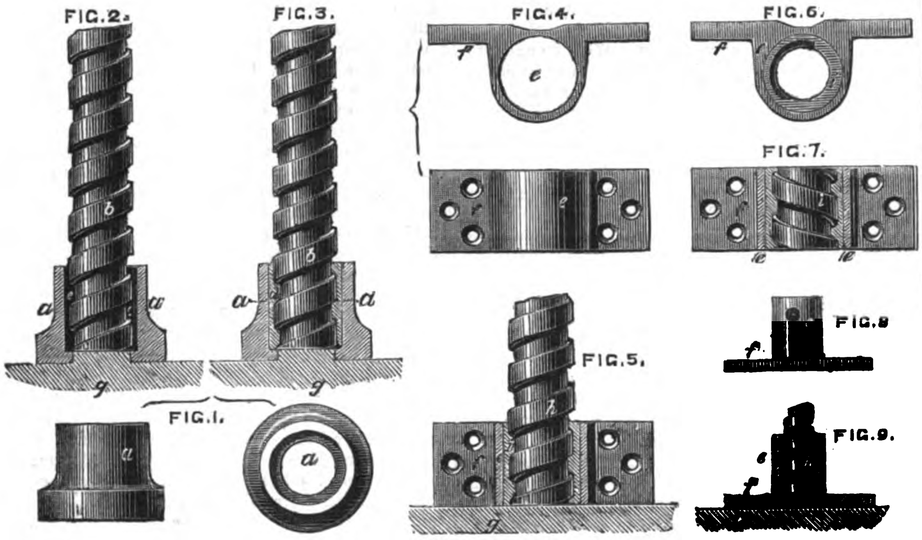
SCIENCE INSTRUCTION FOR WOMEN.

AN important experiment is about to be tried at the South Kensington Museum to promote the instruction of women in science. By permission of the Lord President, Professors Huxley, Guthrie, and Oliver are about to commence a course of lectures on natural science, beginning in November. The fees will not exceed a shilling a lecture, with voluntary examinations, and the terms will even be lower to schools and governesses. The Duchess of St. Albans, Mary Marchioness of Salisbury, the Countesses of Tankerville, De Grey, and Granville, Lady Northcote, and many other ladies have expressed their willingness to assist this experiment. The Hon. and Rev. F. Byng, of Onslow-gardens, London, S.W., is the treasurer and secretary.

DR. CARL BRUHNS, the director of the Berlin Astronomical Observatory, proposes to edit a scientific life of Alexander Von Humboldt, to which the greatest German men of science have promised to contribute. It will be divided into two parts. The first will contain his life in the common acceptation of the word, which has been entrusted to the care of Dr. R. Ave Lallemant, who will have access to a large number of documents and unpublished MSS. The second part will treat of Humboldt's scientific discoveries and investigations. It will be divided into eight chapters, each treating a single science, and committed to the charge of a man of great eminence in that branch. Those who are in possession of unpublished information as to the life or studies of Humboldt are requested to forward it to Dr. Bruhns. The work will be published by F. A. Brockhaus, of Leipsic.

SCREW BOXES OF TABLE EXPANDERS.

BY MR. J. FITTER.



MANUFACTURE OF SCREW BOXES OF TABLE EXPANDERS.

THE invention we are about to describe, and which has been patented by Mr. Joseph Fitter, of Birmingham, consists, first, in making the nuts or screw boxes of table expanders of a white metal instead of the brass or gun metal ordinarily employed for that purpose. Nuts or screw boxes made thus are said to work with a very small amount of friction, and to possess great wearing properties. The invention consists, second, in casting the nuts or screw boxes of table expanders on the screws of the table expanders by the use of metal moulds instead of casting them in sand, as is usually practised. This part of the invention is applicable to the manufacture of nuts or screw boxes made of the white metal or of other metals.

The manner in which this part of the invention is carried into effect is illustrated in figs. 1, 2, and 3 of the accompanying engraving. In the metal mould or chill marked *a*, represented in elevation and plan in fig. 1, and vertical section in figs. 2 and 3, is placed the screw of the table expander, or a pattern screw properly supported. The mould is now ready for the casting of the screw nut or box upon the pattern screw, as represented in fig. 2, where the screw supported in the axis of the mould is marked *b*. The fused metal is poured into the annular space *c* between the screw *b* and the inside of the mould, and the screw nut or box is thus cast upon the screw *b*, as represented in fig. 3, where the cast screw nut in the mould is marked *d*. After the metal has solidified, the mould is fixed in a holder, and the screw nut or box *d* upon the screw *b* is forcibly withdrawn from the mould *a*, the taper figure of the inside of the mould permitting of the ready withdrawal of the cast nut therefrom. The screw *b* is then unscrewed from the nut or screw box, when it is ready to be used.

Mr. Fitter's invention consists, third, in making the nuts or screw boxes of table expanders of an outer iron box or frame, within which the acting part of the nut or screw box is cast. The acting part of the nut or screw box is made either of the white metal or of other metal. The inner acting part may be made separately and forced into and pinned in the outer box or frame. By this improvement, great strength in the nuts or screw boxes is secured, together with great economy in their manufacture. Fig. 4 represents in section and plan the outer iron box or frame used in carrying this part of the invention into effect. The frame consists of a cylindrical part or barrel *e* open at both ends, having side plates *f*, by which it is fixed to the crossbar of the table. The acting part of the nut or screw box is cast within the barrel *e* of the frame in the manner represented in section in fig. 5. The box or frame *e f* is supported on a horizontal rail *g* so as to close one end of the barrel *e*. The screw *h* of the table expander is placed in the barrel *e*. The parts being thus arranged, the metal is poured into the space between the screw *h* and barrel *e*, as represented at *i*, fig. 5, thereby forming the acting part of the nut or screw box. After the metal has solidified, the screw *h* is removed by unscrewing it from the cast screw box *i*. The acting part *i* of the screw nut thus cast in the frame is firmly secured therein by means of pins formed by the cast nut, that is, holes are made in the frame, into which the metal runs, and thus fastens the acting part of the nut to the frame. These holes to receive the cast metal are made at the top of the iron frame *e*, fig. 4.

Fig. 6 represents in end elevation, and fig. 7 in horizontal section, a screw nut or box made in the manner described, that is, of an outer iron box or frame *e*, with a cast inner part *i*. Fig. 8 represents in elevation an outer iron box or frame of a different form from that represented in fig. 4, and fig. 9 represents in section the frame and pattern screw placed in position for casting the acting part within the outer box or frame.

The apparatus for supporting and adjusting the screw perpendicularly in the mould consists of a square bar connected with the horizontal platform or table *g* on which the mould is supported. On the upright bar, two or more holders or clamps slide, being fixed at any required height on the bar by set screws. The screw upon which the nut is to be cast is passed into holes made in the front of the clamps. In front of each clamp is a second set screw, which, by being driven home, fixes the screw in its perpendicular position, and holds it steadily while the nut is being cast upon it. After the nut has been cast, by then removing the front set screws, the screw may be withdrawn from the supporting apparatus, and the screw removed from the cast nut and replaced in the apparatus ready for the casting of another nut.

The white metal to which we have referred is composed of 27 parts by weight of lead, 7 parts by weight of tin, and 3 parts by weight of antimony, or thereabouts; the proportions may be varied within considerable limits without material injury to the metal or alloy.

ON THE MONCRIEFF SYSTEM OF WORKING ARTILLERY AS APPLIED TO COAST DEFENCE.*

By Captain Moncrieff.

UNTIL the time of the Crimean war very little and very slow progress had been made in artillery. Cannon were manufactured on nearly the same models, and of the same materials that had been used for 300 years. Before that time, cast iron was not in use, but the forged or bronze guns, although in some cases large, were not what is now considered powerful, and the penetration of their shot was not sufficient to pass through a parapet of earth that is now pierced even by light rifled artillery. The conditions, therefore, under which artillery was worked, and the means provided for protection against its fire, remained much the same as they were in the time of Vauban. Several events during the Crimean campaign confirmed an impression that has always been more or less entertained, that an increase in the power of individual guns produced greater results than could be obtained by a much greater weight of metal, distributed among a larger number of small pieces of artillery. It is not too much to say, that the development of this art has, since 1855, changed the character of war both on land and water. It has established completely the superiority of a few large pieces over a much greater weight of metal in smaller guns. It has given artillery of all classes a range, a penetration, and an accuracy of fire, which throw into the shade the greatest results that had been previously obtained. It has also stimulated the advocates of cast-iron smooth bores to produce guns that might rival the rifled artillery; and yet it is by no means probable that the limit of power, either of large smooth bores or rifled guns, has been arrived at.

When it became apparent that mighty results were to be obtained from improved artillery, a great deal of engineering talent was directed to the subject. Comparatively new appliances, such as the steam hammer, and new methods of working steel, were called to aid in the construction of the new and powerful guns. So much interest, indeed, was taken in the subject, and so much attention absorbed by it, that the conditions which these improvements in artillery themselves imported with them ran some danger of being neglected. The power of artillery became so great, that the ordinary provisions for protection against its fire were rendered useless. Forts that were considered strong twenty years ago would crumble under the shock of modern projectiles, and in some cases would even be too weak to support the guns while they were fired. That service which the new artillery affected most palpably was the navy, and the navy accordingly took the initiative in introducing means calculated to resist the penetration of the new and terrible projectiles. Everyone is more or less conversant with the process that has been going on of covering ships' sides with iron, which has increased in thickness till it really looks as if the process at last would only be limited by a ship's power of flotation. War ships, however, not only protect their sides against shot, but they also carry the heaviest artillery on their decks. This fact could not be overlooked by those who had to construct coast defences, as well as other works against which modern heavy artillery might be used.

I shall not enter into details regarding the successive steps which were taken in England in this direction, as I understand Colonel Jervoise has already done so in this Institution. It is enough to state that great engineering skill has been exercised, and unwearied efforts have been made to meet the new conditions. That skill and these efforts have, with the experiments at Shoeburyness, given us defensive iron structures which are marvels of strength and ingenuity. Unfortunately, they are also marvels of costliness; and there is room to hope that their use will, therefore, be generally confined to such positions on land as can only be protected by such iron structures. This hope is founded on another system, with which my name is connected, and which I am here to explain. Before doing so, I shall point out the dilemma which left military engineers no alternative, and which compelled them to give up in succession the use of earth, concrete, granite, &c., and at last to resort to the most expensive, but the strongest, material—iron.

There are two considerations always to be taken into account in providing the means of using artillery; the one is to place the gun so as to be most formidable to the enemy, and the other is to place it at the same time under as much cover as possible, so that it is not liable to be disabled, nor are the men serving it liable to be destroyed by hostile fire. These two conditions interfere with one another, that is to say, whatever has hitherto been gained in one direction has been lost in the other. Guns, *en barbette*, lack protection; guns in embrasures or in casemates sacrifice, on the other hand, free lateral range, and it is more difficult in their case to see the enemy, and, therefore, to lay the guns in action. The difficulty that presented itself with the introduction of late improvements in artillery was simply that the increased precision and range, coupled with great improvements in the manufacture of large shells and also in small arms, rendered barbette batteries too exposed to be relied on. At the same time, the tremendous penetration and precision of the new artillery rendered the ordinary parapet and embrasures useless.

What was to be done under these circumstances? Protection from direct fire must be got at any price. The first impulse would be to thicken the parapet. This could not, however, be done, as the necessary angle in the cheeks of the embrasures required for training the guns opens

* Read before the Royal Institution.

up a wider aperture, in direct proportion to the thickness of the parapet, making the maximum thickness in practice 30ft. But shot have been known to penetrate more than 30ft. into the earth; and the most important part of the parapet, viz., that near the guns, must always be thin and weak, whatever may be the thickness of the rest. Shells, striking this part, would just meet sufficient resistance to burst them, and would make havoc among the men. Next, granite masonry was thought of; but it proved in some respects worse than earth, and was found practically bad; there was no alternative but to go to iron. This conclusion was reluctantly arrived at, and reluctantly it was acted on. The decisions of committees which investigated all the bearings of the question, the opinions of professional men, and the experiences of the American war, all coincided, and, accordingly, our important coast works were designed to receive iron shields, casemates, and cupolas. Vital positions in England, such as dockyards and arsenals, must be fortified. It would be false economy indeed to use any method of fortification that experience has proved to be insufficient. No savings could justify the erection of works that might prove at once the tomb of their defenders and, perhaps, of the nation's honour. Therefore, the only proper decision was to take that means to meet the difficulty which was at the time considered best and safest. Expense was properly a consideration very secondary in importance to efficiency.

I shall now endeavour to point out the difficulty of the task which lay before the engineer, even after the decision in favour of iron, from the extraordinary advances already spoken of in artillery. There is only one morsel of comfort left for those who have to provide for the requirements of defence, viz., that a form of artillery fire of a very galling nature remains exactly as before, and, indeed, is not much better than it was in the time of Queen Elizabeth. What is alluded to is vertical or mortar fire. There is some consolation, too, in the reflection that the cause of this fire not being much improved is one to a great extent likely to be lasting. Rifled mortars would no doubt lessen deflection to right or left; but as long as gunpowder is affected in strength by the slightest atmospheric or other influence, and still more certainly as long as a slight error in elevation at long ranges will make a large error on the plane of fire, the comparative inaccuracy of vertical fire must continue. To show how little can be done in this way compared with the admirable precision and accuracy of direct fire, I may state that 100 rounds were fired one day last season at Shoeburyness at 800 yards range, with a 13-inch mortar at the row of experimental casemates which cover a good deal of ground. The mortar was laid with spirit levels and all the appliances of the school of gunnery, and yet the 100 rounds were expended without a single hit. If such is the case with a steady platform, and under such exceptionally favourable circumstances, it can easily be seen how uncertain in its effects would practice be from mortar boats, which move with every wave, if directed at an equally small object. During the eleven months' siege of Sebastopol, the French had 242 mortars engaged, which were themselves exposed to vertical fire, and yet not one of these mortars was disabled. It is, indeed, a strange contrast, that while direct fire is getting more powerful, more accurate, and more destructive every year, vertical fire remains much as it was, and can only be relied on to hit a large object, such as a fort, a town, or anything that covers a great deal of ground. Notwithstanding this, it would be a great mistake to despise it as a powerful and galling means of attack.

To return to the difficulties of meeting direct fire in coast defence. It must be borne in mind that batteries intended to engage ships are obliged to meet an enemy who can move his position to that quarter where he is least exposed, who can continue in motion while he is conducting his attack, and who can seek out the most vulnerable face of the landwork to operate upon. In constructing such batteries it is first of all necessary to make them of sufficient strength to resist the guns of ships which are the most powerful that can be made. It is next required that these batteries should be constructed in such a manner that they can direct their fire with rapidity and precision in any direction in which the ships can take up their position. And, lastly, it is required that they should mount guns of sufficient weight and power to be formidable to the heaviest ironclads. In former times, guns *en barbette* were preferred for this purpose, because they met the two first requirements alluded to; that is to say, that from not being confined by embrasures or ports, they were able freely to follow their floating enemy whatever position he might take up, naval fire at that time being neither so correct nor so formidable as to make such batteries unserviceable. The case, however, is now completely changed; for not only have guns been improved but ammunition also, and heavy shells are most destructive. Rear-Admiral Porter, of the United States Navy, in a report on coast defences, says, "Such guns, standing so high up, are just the objects that naval gunners would delight to explode their shrapnell against, and from my experience in naval gunnery, the third shell would kill every man at the gun."

Von Scheliha, in his treatise on coast defences, says, "Guns mounted *en barbette* may always be silenced by an ironclad." This form of battery, therefore, is disposed of. We shall now examine the difficulties connected with the other alternatives. Common masonry batteries have been condemned as worse than useless, as they would only make the ship's fire more destructive than if directed against guns *en barbette*. Next comes the expensive alternative which has been adopted, viz., iron shields, casemates, and turrets. It is most interesting to examine how far this system of iron, the last alternative left, meets the three requirements of coast defence alluded to, and to see what very great difficulties had to be encountered in applying it. The three requirements are thus recapitulated:—First, strength of the battery to resist naval fire, and give sufficient protection to the men; second, power of fighting the guns with accuracy and effect, of following the enemy with ease as he moves, of being able to face him on any side from which he approaches; third, power of using the most formidable guns to advantage.

The first difficulty was to decide the matter of strength. Now, guns are becoming more and more weighty and powerful every day, and, therefore, the strength required to resist them is an unknown quantity. An iron casemate of the present proposed strength costs, according to official returns, with all the battery adjuncts except the gun and carriage, about £5,000 or £6,000 for each gun. A 2-gun turret about £25,000 or £30,000.* If guns of 50 tons are introduced in ships, as is proposed, these defences are at once quite inefficient, and it is not known how strong or how expensive should be the ironworks to replace them. Such questions must be very embarrassing indeed to those who have to decide these matters. Besides protecting the gun and carriage from the enemy's shot, protection must also be given to the men. This is the most serious of all considerations in coast defence, for the following reasons:—

The best experience we have regarding naval attacks on land works is derived from the late American war, in which a great many actions of that kind took place. It would be unwise to ignore this experience, because the increasing power of artillery only gives it more weight. During the whole of that war very few guns were destroyed by the naval fire in earthen batteries. At Fort Wagner only three guns were totally dismounted, although 2,864 shot and shell were fired into it in 48 hours, and the bomb-proofs were hit 1,200 times. 17 siege mortars, several cohorns, and 13 heavy pieces of artillery were incessantly employed. At Fort Fisher the bombardment was opened at the rate of 115 shells per minute, and although the guns were mounted *en barbette*, only two of them were dismounted when the place fell. At Fort Powell a tremendous bombardment from mortars and gun-boats (the most accurate firing being from 15-inch mortars) was maintained from February 22 till March 2, and not a single gun was dismounted. The success of the ships over the forts was gained by demolishing the works, and still oftener by making the service of the guns so dangerous that the men could not work them. Rear-Admiral Porter, United States Navy, in his report on coat defence, states, "The new-fashioned casemates turned out to be no better than the guns *en barbette*. They were perfect slaughter-houses, and were piled up with dead and wounded. Every shell that went through the port holes killed and wounded every man in the close casemate. This proved to me most satisfactorily that guns in casemates were no better protected from shells than those *en barbette*."

With such evidence as this before them, from men who were conversant with all the events of that great war, it was indeed a serious question to decide what was to be done. I myself cannot see how men in an iron casemate are as much exposed as in a barbette battery; but there is no doubt that if the port of the strongest casemate was as large as those referred to by Admiral Porter, it would be open in the same circumstances to the same dangers, as the damage was done by the entrance of shell through the port. The protection a casemate would afford from vertical fire in such a case would be but a poor advantage if more correct and more deadly weapons than the mediæval mortar could still search out at times the exposed point of the casemate and kill every man inside.

(To be continued.)

* The price of a permanent Moncrieff battery, with magazines, &c., including the extra expense of carriages, is from £1,100 to £1,500 for each gun; an iron shield battery from £1,800 to £2,000 per gun; an iron casemate battery from £5,000 to £6,000 per gun; a turret from £12,500 to £15,000 per gun.

TONNAGE AND NAMES OF STEAM VESSELS.

THE following facts relating to steam vessels are made known through an official return. According to that document, it would seem that, down to January 1, 1869, there had been registered at the ports of the United Kingdom 2,916 steam vessels, their aggregate registered tonnage being 904,191 tons, and their gross tonnage 1,341,106 tons. The date of build ranges from 1823 to 1868; the oldest is the "Ann and Jane," of Newcastle, of 27 tons. The list of the names is a loyal list. Three vessels bear the name "Her Majesty," 16 that of "Victoria," and there are 12 "Queens," 4 "British Queens," 11 "Princes of Wales," 7 "Alberts," 8 "Alexandras," and namesakes of other members of the Royal house. There are 2 "Dagmars" and 2 "Denmarks." Our own country finds upon the waters 10 "Albions," 3 "Anglias," an "England," 5 "Cambrias," 10 "Britannias," a "Great Britain," 3 "Caledonias," 7 "Scotias," 5 "Erins," 3 "Hibernias," 3 "St. Patricks," and a "Brian Boroimhe." Then there are 4 "Britons," a "True Briton," a "Scotchman," and an "Irishman." Of birds and beasts and fishes we have 3 "Hawks," a "Sea Hawk," a "Sea Swallow," 7 "Lions," 8 "Tigers," 3 "Camels," 5 "Bulldogs," 4 "Bees," 2 "Ants," 6 "Dolphins." Heroes of sacred and profane stories are represented. There are 10 "Samsons," 5 "Ajaxes," 3 "Apollos," 2 "Catos," 1 "Tubal Cain," besides 3 "Ariels," 4 "Fairies," and 4 "Fairy Queens." Lords and ladies of high and low degree have given their names to our ships; dukes and earls, "Paul Jones" and "Paul Pry," "Anne Smith" and "Susan Gibbs," "Kates" and "Nellys," "Galileo" and "Euclid." There is 1 "Bridegroom," but 2 "Brides;" 1 "Nun," and last, not least, an Irish steamer, "Number One."

FIXING ANILINE COLOURS.

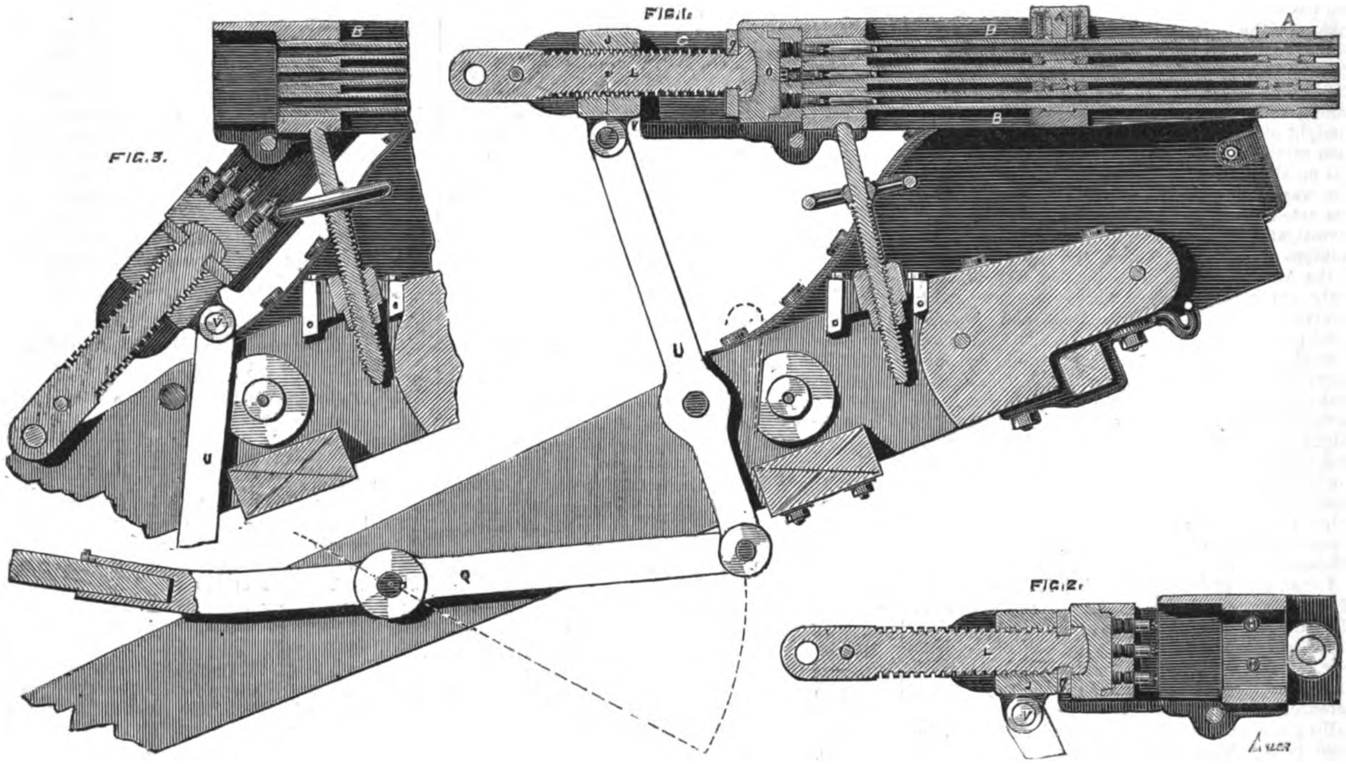
A PASTE for thickening aniline and pigment colours employed in printing woven fabrics, and at the same time fixing the colours and brightening and greatly improving their appearance, has been patented by Mr. Joseph Clayton, of Radcliffe. The paste may be used either as a substitute for or in conjunction with the egg albumen hitherto employed for that purpose, being much less costly, and is composed of water, kid or other glue, turpentine, and blood albumen. We may here remark that when employing this mixture, the operator is enabled to use egg albumen therewith made by beating up both the yolk and the white of the egg together, and thus to effect a considerable economy in this ingredient.

The proportions and method of manufacture which Mr. Clayton has found to answer best in practice are as follows:—First boil 4lb. of kid glue in two and a half gallons of water till dissolved, stirring it well all the time. When boiled down to about two gallons add thereto two gallons of turpentine and boil again; then cool down to about 110deg. Fah., and add four gallons of blood albumen at a strength of about 3lb. per gallon previously dissolved in either water, buttermilk, or blood; mix well and stir for about four hours. To prepare for use take one gallon of the above preparation and mix with it an equal quantity of blood albumen solution (at a strength of about 1½lb. to the gallon), and to this mixture add the aniline or other colour as required.

IT is now finally settled that Lord Napier of Magdala will succeed Sir William Mansfield as Commander-in-Chief in India next year.

THE FRENCH MITRAILLEUSE.

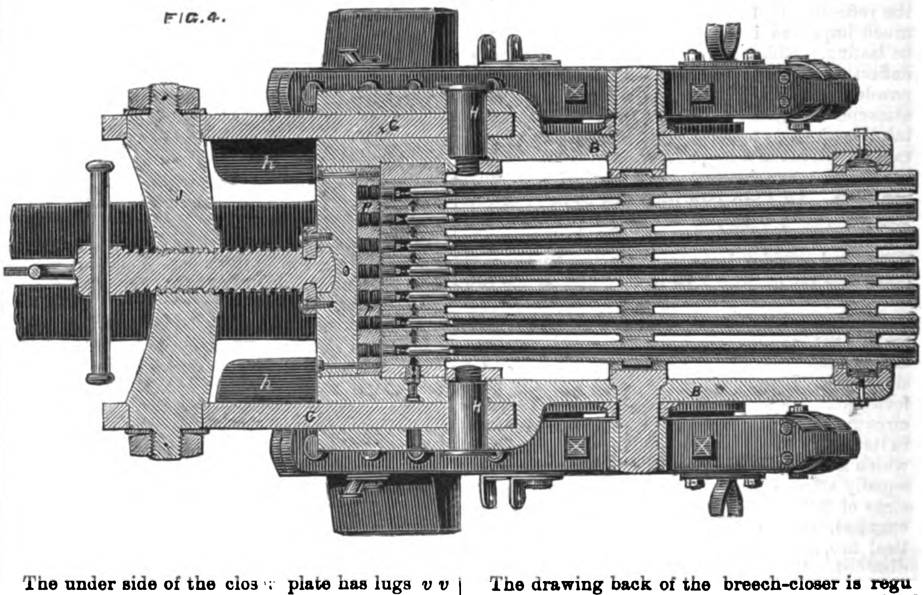
BY M. FRANCOIS J. MANCEAUX.



THE FRENCH MITRAILLEUSE.

OUR readers have been made acquainted through our columns with the principles of the Belgian mitrailleuse; we, therefore, now have much pleasure in placing before them the details of the French mitrailleuse. This important and deadly weapon of warfare is the patented invention of M. Francois Jules Manceaux, of Paris, a gentleman well known for his various improvements in firearms in general, the patent having been secured through Messrs. Robertson, Brooman, and Co., patent agents, of 166, Fleet-street. We may here mention that a mitrailleuse was patented by M. Manceaux in 1867; the present invention, however, is a great improvement upon the former weapon. The first part of the present improvement consists in fitting the barrels between plates which stretch across from one side to the other, and are connected to side plates or straps, which are carried on trunnions. The trunnions enable the apparatus to be mounted upon a carriage, so that it can be used in field operations.

The principle of the French mitrailleuse will be seen from the accompanying engravings, fig. 1 of which is a sectional elevation of the weapon and carriage; fig. 2 is a section of the breech end; fig. 3 is a section of the breech end, with the block or closer drawn down, leaving the barrels free to be loaded; and fig. 4 is a sectional plan, with the cartridges in the barrels and the closer screwed home. This compound gun is composed of a series of barrels, which are fitted between plates A A, which stretch across from one side to the other so as to firmly unite the two side plates B B, upon which the trunnions are formed for supporting the mitrailleuse upon a carriage, so that it can be moved from place to place and employed in field operations. The rear ends of the side plates B B are of greater thickness than the other portions, and are slotted so that the guide plates of the closer can work therein. These plates are centred upon pins, which are kept in position without working loose by means of tappets acting upon the nuts on their ends. The breech-closer plates G extend a distance beyond the rear end of the barrels, and have near their ends long holes, which serve to hold secure a transverse bar J. The central portion of the transverse bar is of larger diameter, or is thicker than the other parts, so that the threaded rod L, which passes through it, may be turned so as to bring the breech-closer nearer to or further from the rear of the barrels. The front of the threaded rod L is rounded, the rounded portion being fitted between two half plates q q.

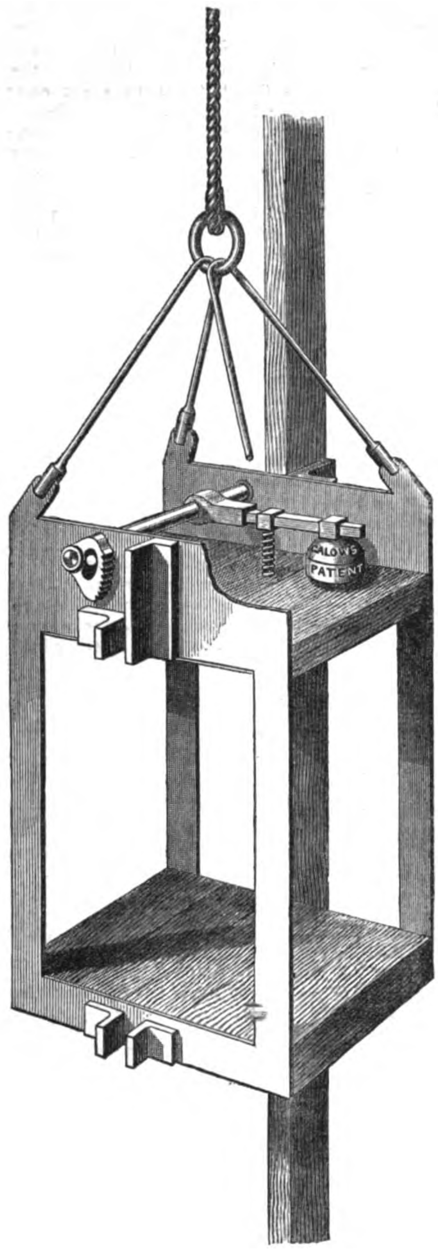


The under side of the closer plate has lugs v v for carrying a pin V, to which the upper end of a link or lever bar U is jointed. The lower end of the link is pinned to a lever Q, so that the closer, when released from the barrels, can be raised and lowered upon their joint pins H H, which are fitted in the side plates B B. The under side of the rear of the side plates has projections for the closer to slide upon as it is being moved, and when it has travelled such a distance as to be tilted, it rests upon a plate h, which forms part of the closer frame G G. The front of the closer or breech block O has a face plate P secured thereto. This plate is provided with a series of holes corresponding to the number of barrels fitted in the frames upon the carriage. The holes are threaded for the reception of screw plugs or nipples, through which pins are fitted. The inner ends of these pins rest upon a disc of horn or other yielding material, so that when the explosion takes place the force of the recoil is diminished. The distance the pins may project is regulated by a washer or plug screwed into the back of the plate P. Under the rear of the breech end of the barrels is attached one end of an elevating screw, by which the depression or elevation of the barrels is governed. The lower end of the screw works in a block or socket on the carriage.

The drawing back of the breech-closer is regulated by the hand lever Q, and it can be retained at the required point by means of a pawl working in the teeth of a ratchet wheel fitted on the side of the frame. When the barrels are filled or loaded with cartridges, and the breech-closer brought in contact with the rear of the barrels by means of the lever handle, the fire can be communicated by means of a percussion cap or fuse or quickfire at one side of the barrel framing, which fire is instantly forced through a hole, and impinges against the cartridge case with sufficient impulse to break it and explode the powder therein. The explosion in the barrel causes fire to be driven through another hole, which leads from the first barrel to the second, and this causes the second charge to be fired in the same manner as the first, and from the second to the third barrel in succession until the whole of the barrels on that level have been discharged. The fire then passes up to a second series of barrels, placed above the lower series in succession, and in a similar manner to a third series of barrels. If the frame has three series of barrels placed in it as is represented in our engravings, M. Manceaux uses a special cartridge for his mitrailleuse, particulars of which will appear in a future number.

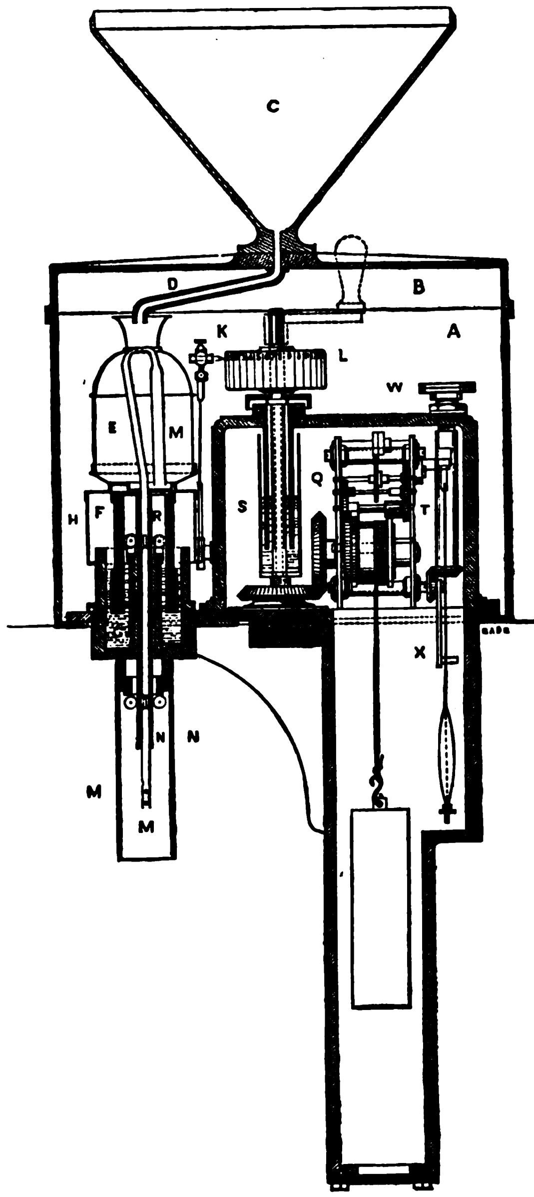
SAFETY HOIST APPARATUS.

BY MR. CALOW.



SELF-RECORDING RAIN GAUGE.

BY MR. ROBERT BECKLEY.



CALOW'S PATENT SAFETY HOIST.

PRACTICAL engineers know that the great objection to safety apparatus for preventing accidents in hoists of mines, &c., hitherto invented has been this—they cannot trust to the old principle of safety cages on account of the terrible amount of friction and destructive action. It is well known that every time the cage descends and ascends the machinery is acted upon four times, which at modern collieries would amount to some thousands of times in a day. Hence the great objection, because they cannot be kept in order without great care and expense. Mr. Calow has, however, through the result of six years' experience, overcome the objection in every way, for, by his arrangement of mechanism, it is not brought into play by the mere slacking of the rope, but when the rope breaks only, the rope not being in any way connected to the apparatus. The motion is obtained in a very simple manner, which constitutes for the apparatus its strong recommendation. Anyone having studied the difference between a falling body and the same body being let down a shaft at the greatest speed it is possible for an engine to accomplish will find a great difference in their respective speeds; it is in the difference in the speeds wherein the motion is obtained, so that the cage has to gravitate before the machine is acted upon. It will be seen from the accompanying illustration that a bar has on it a weighted lever; this weight keeps a spiral spring compressed. When the cage becomes a falling body (*i.e.*, falls at 16ft. in the first second) the support for the spring ceases to exist, and it becomes of a greater length, thrusting the eccentric jaws or grips into the slides, and effectually preventing the cage descending.

This invention was exhibited at the recent meeting of the Iron and Steel Institute at Middlesborough-on-Tees, where it attracted attention. There are already twelve at work at Messrs. Bolckow and Vaughan's works. Messrs. Bell Brothers, another well-known firm in the north, have it to sixteen cages, and the Clay Cross Colliery Company have it to twenty. All have given great satisfaction, and have saved lives and property on more than one occasion. The invention is being introduced into the mining and manufacturing districts by the sole makers, Messrs. Bailey and Co., of the Albion Works, Salford, Lancashire.

SELF-RECORDING RAIN-GAUGE.

By Mr. Robert Beckley.

AT the present time, when the collection of meteorological data has become a matter of such general interest, the need of some apparatus which would record the exact fall of rain is frequently felt, and this instrument has been invented with a view to meet this deficiency. The ordinary rain-gauge, as is well-known, is simply a receiving surface of definite area attached to a reservoir, the amount of water collected being measured at stated intervals. No record is therefore supplied by the instrument of the time in which rain fell, and of the rate of the down-pour. Several attempts have been made by which these would be registered, either by placing a float on the surface of the water collected in the receiver, and attaching it to a pencil, or by receiving the water in what is technically called a tumbling bucket, and employing its oscillation in giving motion to a recording apparatus.

Both these plans are open to serious objections; for, in the first case, the instrument requires to be made with a very open scale if it is desired to record small quantities, and therefore becomes large and cumbersome; while, in the other form of instrument, no fall will be registered unless it is sufficient to fill one of the buckets. Neither of these objections can, it is believed, be urged against the new instrument, which records equally well all falls, either summer showers or heavy storms, and is at the same time small, compact, and self-contained, requiring no special erection, and capable of being placed in a hole in the ground, with the receiving surface barely raised above its level.

The instrument, which was made by Mr. James Hicks, of London, is shown in the accompanying engraving, in which a section is given of the whole. A is a cubical box of thin cast iron, 18in.

square and 12in. deep, furnished with a loosely-fitting hinged cover B. The top of the cover is stiffened by four ribs, which meet at a boss in the centre, into which the funnel C is screwed. The funnel is also of cast iron; but, to prevent rusting, its interior surface, after having been turned, is enamelled. It is provided with a lip 1in. deep to retain the splashes, which is turned exactly to give an area of exposure of 100 square inches. A small aperture in the bottom of the funnel, covered by a strainer, opens into a pipe, D, which conducts the water as it is collected into the copper bottle or receiver E. This is supported by a hollow cylinder F, floating in mercury contained in the annular vessel or cistern G.

As water enters the receiver the float descends in the cistern, displacing more mercury the further it descends; at the same time, the relation between the areas of the cistern and float is so proportioned that the admission of equal quantities of water into the vessel E causes its descent to take place through equal spaces. A cover H, fixed to the top of the float, supports on one side a spring, the upper extremity of which is adapted to hold a pencil K, which presses against a cylinder made of white glazed earthenware, marking on it vertical lines, as the float with the receiver rises and falls.

When the level of the water in the receiver reaches the neck of the vessel, which has then descended to its lowest point, the syphon M comes into play, and, rapidly emptying it, enables it to rise and resume its original position; at the same time the pencil K marks a vertical line from the bottom to the top of the cylinder. As the receiver E has a capacity of 25 cubic inches, this occurs whenever a quarter of an inch of rain has fallen. The syphon M acts on the principle of the intermittent syphon, modified and adapted so as to enable it to act accurately and with certainty in the present case. As the water enters the vessel E, it rises in the short leg M of the syphon, driving the air before it through the long leg $M^{I} M^{II}$; this continues until it reaches the bend at the top, which, being contracted, prevents the passage until a sufficient head of water has accumulated above it to overcome the capillary action; the water then runs down the long leg and brings the syphon into play, which then runs until the vessel is quite emptied (a small depression in the bottom materially assisting it), and the air can enter at the lower extremity of the short leg. The flattened contracted bend of the syphon answers the double purpose of preventing the entrapment of an air bubble in the bend, and also ensuring the emptying of the vessel always occurring immediately the water in it arrives at a constant fixed height; at the same time sufficient area is left not to retard the flow through it.

In order to prevent the retention of a few drops of water in the lower extremity of the tube by capillary action, several small irregular apertures are made in the glass at M^{II}; these, by admitting air, and also allowing the lateral escape of the last few drops, effectually prevent all stoppage of the tube from this cause. The action of the syphon as thus constructed is so certain and constant that it is found on experiment that, if the water running out of the receiver when it is discharging itself be caught in some vessel and returned to the receiver, the syphon will not commence to run until the last drop is poured back, and this may be repeated many times with the same result.

The long leg of the syphon, on issuing from the lower side of the receiver E, passes down a brass tube N N, guided by rollers through the centre of the mercury cistern, so serving to keep float and receiver perfectly vertical and central. In the experimental forms of this instrument, some difficulty was caused by the oxidation of the surface of the mercury in the cistern, preventing the floats moving with sufficient ease and freedom; but a suggestion of Mr. Hicks completely removed this source of annoyance. It consists in pouring a thin layer of fluid glycerine over the surface of the mercury, which, by preserving it from oxidation, and also by acting in a measure as a lubricant, causes the movement of the float to be extremely delicate. The glycerine has also the additional merit of preventing the rusting of the float and cistern.

The registering part of the apparatus consists of a clock Q moving a cylinder L at a uniform rate, a pencil K marking on the cylinder. The pencil is a piece of ordinary black-lead pencil, fixed in a holder, capable of being raised and lowered in an adjusting piece. This piece is fastened to the top of a flat metal spring, which terminates below in a brass bar screwed to the cistern cap, and running up and down between two friction rollers R to destroy any lateral movement. The cylinder L is, as before mentioned, formed of white glazed porcelain, and fits easily on the clock spindle, but capable of being fixed in any position on it. The cylinder is divided by lines marked on it into twenty-four hour spaces, and the traces made on it by the pencil can be easily removed by washing. Two or more cylinders are supplied with each instrument, so that every morning one cylinder can be substituted for another, and the preceding day's record either copied on tracing paper or tabulated at leisure.

The clock Q is contained in a hermetically-closed case, the two places where communication takes place between the interior and exterior being guarded by mercurial stuffing-boxes S and T. S is the vertical axis, supporting and giving motion to the cylinder, being driven round by the clock once every day. By means of a peculiar adaptation of the wheelwork of the clock, a reversal of this motion winds up the clock, a handle (shown by dotted lines in the figure) being temporarily fitted on to the end of it, which is made square for that purpose. The upper bearing of this axle is formed of a tube which surrounds it loosely for the greater part of its length. This tube is again contained within a larger tube, closed at its lower extremity, and fastened to the axis. Mercury is then poured into the tube, half filling it, and so preventing the passage of air either into or out of the clock case, but allowing of its expansion under varying changes of temperature, whilst, at the same time, freedom from friction of the axle in its bearings is retained.

A similar arrangement at T serves to put the pendulum in motion. On turning the milled head W on the exterior of the case, movement is imparted by bevelled wheels to a small arm X, which, pressing against the pendulum rod, forces it out of its vertical position. Immediately the pressure is removed from the head W, the arm X falls back to its original position by its own weight, leaving the pendulum vibrating freely. The clock case is recessed at the bottom to a sufficient depth to allow of the weight falling freely for one day. The clock mechanism can readily be altered so as to go any number of days, and the time scale can be made to any desired length; but, in the present instrument, the scale adopted is that chosen by the Meteorological Committee for their self-recording instruments.

One of these instruments has been at work during the past fortnight, its action, Mr. Beckley informs us, being in every way satisfactory. It records less than 1-100th of an inch fall, with a receiving surface of 100 square inches area, a delicacy, we imagine, quite sufficient for all but the most exceptional requirements.

COPPER AN ANTIDOTE AGAINST CHOLERA.

M. DUMAS recently laid before the Academy of Sciences an analysis of Dr. Burg's report on the preservation from cholera of men engaged in working with copper. He said, in effect, statistics clearly prove that wherever the manipulation of copper was carried on the men engaged in it have almost invariably escaped harmless. The investigations into the subject were conducted under the supervision and control of the commissaires of police, and may, therefore, be implicitly relied on. The number of men who died of the epidemic in 1865 was eight, three of whom were engravers. one optician, one polisher, or burnisher, and one turner. In 1866 the mortality among them from the same cause was exactly the same. According to M. Burg, several of these deaths appeared to result from exceptional circumstances; they were either out of work or under bad sanitary conditions. To enable it to be clearly understood what proportion these numbers bore to the great body of workmen engaged in copper works, it must be stated that the census of 1866 showed that there were in the department in which Paris is situate 122,838 workers in metal, and it is putting it below the mark to say that of this number at least one-fourth—that is to say nearly 31,000—are engaged in working copper in some form or another. Deducting boys under 12 years of age employed in the same work, there remained upwards of 26,000 adults really workmen, consequently the number of deaths in the years specified was in the proportion of 3 to every 10,000. Further inquiries were made with the view of ascertaining if the preservation varied in accordance with the degree in which the metal was handled by the operatives, it being evident that if copper possessed the preservative properties attributed to it this would be manifested in the case of the workmen who died. The result of this branch of the inquiry, it is said, proved the correctness of the theory.

Among gold and silversmiths and watchmakers, the total number of whom was 11,500, there were 16 cases, and there died 1 of every 719 employed. Among makers of metallic spectacle frames, engravers on copper, men engaged in plating copper, polishers, rollers, and coiners, the total of whom was 6,000, there were six cases, the mortality being 1 in 1,000. Among founders, tap-makers, lamp-makers, workers in bronze, sham jewellery, and copper utensils, the number of whom was 14,000, there were seven cases; the mortality was 1 in 2,000. Among opticians, makers of mathematical instruments, dry polishers, stampers, turners, and musical instrument makers, the number of whom was 5,650, there was no case at all. Thus the rate of mortality diminished in proportion as the workmen were more exclusively employed in the manipulation of copper. In other manufactures the mortality was from 10 to 40 times greater. Further testimony in favour of the preservative action of copper was supplied by the society known as the Bon Accord, which was founded in 1819, and entirely composed of workers in bronze, and the medical registers of which are thoroughly well kept. During the whole of the five visitations of cholera, this society, the members of which were scattered in quarters where the epidemic raged with the greatest virulence, had not only not had a single death, but had been called upon to pay only for 106 days of sickness, divided among ten members of the society. Facts supporting the theory were also supplied from other sources. The conclusion drawn from this statement was that if further inquiries established the truth of the theory exceedingly valuable results from a hygienic point of view would follow.

OVERHEATING OF FURNACE CROWNS AND OTHER BOILER PLATES WHEN COVERED WITH WATER.

By Mr. L. E. Fletcher.

(Concluded from page 248.)

THE seventh case was met with near Carlisle, in July, 1868. The boilers, in this instance, which were of the ordinary Lancashire type, and strengthened at the ring seams of rivets in the furnaces with T-iron hoops, drove a condensing engine, and were fed from the hot well. The length of these boilers was about 30ft., their diameter in the shells 7ft., and in the furnace tubes 2ft. 8in., while the load on the safety-valve was about 50lb. per square inch. These boilers gave way as in the previous cases at the furnace crowns, in consequence of which the owners reflected on the makers, and the makers, knowing they had delivered sound work, could only account for the failure by supposing that the boilers had been neglected, and the water supply allowed to run short. On making an examination I found that the deposit within the boilers was of a fine floury nature, like that already described in the previous instances, though the quantity was not so great, neither were the furnaces so severely distressed. The following is an analysis:—

Carbonate of lime	69·39
Iron (per oxide)	2·17
Alumina	2·03
Sulphate of lime	2·39
Carbonate of magnesia	8·38
Silica and sand	10·78
* Organic matter	7·56
Moisture	2·35
	100·00

* Containing 2·95 of fatty matter.

From the above analysis it will be seen that the feed water was very similar to that met with in the other cases previously referred to, though it will be seen that the percentage of carbonate of lime is scarcely so high, which possibly explains the fact stated above, that the furnace crowns were less distressed than usual.

The eighth case that may be referred to was met with in August, 1868, and occurred to a couple of boilers laid down near the River Mersey, in the neighbourhood of Widnes. These boilers were of the ordinary Lancashire type, and were but just new, yet they had failed repeatedly at the ring seams of rivets of the furnace crowns, when the old rivets had been cut out, the holes rimered, and new rivets inserted, but without success.

Under these circumstances the maker of the boilers called upon me, when, in answer to inquiries, it appeared that the feed water was heated by the exhaust steam from the donkey engine, and that the deposit was of a light floury character. I at once recommended that the exhaust should be diverted from the feed water, and on this being done the difficulty with the furnace crowns was overcome

In about a month afterwards the boilers were reported as working satisfactorily, although they had never stood for more than forty-eight hours before.

The following is an analysis of the sediment, which, as in the previous cases, shows a predominating proportion of carbonate of lime:—

Carbonate of lime and magnesia . . .	83·33
Sulphate of lime	1·17
Alumina and iron	4·25
Silica	7·40
Oily matter	0·25
Organic matter	3·60
	100·00

It may be added that further cases have been met with in the neighbourhood of Widnes, and that in December last two other boilers came under my attention, the furnaces of which were bulged out of shape from the same cause as that referred to above.

It is worthy of note that three different cases of injury to furnace crowns from this fine floury deposit have been met with in the neighbourhood of the Mersey, and within a few miles of Liverpool.

I have gone into this subject at some length, because it is one not generally understood. It will be seen that the cases of injury referred to were not confined to any peculiar locality, but were met with in the neighbourhoods of London, Lancaster, Carlisle, Birkenhead, Sunderland, Ruabon, Widnes, and Manchester, so that they were widely scattered over the country. It can scarcely be doubted that for the want of understanding this subject many cases of misapprehension between boiler owners and boiler makers must have occurred, and the blame of leakage at the seams of rivets in the furnaces attributed to defective workmanship, or overheating through neglect of the attendants, instead of to the feed water. It is trusted that the general diffusion of information on this subject will prove of practical value to boiler makers and boiler users, and that the number of examples given will be considered sufficient to establish the fact that in both externally and internally-fired boilers, the plates over the fire may be overheated and bulged out of shape even when covered with water.

Since the above was in print, other cases of injury to furnace crowns have been met with, which strikingly corroborate the views given above, and as they increase the weight of evidence it may be well to refer to them.

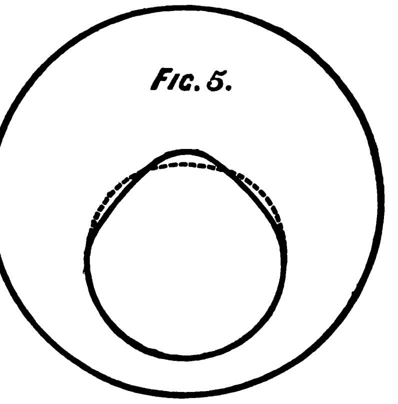
An engineer, who is a corresponding member of this Association, writes from Kirkcaldy that he has met with three cases of the furnace crowns of Cornish boilers becoming overheated, starting at the landings, and getting slightly out of shape in consequence of using waters of certain characteristics, and not from the plates being left bare with the fires burning, or from over pressure of steam. In two of these cases no analysis of the water was taken, but the overheating and flattening of the furnace plates ceased whenever the usual feed was changed for surface water. In the third case it was found on analysis that the water contained 23·63 grains of impurity per gallon, thus:—

22·46 grains of saline matter, principally carbonate of lime, sulphate of lime, and chloride of sodium.
1·17 grains of vegetable organic matter.

23·63

Hardness 14deg. When boiling it quickly begins to leave a deposit, consisting principally of carbonate of lime.

FIG. 5.



The character of the distortions in this case will be best seen on consulting the accompanying cut, fig. 5, which shows that the flattening is at the sides of the furnace rather than at the top, and thus at the haunches of the arch rather than at the crown, while the latter, instead of being depressed, is thrown up. Though it is difficult to establish any precise rule, it may be stated that this is a very general type in the early stages of distortion caused by this description of feed water, though the furnaces soon loose this shape as their distortion increases, and the depression of one side soon preponderates over that of the other, and obliterates it altogether. An illustration of this will be found in fig. 7, on reference to which it will be seen that the right hand furnace just commencing to yield has flattened at both sides at the haunches, while in the other furnace the distortion on the right hand side has completely overwhelmed that on the left. Also in fig. No. 8 a nipping together of the sides and an uplifting of the crowns will be observed.

It will thus be seen that there is a good deal of similarity between the behaviour of the furnaces illustrated in fig. 5 and fig. 7, while the cases of distortion of furnace crowns, owing to the character of the feed and not to shortness of water, met with in the neighbourhood of Kirkcaldy clearly corroborate the views expressed in the previous part of this report.

Another case which was met with in the neighbourhood of Manchester occurred to a well-made boiler of the Lancashire type, measuring 33ft. in length, 6ft. 6in. diameter in the shell, and 2ft. 6in. in the furnace tubes, which were strengthened at each of the ring seams of rivets with a hoop of T iron, while the thickness of the plate was seven-sixteenths of an inch, and the load upon the safety valve 60lb.

The boiler was found to give trouble at the ring seams of rivets in one of the furnaces, the plates cracking at the rivet holes a few inches above the level of the firegrate. This was an extremely mild case. No bulging of the plates took place, neither were the seams of rivets at the crowns affected, while the injury was entirely confined to a range of a few inches above the firebars.

ON THE MODES OF DETERMINING THE COMPOSITION OF THE SUN AND OTHER HEAVENLY BODIES BY THE SPECTRUM OF LIGHT.*

By PROFESSOR MILLER.

It is only three years since the Council of the British Association wisely adopted the plan of still further connecting themselves with the general public by nominating the chief amongst scientific men to give lectures to working men. Professor Tyndall addressed those at Dundee, Professor Huxley the men of Norwich last year, and Professor Miller was appointed to lecture to the working men of Exeter. Professor Miller, in commencing his lecture, which was a series of experimental illustrations of the modes of determining the composition of the sun and other heavenly bodies by means of the spectrum analysis, gave a general account of the modes by which many minerals and metals testified their presence. He then gave a few ordinary chemical illustrations of the manner with which the old system of tests was applied, and commented on the delicacy with which they could now be conducted, some metals manifesting themselves in such infinitely small quantities as less than a millionth part of a grain. After giving a general idea of the law of vibration of musical notes, which were illustrated on the screen as curves caused by a tuning fork, the learned Professor said that everything, solid and liquid, when white hot gives out a spectrum. They could be converted into vapour, and that vapour told its own tale when the light was decomposed into the banded colours. Several beautiful experiments were then given, the white screen being crossed, after the gas lights were lowered, by a large and beautiful spectrum showing the three primary and the secondary colours. Silver was then vaporised, and its beautiful green lines at once manifested themselves as so many bands crossing the red end. The spectra of copper, iron, and manganese followed, and the green, red, orange, blue, and other coloured bands were equally visible. The spectrum of manganese was especially beautiful and brilliant.

The learned Professor then explained that these coloured bands of light were due to vibration among the particles of the vaporised metals. When solar light was thrown on a screen, he stated that, instead of coloured lines or bands, black or very dark ones made their appearance. They were first noticed by Dr. Wollaston, and afterwards by a German optician, named Frauenhofer, who found them so plentifully that they were named after him. A few years ago, Kirchoff discovered there were several thousands, and actually mapped out their relative places. How was it that in an artificial spectrum produced by the oxy-hydrogen flame there were coloured bands, whilst in the solar spectrum they were all dark? Simply this, that the light of any burning metal when it passed through vapour of the same was absorbed. This was illustrated by first showing the bright yellow spectrum of common salt or chloride of sodium, and then passing the light through a lamp that was filled by sodium vapour. The dark band immediately made its appearance on the screen. Professor Miller then explained the structure of the spectroscope as being simply a telescope through which to look at prisms fixed near the further end. By intensifying the telescopic power, the fine dark or coloured lines could be seen in all their abundance. The photograph of the solar spectrum was then thrown on the screen, and its crowd of varying thin and thick dark lines could be seen traversing its entire length. By passing an electric spark through a prism, alongside with solar light, both the dark and coloured bands could be seen at the same time. This proved that the sun contained certain metals, as iron, copper, manganese, calcium, &c. The glowing body of the sun shone through an exterior atmosphere, wherein were floating vaporised metals, and these absorbed the light, and caused the dark lines in the solar spectrum.

The Professor then showed how the feeble light of the fixed stars could be lengthened into an attenuated line, and this line, when minutely examined, was seen to be crossed by dark lines as in the case of the sun. Hence we could tell what the stars are made of, photographs of the spectra of the stars Aldebaran, Betelgeus, and Sirius were shown, and the metal lines explained. The lecturer then proceeded to notice the nebulæ, remarking that some of them could not be decomposed into groups of stars, but were a sort of cosmical vapour. The spectra of several had been analysed. The photographs of spiral and ring nebulæ were then thrown on the screen, as well as the nebulæ in Andromeda. The distances of these heavenly bodies whose composition could thus be ascertained was immense. The light of the star Sirius, travelling at the rate of 192,000 miles a second, would be twenty-three years in reaching our earth. This was almost nothing to the immense distances of other heavenly bodies. They could not but reflect on the vastness of the Creator's universe, and feel that a common mind had elaborated it all. It made them humble when they contemplated such overwhelming vastness.

* British Association.

EXPERIMENTS WITH CHILIAN COAL.

With a view to ascertain the industrial value of the coal produced in Chili, a series of interesting experiments have been made by Mr. V. Pons, first master mechanic, upon the nature and quality of the coal from the Lota Mines, and from this report, published in "La Houille," it appears that the results obtained were highly satisfactory. This coal is of the carbon-maigre character, of deep grey colour, and its fracture is lamellar, or in regular grains; it but slightly soils the fingers when touched, and lights and burns readily, giving a long white flame; it gives off an abundance of very black smoke, is but very slightly contaminated with pyrites, gives but a small percentage of ash, but produces a considerable quantity of clinker.

The subjoined is a comparative table, showing the results obtained in the experiments:—

Coal.	Mean tension of steam p. cent.	Revolutions per minute.	Consumed per hour.	Ash per cent.
Cardiff and Newcastle	400	65	750	10
Cardiff and Newcastle	95	62	780	13
Patent fuel	95	63	800	12
Cardiff	100	64	715	10
Lota	105	64	1042	6
Lota and one-third Cardiff	100	63	980	7
Lota and one-half Cardiff	100	63	900	6

In the first experiment, Lota coal was used alone the journey being made between Lota and Talcahuana. During the journey of 5½ miles, Lota coal without admixture was the fuel employed, the boilers being disposed as favourably as possible; the tubes were swept, and the fire-boxes cleared of clinker. The trial was made with the greatest care, with the object of comparing, by the performance of the engine, and both as to quantity used and calorific effect, the relative value of Lota coal and that of Cardiff, usually employed. With regard to the quantity of fuel used, it greatly exceeded the quantity usually considered as the limit for obtaining the same result; but at the commencement of the experiment, before the bars became clinkered, the pressure in the boilers was very well and regularly maintained, which is often a difficult matter, however much care may be employed in stoking, when an inferior quality of coal is employed. As to calorific power, the Lota coal may be placed amongst the non-bituminous coal of good quality, for they were able to produce with it results obtained with coal enjoying a reputation as of superior quality, and for a short time even to surpass those results. The coal, however, has certain objectionable qualities, which Mr. Pons considers should be mentioned—it burns only on the surface of the mass, it gives off a large quantity of gas, forming a long vivid flame, but of short duration, although the residue remains incandescent on the fire-bars; this inconvenience might be, to some extent, obviated by feeding little and often. The quantity of clinker produced is, moreover, considerable, filling the ashpit in a very short time, and quickly covering the bars to a thickness of 2in. or 3in.; it is very friable, breaking with the least touch, and does not agglutinate on the bars, but mixes with the coke, and deteriorates the quality of the coal, through the necessity of frequent raking; and, lastly, the smoke is very abundant, and quickly chokes up the tubes to a considerable extent.

The second experiment was made with a mixture of one-third Cardiff with two-thirds Lota coal, the journey made being from Talcahuano to Valparaiso; and the result showed a sensible improvement. The pressure of steam was maintained without difficulty

PROPOSED PONTOON VESSEL FOR THE CHANNEL PASSAGE.

BY MR. J. H. PARSONS.

FIG. 1.

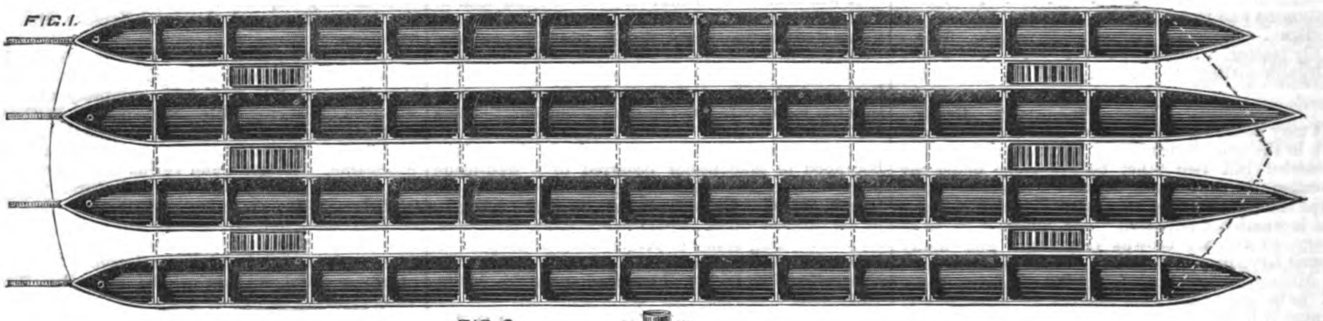


FIG. 2.

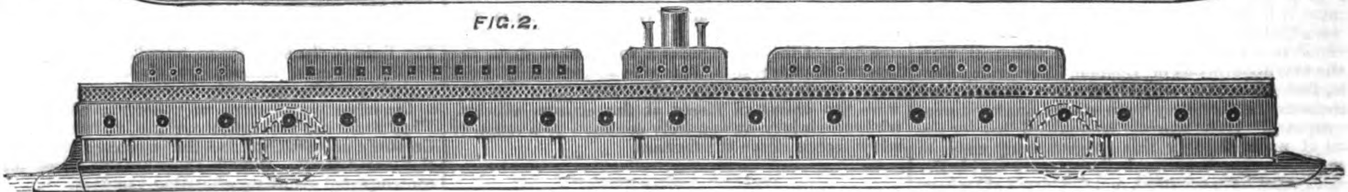


FIG. 3.

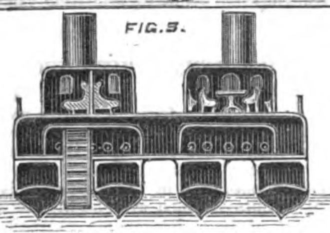
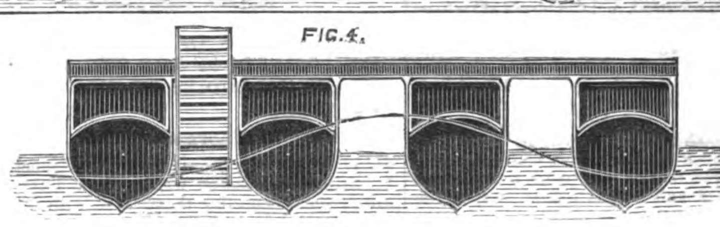


FIG. 4.



and the choking of the fire-bars was much diminished by the addition of Cardiff coal, but the admixture did not appear materially to diminish the consumption of fuel. In this second trial, the fire was lighted with Lota coal alone, and steam was got up in forty minutes, whilst one hour ten minutes was the shortest time in which they had got up steam from the time the "Megere" left France, which proves that during the combustion of the coal a large amount of caloric is given off. Considering the matter seriously, impartially, and without exaggeration, Mr. Pons considers it good and advantageous for steam navigation. In the last experiment with Lota and Cardiff, half and half, which was likewise made on the journey from Talcahuano to Valparaiso, the improvement was much more decided. The regular production of heat and steam was much more facilitated, and Mr. Pons has remarked that, although the production of clinker was about the same, it was less friable, owing to the combination of bituminous matters from the Cardiff coal, so that it mixed less with the coke, and was more easily removed. Even with this mixture the consumption was still very high, and he attributes it not only to the rapid combustion of the Lota coal, but also to the necessity for frequent raking, which was often necessary twice in a quarter of an hour.—"Mining Journal."

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, October 7.)

Chemicals.—There is no feature of importance to relate in the chemical trade of the past week, in its main characteristics the market has not undergone any material change—values are unaltered, and, although production has been considerably lessened, no advance in price is obtainable for immediate consumption. Soda: for soda ash, prices are irregular and remain at £7 to £7 10s. for 48. Crystals at last week's prices, of £4 5s. to £4 7s. 6d. An improved market for caustic at 13s. 6d. Nitrate of soda: stocks remaining very light, nitrate is firm at 17s. Potash: in muriate the demand has fallen off since the close of the month; £7 7s. 6d. to £7 10s. is quoted for 80. Easier prices may be anticipated with the reduction in business. Saltpetre: for Indian 23s. is quoted, and 27s. 6d. for English refined. Transactions have been limited. Alum: the home and export demand keeps pace with production, and prices are not altered. Ammonia: in sulphate there is no falling off in the continental demand; the production having considerably increased, prices are slightly easier for spring delivery, £16 5s. to £16 7s. 6d. being asked for 23 and £13 for 20. Copperas: A more substantial market at 52s. for green and 50s. for dry. Chloride of iron is quoted at 51s. 6d. per ton. Pyrites: maintains previous quotations at 7d. to 8d. per unit; with an increased demand for Spanish. Lime: the sales of phosphate are unimportant, with declining prices, 50s. being asked for 65; bleaching powder is in brisker demand at £8 5s. to £8 15s. Disinfectants in fair request at £5 5s. to £5 15s. per ton. Acids: Tartaric: Foreign quoted at 1s. 2d.; English ground at 1s. 3d. Citric offering at 2s. 5d. Oxalic dull at 7¼d.

Metals.—The past week has been a quiet one in the metal market. At the preliminary meeting of the iron trade, held at Birmingham on Thursday last, it was determined to make no alteration in the present prices of manufactured iron. Iron: Scotch pigs maintain their value, closing at 52s. 9d. to 53s. Cleveland firm, at 43s. for forge, to 48s. for No. 1. Welsh bars, £6 5s. to £6 7s. 6d; Staffordshire, £6 10s. to £7; gas tubes at 60 to 70 off list; boiler tubes, 40 to 45. Copper: nothing of importance has been done in this during the week, and prices are still £73 to £74 for tough ingot, and £68 to £69 for Chili slab. Tin: quiet. Straits £130 to £131; English £125 to £126. Lead: a good business doing in this at £19 to £19 5s. for soft English pig: P. G. brand £18 15s. Spelter: a moderate trade has been doing during the past week, and English is now very firm at £20 15s. to £21 5s.; Silesian, special brands, £20 5s. to £20 10s.; hard spelter for export, £16 5s. to £16 10s.

Correspondence.

THE CHANNEL PASSAGE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I beg to forward you the following proposition for accelerating the route between London and Paris viâ Folkestone, by making the service direct instead of tidal. At the present time, as your readers are aware, there are various schemes afloat for bridging and tunnelling the Channel so as to facilitate the transit to the Continent. It has struck me that the necessity for either of these schemes, which would involve an enormous outlay, would be overcome by carrying out the following:—My idea is to construct a pontoon vessel, as shown in the accompanying sketches, with as shallow a draft as possible, and, by thus rendering it independent of the tide to cross the Bar at Boulogne, to make the service direct instead of tidal as it now is.

If this idea could be carried out, it would be of the greatest public utility, besides being of considerable advantage to the South-Eastern Railway Company, more especially if they could obtain the contract for carrying the Paris mail viâ Folkestone and Boulogne, instead of Dover and Calais as at present. Now the South-Eastern Company carry the mail by special train from London to Dover, and then it is handed over to the London, Chatham, and Dover Company, who have the contract to carry it across the Channel to Calais; it is then passed to the postal authorities, and goes on by train to Paris viâ Boulogne by the Chemin de fer du Nord. If my proposal was carried out it would be the means of a great saving of time, irrespective of the prevention of the present interruption of the regular traffic caused by the tidal service. And not only this, but the vessel itself would, I imagine, by distributing the weight and reducing the resistance of the water to a minimum, be so steady and manageable as to mitigate in a great degree that ordeal of sea-sickness, so terrible to most persons, which must be endured in crossing the Channel in the little packet-boats in use at the present time. This small build is necessitated by the construction and small depth of the harbours both at Boulogne and Calais. The voyage across is to my mind much worse than that across the Irish Channel, and that a great deal owing to the size of the boats. I surmise that the use of a vessel such as I propose would greatly conduce to the comfort of people crossing, and make the journey a pleasure instead of an annoyance. Apart from these advantages, I think that the personal convenience of passengers might be much enhanced by dividing the sleeping from the general saloon where sleeping accommodation is required. The amount of available space on such a vessel as I propose would render this easy, as well as allow them to be of the most commodious and even luxurious style and size.

In the drawings which accompany this letter, I have set out the after part of the deck in separate cabins for the captain and officers, and a general saloon and sleeping saloon for first-class passengers. The sleeping saloon could of course be divided for ladies. The fore part of the vessel I propose to lay out on the same plan, with the difference only of a sorting room for post office officials in case of carrying the mails. For vessels generally, when great speed is not an object, the paddle wheels might be fixed in the centre, leaving a large hold fore and aft for merchandise, &c. The present railway and the improvements now going on at the Harbour of Boulogne can be made available for running trains direct to the boat, as at Dover and Holyhead. The speed of such a vessel as I propose would, I imagine, be very great, if desired, on account of the slight resistance of the waves, which would pass through, under, and over the pontoons both laterally and longitudinally. Although I have adapted my idea of a pontoon vessel to the purpose of facilitating the transit across the Channel, it is, I believe, one that can be applied to navigation generally, and especially for tidal harbours and shallow rivers,

on account of its slight resistance to the water and its light draft.

The following is a description of accompanying plan:—Fig. 1 shows proposed pontoon boat, consisting of four pontoons bolted together with cross girders, leaving free access for waterway to paddles between each, and also forming the bottom or floor of engine room. The boilers, coal bunkers, &c., would be placed in the centre of the vessel, and the engines at each end. The weight being thus equally distributed, enables us to use engines fore and aft when speed is required. The present arrangement of the engine rooms is most unhealthy and distressing to the men, and I know of no means by which, under the present plan, the same amount of light, ventilation, and comfort could be obtained as by the proposed pontoon vessel. In the deck arrangements, the present idea is to separate the sleeping from the general saloon, and to leave a clear passage from stem to stern, which would be an advantage in working the vessel, and serve as a promenade for passengers. Fig. 2 shows the elevation of proposed vessel. Fig. 3 shows section of the same through the saloons. Fig. 4 shows the pontoons and waterway between floor of engine room and pontoons, with supposed line of wave passing through.—I am, Sir, yours, &c., J. H. PARSONS.

59, Gray's Inn-road, October 2.

HARDENED WOOD OR "BOIS DURCI."

SIR,—I shall feel much obliged to any of your readers who can give me information as to the manufacture of the composition known in both France and Germany by the above name. Articles such as small reading desks, fancy perforated work, &c., imitation carved oak, are made by this process. Papier mache is also used. Was there not a company started to work this process here? —I am, Sir, yours, &c., S. D. T.

6, Mildmay Park, N., October 2.

HYDROSTATIC STEERING APPARATUS.

SIR,—The letter of your correspondent "Robert Shenton," in your journal of the 17th ult., escaped my attention, or I should have replied immediately with the following statement of the first experiment of my patent hydrostatic steering apparatus. The "Achilles," of 6,000 tons, was steered for four hours by myself with a small wheel in the chart-house on the bridge, at all speeds and on various courses—putting the helm hard down many times during the four hours the experiments were being carried out. The bilge pumps, equal to about a donkey power, kept the ship quite free from water during the whole time, although the admission of water to work my engine was of course very greatly in excess of what would be employed under ordinary circumstances.

Your correspondent, though doubtless a far better mechanic than I can ever pretend to be, must allow me to remind him of this peculiarity in the demands for a ship's steerage. When a large vessel is going full speed, a great power must always be available at the shortest notice, to avoid collisions and alter the course suddenly for various purposes, such as a man falling overboard or other casualty. To ensure this, if no purely mechanical means are used, a number of men must stand at the wheel for hours together, actually employed during that time in moving it only a few spokes, which is easily effected by one of their number. Now, it is clear that if a special steam engine be employed, as proposed by your correspondent, the steam must be always in readiness in the pipes and passages from the boiler, and there must be condensation going on. This was proved in the "Minotaur" and other vessels which have been fitted with steam hydraulics, and there was always found a want of readiness for immediate action. The principal advantages I claim for my apparatus are a constant readiness for immediate action, without expense while lying idle, and requiring no care or attention—which the steam engine cannot dispense with.

In conclusion, let me add, that owing to the pipe leading the water through the bottom of the "Achilles" having been fitted—so as to avoid the magazine—with five right angles in its course to the cylinder, and a mistake in the working drawings, by which the port in the cylinder is only one half of its proper dimensions, the engine is unnecessarily large and slow in its action. Nevertheless, the power attained indicated an average pressure of 600lb. on the square inch, though 150lb. to 200lb. was proved amply sufficient for putting the helm hard down to 35deg. when going at the rate of fourteen knots, the men never being able to attain a greater angle than 24½deg. I am now able to supply a similar engine, capable of doing the same work in a better way with half the expenditure of water, in less than half the time, and at a cost of little more than half of the one now fitted to "Achilles."—I am, Sir, yours, &c.,

E. A. INGLEFIELD, Rear Admiral.

10, Grove End-road, N.W., October 6.

THE ROYAL AGRICULTURAL SHOW AND THE PLOUGH: ITS HISTORY AND ACTION UPON THE SOIL BOTH IN ANCIENT AND MODERN TIMES, AND THE MODIFICATIONS IT HAS UNDERGONE.

LETTER No. II.

SIR,—In comparing the English ploughs with the whole of those used on the Continent, the English is the only one that cuts a solid unbroken furrow. The plough shown in the International Exhibition of '62, in the Foreign Department, had short, deep, concave turn-furrows and a share to cut the whole width of the furrow, which, as a matter of course, would cause the furrow slice to be pitched roughly over on one side, which would break in falling; but the English ploughshare only cuts about two-thirds of what it turns over. Thus, the tearing up the one-third of the furrow slice assists the gentle action of the turn-furrow to lay it on one side unbroken. Now this, on the light soils, requires a pressure roller to break in the hollow under the furrow, and on the stiff soils it leaves it without a crack, and fairly, as we may say, puddles the face of the furrow, and stops the breathing pores of the soil, the very thing that should never be done. The whole of the French and German ploughs are very short in the handle, which makes them very difficult to guide; and, if their wheels and turn-furrows were taken off, they would resemble their own ploughs a thousand years ago. But who shall say, out of all the different shaped ploughs that till the ground, which is the best? The American plough stands alone in form, but its action on the soil is more perfect, breaking the furrow slice to a much greater degree than the English or any other, and its workmanship and mechanical arrangements are perfect.

The "pulveriser plough" (we are now speaking of our own invention, but it will be more as historians than as advocates) consists of three small ploughs on one beam, one acting below the other, cutting the furrow slice (say) 6in. deep into three parts, each plough being furnished with a short deep concave breast. Thus, at one operation, any clean field is made into a good seed bed. The Canadian swing plough reflects great credit on our rising colony. They lay no claim to invention. They have evidently been taken to Canada by emigrants from Scotland and North Wales, where they used that form long before Canada was of any note. These swing ploughs are beautifully made in lines and workmanship, and vie with those of our best English makers.

Having traced the rise of the plough from the earliest periods, we will next direct attention to the action of English ploughs, which will give our letter a practical and useful bearing.

Perhaps there never was a time when the action and principle of ploughs were so much discussed as at the present moment, every new method of treating the soil being looked upon as of the highest importance. It is believed that our great country could feed itself if better implements were used and a deeper and broader area cultivated. We have, in the United Kingdom, about 74,000,000 of acres of land, and only 44,000,000 of acres under cultivation. Now, it takes about 6,000,000 acres of land in foreign countries to grow the edibles we import to make up the home deficiency. But surely we could find 6,000,000 acres in the 30,000,000 that are now lying idle at home if a wiser and more national policy were pursued by what newspaper leaders call our great statesmen. This is what must be done if we would save our labouring population from the appalling pauperism that now hedges it in on every side, and check the export of gold to foreign lands that should be paid to our unemployed poor, and a patriotic parliament could find no nobler field to labour in. The plough is the main implement that tills the land, but its action upon the soil is opposed to high-class farming, and a drawback to agricultural progress, for the two following reasons. First, the plough leaves the furrow solid, which must occupy time and other implements to make a seed bed. Secondly, it leaves the furrow hollow, into which a great portion of the seed falls and dies. This may be called the death well. And of a great portion of that which does grow, the rootlets get into the hollow chamber, the frost nips them, and the plant dies in spring; or, if it grows in summer, the straw is weak, and falls. This is part of the bad effects of the hollow furrow. Good or bad farming is nothing more nor less than a good or bad seed bed.

It is interesting to observe the action of the plough in different counties. The celebrated iron plough makers cut their furrows at an angle of 45, in order to have as much top as possible for the action of the harrow, but they leave the furrow very hollow. The old wood ploughs of Yorkshire and Lincolnshire place their furrows at an angle of 30—a little too flat, but less hollow. The Kent plough turns its furrows quite over on their backs, that they may have no hollow; but, on the stiff soils, it leaves it too flat. In many parts of Wales, the farmers hold it of the highest importance to have a keen top to the furrow, that the harrow may make a good tilth for the seed. And this would be very well if the bottom of the furrow was as good as the top. Unfortunately, this is only a sacrifice of utility to appearance, for the left side of the furrow is cut out 2in. deeper than the right, which leaves the bottom corrugated.

At the Warwick meeting of the Royal Show, the farmers and plough makers were startled by a kind of new plough made and exhibited by the Messrs. Hornsby. The novelty consisted in a long convex turn-furrow, as, up to this time, all others had been concave. So great and so sudden a change in the mode of turning the furrow slice created a great sensation; yet the result of the trials gave the first prize to this new convex breast plough. We remember well the conversation on the ground at the time it made its appearance. There was hardly a conflicting opinion expressed, but one and all said that if this convex turn-furrow was right, all the others were wrong; and, when the trial of ploughs took place again at Newcastle four years after, there was not one concave turn-furrow on the trial ground. We do not remember an instance in the history of implement progress where there has been such universal copying. Thus, the convex became a raging fashion for four or five years; but it disappeared as suddenly as it came, and left hardly a trace behind, for at the Leicester and Manchester meetings, all the turn-furrows except one or two were concave again. There were no scientific reasons given for its adoption nor for its rejection. It was a wanton caprice of fashion, from which the mechanical sciences should be quite free.

We will conclude this letter by a few remarks on what were called three new ploughs exhibited for the first time at the Manchester meeting. We will take, first, the one invented by Mr. William Woof, of Bedford, which we think is a step in the right direction. His object is to destroy the hollow furrow and leave a tilth in its place; and to cut off about 2in. at the top of the furrow, to bring the furrow in a forward state for the action of the harrow. We saw this plough in operation, and it accomplished its object in a very perfect manner at one operation. His means of accomplishing this important work was simple. He places, at the back of the plough, a bevel disc wheel; and, in the turn-furrow, a steel disc revolving knife.

The next was a new beam for a plough, the invention of Mr. Cook, of Lincoln. It consisted of angle iron filled up with wood, which prevented the beam of the plough from springing or bending in work, which is so common a defect of the iron plough. This we consider the best plough beam ever produced, as it is lighter and stronger than any other. The other was an invention by a Scotchman, and manufactured by Messrs. Fowler, of Leeds. It consisted of a double plough working on three wheels, the object being to have a rolling friction instead of a dragging; but in this there is nothing new, yet, nevertheless, the plough was giving great satisfaction.

All these different modes of treating the soil by the common plough are but one step on the journey, and the end of the journey is a good seed bed. Now, we hold that implement to be the best which brings the soil the nearest to the seed bed at one operation.—We are, Sir, yours, &c.

F. and C. HANCOCK, Engineers.
Plough and Screw Propeller Works, Dudley,
September 4.

THE Edmunds' case will come on in the Court of Arbitration (Court of Common Pleas, Westminster Hall) on Thursday, the 21st inst., at ten o'clock, and there is now every prospect of this long-protracted litigation, which has subsisted now for nearly six years, being brought to a final determination. The arbitrators are the Hon. G. Denman, Q.C., and Mr. C. Pollock, Q.C.; the umpire, Mr. Manisty, Q.C.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

RECEIVED.—H. E.—E. K. D.—J. H.—J. C. L.—R. R.—W. C. and Co.—R. D.—F. R.—S. E. C. and Co.—H. R.—T. H. T.—J. H.—R. B.—S. D. T.—A. N.—R. F. B.—R. S.—G. E.—S. and A.—C. M.—J. D. W.—H. F.—W. N.—H. B.—F. H.—A. O.—H. and Co.—E. H.—E. A. I.—R. T.—J. B. S.—L. E. F.—J. B. and Co.—W. C. and Co.—H. N.—R. B. C.—T. E.—B. J. and Co.

Naval, Military, and Gunnery Items.

WE, ("Army and Navy Gazette") believe that the fiat will shortly go forth for the disbanding of the Royal Canadian Rifles and the Cape Mounted Riflemen, both of which corps will disappear from the Army List at the commencement of the next financial year.

THE "Thermopylæ," Captain Kemball, owned by Messrs. George Thompson and Co., has arrived off the Lizard in 88 days from Foochow, with new season's tea. This is the quickest passage ever made. The average is 95 to 100 days against the monsoon.

THE maritime insurance companies of Paris, on hearing of the disaster at Bordeaux, immediately opened a subscription for the sufferers. Ten thousand francs have been already collected. There is reason now to believe that the losses will not greatly exceed 3,000,000f.

THE following ships are under orders to return to England from the stations named:—"Argus," 6, paddle sloop, Commander F. W. Hallowes, from the Cape of Good Hope and West Coast of Africa station; "Peterel," 8, screw sloop, Commander the Hon. E. G. L. Cochrane, from the Cape of Good Hope and West Coast of Africa station; "Rodney," 72, screw ship, Captain Algernon C. F. Heneage, from the China station.

A NUMBER of officers and non-commissioned officers from the various brigades of Royal Artillery stationed in the United Kingdom are now pursuing a course of instruction in army signalling at the School of Military Engineering at Chatham, under the direction of Captain R. H. Stodhert, R.E., the instructor in telegraphy at that establishment. A party of these have left Chatham for Sheerness, and at night they exchange signals with parties stationed at Chatham, the lime light being used, and the signals being made on Major Bolton's system.

THE Adjutant-General, Lord William Paulet, by command, has issued the subjoined General Order in reference to the Staff College examinations:—The following campaigns will form the subject of examination in Military History and Geography at the examination for admission to the Staff College, to be held in July, 1879:—1. The operations in East Prussia and Poland from December, 1806, to June, 1807, with the battle of Friedland in detail. 2. The campaign of 1859, with the battle of Solferino in detail. Candidates will be expected to have an accurate knowledge of the geography of the seat of war in both campaigns, with reference more especially to military operations.

Miscellanea.

DR. RUTHERFORD has been appointed Professor of Physiology in King's College, London, in the room of Dr. Beale, who has been appointed to the chair of Pathological Anatomy.

BORDEAUX has been visited with another conflagration. The fire broke out in the shipbuilders' yards near the docks, and destroyed property to the value of a million francs.

THE Bishop of British Columbia received on Sunday last a telegram from Victoria, the capital of the colony, announcing the total destruction by fire of the Anglican Cathedral in that city.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending October 2, was 4,931. Total number since the opening of the Museum, free daily (May 12, 1858) 1,657,205.

A FIRE, which is believed to be the work of an incendiary, broke out on Monday in the gun-cotton magazine of Messrs. Reed and Rowe, situate near the town of Penrhyn, Cornwall. Forty thousand gun-cotton charges for mines were destroyed, but fortunately were so stowed away that no dangerous explosion occurred, although the fire burned with great fury.

THE autobiography of Flora Macdonald, the preserver of Prince Charles Stuart, will shortly be published in Edinburgh. The MS. has till now been carefully kept in the family record chest. The volume, which is being edited by the last surviving granddaughter of the heroine, will contain some interesting anecdotes hitherto unpublished regarding the memorable escape of the Prince.

THE interest in the All-England Ploughing Matches has very considerably abated since the Howards of Bedford and the Hornsbys of Grantham have ceased to compete at them. These two great firms have for some time declined to send their skilled hands against ordinary local ploughmen, and only enter the lists in England at the great periodical trial of the Royal Agricultural Society, regarded as "The Derby" in the ploughing world.

THE number of visitors to the South Kensington Museum during the week ending October 2, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 14,197; Meyrick and other galleries, 2,353; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 1,767; Meyrick and other galleries, 133; total, 18,450. Average of corresponding week in former years, 12,709. Total from opening of Museum, 8,848,211.

THE "Montreal Daily News" gives a summary of the gold production of Nova Scotia for the eight years ended December 31 last, this comprising nearly the entire period since the first discovery. The total yield in that interval is stated to have been 160,000oz., valued at £640,000, nearly the whole of which was obtained from quartz. Hence the yearly average has been 20,000oz., worth £80,000. The best year was 1867, when the total reached nearly 30,000oz. The number of miners employed is about 700 or 800.

A NUMBER of influential gentlemen met on Saturday last at Middlesborough-on-Tees, for the purpose of founding an Association of Foremen Engineers and Foremen Ironworkers. The proposition met with general approval. It was felt and admitted that the London Foremen Engineers, by associating for intellectual and material advantage, had been instrumental in dignifying the class to which they belong, and that those of Middlesborough might well follow the example set them. The meeting was adjourned to Saturday, the 9th inst. (to-morrow).

AN important meeting of the Royal Horticultural Society took place on Tuesday afternoon. The principal objects of interest were the fruit and esculent and poisonous fungi, though these were far from being the only objects. The Rev. Mr. Berkeley read a most interesting paper from Dr. Curtis, as to the use of esculent fungi in the United States, where they became an important article of food during the mournful struggle between the Northern and Southern States. The various specimens of edible fungi were cooked and freely partaken of by the large assemblage of persons who thronged the council-room.

M. BRUN, living at Soleilhas, Lower Alps, has sent specimens of what he calls St. Helena wheat to the editor of a provincial newspaper. The description he gives of it is that it has one central ear, and round this spout nine or ten others. It is bearded, and each ear, or rather cluster of ears, growing on one stalk contains from 100 to 120 grains. There is, according to him, a double advantage in growing this grain, that it requires a much less quantity of seed, thin sowing being essential to its proper development, and that the crop greatly exceeds that obtained from ordinary wheat.

SINCE Mount Palatine, at Rome, has become the private property of the Emperor Napoleon, the excavations executed by his Majesty's orders and at his cost have produced most valuable results for archæology and for the history of ancient Rome. The works, ably directed by Chevalier Pietro Rosa, member of the Paris Academy of the Fine Arts, have lately brought to light nearly the whole extent of the Palace of the Cæsars, and a description of them will be included in the supplement which the savant Fabio Gori purposes issuing to his great work on the Palatine edifices.

SEVERAL shocks of earthquake were felt at Santo Gemignano, a town about 25 miles south of Florence, on the 26th ult., and the following days. Each was accompanied with subsultory motion and a loud noise. Two houses were shaken to the ground, and many others, with the museum and the churches of the Madonna and Santo Augustino, seriously damaged, those on the north-western side especially. The shocks were felt less severely at Sienna, Colle, Castelfiorentino, Volterra, Certaldo, and Poggibonsi. The sky was cloudless and the heat almost insupportable.

AT the beginning of 1867, there were 5,110kils. of railway opened in Spain, which, during the previous year, carried 10,962,866 passengers. The net receipts of these lines, in 1866, amounted to 143,814,402 reals (£1,498,066). 1,887kils. of railway, in addition to the above-mentioned 5,110kils., are to be opened by the end of 1867, making a total of 6,977kils. The total cost of this network will, when complete, amount to 607,848,512 escudi (£65,850,255), towards which the government give subventions to the amount of 183,228,815 escudi (£19,849,735).

FOUR more statues of the Kings and Queens of England have within the last few days been placed in their respective niches in the Royal Gallery leading from the Victoria Tower to the House of Lords; viz.:—Statues of Queen Elizabeth, James the First, Edward the First, and Queen Anne. These statues are of Caen stone. The sculptor is Mr. J. B. Philip. The statues which had previously been placed were those of Richard the First, Edward the Third, Alfred the Great, and William the First. Only four niches now remain to be occupied.

IT was officially reported on July 1 that a very rich gold field had been discovered at Trunkey Creek, which lies in the west, about thirty-eight miles from Bathurst and sixteen from Careoar. The field is described as consisting of auriferous quartz reefs, in which the precious metal is very abundant. These reefs have been marked off for six miles, and fresh discoveries in the vicinity are reported daily. The district is mountainous for many miles around, and, besides bearing gold, has silver, copper, iron, marble, and limestone. It is also a purely agricultural country. All the gold-bearing reefs run north and south, and dip slightly to the west. A report is current to the effect that there are already 800 people on the ground, and the whole neighbourhood is in a ferment.

THE "Ironmonger" suggests the desirability of constructing trains wholly of iron. They might be so constructed of this material as certainly to offer greater power of resistance in case of collision, and this without materially augmenting their weight, whilst the danger from fire would be almost nil. With strong frames, properly braced, the sides might be covered with comparatively thin sheets of iron. Railway companies cannot certainly be expected, in view of the large intermediate outlay that would be involved in an entire change of rolling stock, to carry out at once the suggestion, but the transformation might be effected gradually, and all carriages hereafter constructed might be of iron. These iron cars would doubtless be more lasting, and, in the end, more economical. Our large iron manufacturers would do well to give this subject their attention.

PROFESSOR G. CAMPANI, of Siena, has been investigating the action of permanganate of potash on asparagine, the vegetable base of asparagus, but which may also be extracted from the roots of marshmallows and various other plants. The results he has arrived at are as follows:—1. That asparagine exercises a slow reaction on permanganate of potash at the common temperature, when both these substances are dissolved in water. 2. That the former acts quickly and powerfully on the other when both substances are reduced to powder, then mixed together, and afterwards moistened with a little water. 3. That their reaction is equally prompt and strong when, being dissolved in water, their mixture is heated to ebullition, and much more so if sulphuric acid or caustic potash be added. 4. That under such circumstances asparagine yields nearly the whole of its nitrogen in the shape of ammonia, and a little of it in that of prussic acid, but never in a free state. 5. And that carbon is chiefly disengaged under the form of a carbonic anhydride or oxalic acid; and very little of it under that of hydrocyanic and formic acid.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—754, 784, 786
BUILDINGS AND BUILDING MATERIALS—742, 764, 777
CHEMISTRY AND PHOTOGRAPHY—744, 761
CULTIVATION OF THE SOIL, including agricultural implements and machines—761, 767, 795
ELECTRICAL APPARATUS—770, 797
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—752, 756, 759, 772, 773, 776, 789, 796, 799 802, 811

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—738, 740, 767, 769, 778, 790, 798
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—748, 750, 751, 760, 765, 780, 801, 803, 804, 813, 814
GENERAL MACHINERY—758, 768, 785, 787
LIGHTING, HEATING, AND VENTILATING—749, 753, 782, 784
METALS, including apparatus for their manufacture—755
MISCELLANEOUS—741, 743, 763, 766, 775, 781, 788, 791, 806, 807, 809, 815
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—737, 748, 775, 800, 805, 808, 810, 816
SHIPS AND BOATS, including their fittings—744, 762, 770, 774, 792, 794, 812
STEAM ENGINES—746
WARFARE—729, 757, 779, 783, 793

737 F. O. PALMER, Hurstpierpoint. *Conveyances.* Dated March 10, 1869.
The inventor uses a car hung to the axis of a pulley or pulleys running on a line or lines, which may be of wire, chain, rope, or other material, and the car is caused to travel to and fro from end to end of such line by bringing the line into an inclined position so that the car may descend along it by gravitation. For the purpose of raising and lowering the ends of the line each end of the line may be attached to a pillar which can be raised or lowered at pleasure, either by a rack and pinion or by hydraulic pressure or by other suitable means, or the end of the line might be attached to a slide capable of being raised or lowered by any suitable means upon a pillar, or the end of the line might be unhooked from the point of the post and hooked on to another point on such post so as to alter the angle of the line, or the end of the line might be attached to the end of a lever and be raised or lowered by running such lever on its axis.—Patent completed.

738 G. SPENCER, Cannon-street, E.C. *Preserving grain, &c.* Dated March 10, 1869.
The inventor places the substance to be preserved in a suitable air-tight vessel from which atmospheric air is partially or wholly withdrawn by any convenient means, and replaces it by filling the containing vessel with either carbonic acid gas or carbonic oxide gas, by which means the substances are preserved from change.—Patent abandoned.

739 A. MONCRIEFF, Culfargie, Perth. *Ordnance.* Dated March 10, 1869.
This relates to a patent dated 4th June, 1866 (No. 1548), and consists in so arranging the counterweight connected to the elevators that the gun, on sinking down after firing, can pass below the counterweight so as to be more accessible for loading and more under cover. For this purpose the inventor constructs the counterweight with an opening through which the muzzle of the gun or the counterweight may be constructed of separate parts between which the gun passes.—Patent completed.

740 D. JOHNSON, Wrexham. *Decorticating grain.* Dated March 10, 1869.
This consists chiefly in the arrangement together of two filing or rasping surfaces by which the grain is acted upon as it passes between them, and in certain details of construction hereinafter described. The files or rasps are fixed on a drum and case. The drum is made to revolve within the case. The wheat, rice, or other grain is admitted into the space between the drum and case and is therein subjected to the action of the files or rasps, which rapidly and effectually clean and remove the husks therefrom.—Patent completed.

741 J. B. BERNIER, Wilmington-square, E.C. *Preserving yeast for manure.* Dated March 11, 1869.
The process consists in mixing yeast with a suitable proportion of quicklime, to which some plaster may be added; this mixture produces a good manure. The proportion varies according to the condition of the yeast, but generally 30lb. of quicklime and 10lb. of plaster is used to every hundredweight of yeast is best.—Patent completed.

742 T. H. HARRISSON, Liverpool. *Waterclosets.* Dated March 11, 1869.
This consists of an enlargement of the main pipe, or a chamber situated between the ordinary valve cock and the watercloset basin, from the top of which vessel or chamber an air pipe is taken into the basin by the side of the supply (or air is otherwise admitted), so that when the valve cock is lifted and the water turned on, the vessel is instantaneously filled and the supply rushes forward into the basin unchecked in force. When the valve is reclosed the air releases the store of water or back-wash, which then flows into the basin and securely traps the closet.—Patent abandoned.

743 W. WELLS, Ardwick. *Sanitary apparatus.* Dated March 11, 1869.
This consists in an improved privy, which is so constructed that the solid portion of the excreta is kept separate from the urine, thereby keeping the solid portion dry and facilitating its removal. In carrying out the invention the inventor places a drum rotating on a horizontal axle or slightly conical disc mounted on a vertical or nearly vertical axle under the pan or seat of the privy, and this drum or disc is made to revolve partly round every time the privy has been used by a footboard which is hinged to the floor or by the seat itself, the footboard or seat being connected to the drum or disc by a lever catch and ratchet wheel or other equivalents, and when pressure is removed from the footboard or seat it is brought back to its original position by a counterweight. When the privy has been used the urine runs off the drum or disc, while the solid matter adheres to it, and when the drum or disc is turned partly round by the moving of the footboard or seat the solid matter is scraped off by a thin blade of metal or other suitable agent, and is collected in a separate vessel, from which it can be removed at any time.—Patent completed.

744 G. GLOVER, Pimlico. *Colouring hydrocarbons.* (A communication.) Dated March 11, 1869.
The colour best suited for the purpose is derived from the root of the "anchusa avensis," known in commerce by the name of alconet root, which imparts to the fluid a rose tint. Or the inventor takes the common turmeric of commerce (curaima longa), which would impart a yellow tint. Or he uses indigo (fera tinctoria) or prussate of iron, or any of the blue anilines, by first dissolving them and then mixing them within the hydrocarbon, which imparts a blue tint. Or the tint may be changed by any vegetable, animal, or mineral colour, so as to impart the special tint intended.—Patent completed.

745 W. H. CLAPP, Ball's Pond. *Signal lanterns.* Dated March 11, 1869.
The lamp of the lantern is surrounded with a revolving cylindrical slide, such as is used in an ordinary dark lantern, there being an opening made through the cylinder, which, when brought between the lamp and the lens or glass of the lantern, allows a stream of light to pass from the lantern. In some cases the lantern may be made with more than the lens or glass.—Patent completed.

746 J. and A. WADDINGTON and F. BELL, Barrow-in-Furness. *Condensing steam in breweries.* Dated March 11, 1869.
This consists in causing the steam, and the smell arising therefrom, to be condensed by coming into contact with a lid or cover, over or through which a current of cold air or cold water, or other liquid or fluid is caused to pass.—Patent completed.

747 W. BETTS, Wharf-road, City-road. *Capsules.* Dated March 11, 1869.
Capsules made according to this invention are perforated in any ornamental or other pattern or device, so that the contents are not hermetically sealed, whilst they are nevertheless at the same time protected from being tampered with. This perforation of the capsule can be effected in any convenient manner, but it is found that stamping is the most ready mode of accomplishing it.—Patent completed.

748 C. H. COOPER, Birmingham. *Whip sockets.* Dated March 11, 1869.
This consists in fixing, by stitching or otherwise, an internal lining from the mouth of the socket downwards. The lining is of any suitable material, such as leather, sheet gutta-percha, or suitable prepared waterproof cloth, and formed from the plain without moulding of one or more pieces or thicknesses partially divided vertically by the removal of parallel arranged gores, that is to say, pieces removed broader in the middle, and curving off towards the end.—Patent completed.

749 J. BATHGATE, Edinburgh. *Gas meters.* Dated March 11, 1869.
The case of the meter is constructed in two distinct parts, an under part and an upper part, the under part containing the movable diaphragms and passages thereto, whilst the upper part encloses the valve box and valves with the regulating and indicating mechanism, none of which, however, are attached to it, but are placed on the top of the under part, the upper part merely serving as a protective covering for them, and these two parts, namely, the upper and lower parts of the case, are put together by means of screws or other similar fastenings. The valve box is made separately, by preference, of cast metal, and is also retained in place by means of screws.—Patent completed.

750 W. E. NEWTON, Chancery-lane. *Cigar cases.* (A communication.) Dated March 11, 1869.
This consists in a case, of double hollow leaf form, struck or cut, and stamped (with corrugated formations to form pockets for the article or articles it is designed to carry) out of a single piece of sheet metal or other suitable material. The corrugated sheet is then folded intermediately of its length to constitute a spring hinge or connection and gives to the case its necessary hollow double leaf or book form. This completes the case, which may, however, afterwards be lined with paper or other thin material, and, if desired, any suitable fastening may be applied thereto.—Patent completed.

751 W. E. NEWTON, Chancery-lane. *Attachment for picture cords.* (A communication.) Dated March 11, 1869.
This consists in the use of tubes formed with longitudinal or transverse notches or slots provided or not with pins, hooks, or teeth. The improved attachment is cut out of sheet metal, and is made with wing pieces, which are bent up to form tubes to receive the cord, the notches in the sides of the upper part forming transverse notches at the ends of the tubes, and the notches in the lower part forming longitudinal notches in the sides of the tube, so that the cord may be secured in place when adjusted by drawing it into one or the other of these notches.—Patent abandoned.

752 T. GREENWOOD, Leeds. *Preparing fibres.* Dated March 11, 1869.
The inventor provides a novel arrangement of mechanism, which will enable him to accumulate the fibrous material fed thereto, and to form it into a lap or sliver, and then strip it off the retaining surface and deliver it out of the machine ready for undergoing the operations of the drawing frame.—Patent completed.

753 J. H. JOHNSON, Lincoln's Inn-fields. *Artificial fuel.* (A communication.) Dated March 11, 1869.
This consists in the manufacture by means of vegetable resin, used in proportions determined according to the product to be obtained, of:—First, agglomerated fuel, produced from small vegetable and mineral fuel or the dust thereof, and intended to be consumed in furnaces and ordinary domestic firegrates. Second, dense coke capable of being employed for the same purpose. Third, lighting gas and dense coke produced simultaneously, vegetable resin thoroughly mixed with fuel dust and properly burned, produces a coke of good quality, whilst the dust employed alone either yields an inferior coke or is not capable of producing coke at all.—Patent completed.

754 H. ORMSON, Chelsea. *Boilers.* Dated March 11, 1869.
The internal boiler may be of a concentric, convolutic, or multitubular shape, and the boiler is made with more or less number of tubes or convolutions according to use.—Patent completed.

755 J. M. NAPIER, York-road, Lambeth. *Striking coins.* Dated March 11, 1869.
This consists in machinery or apparatus for cutting into pieces the ingots of metal to be manufactured into coins, so as to facilitate the charging of the crucibles, and afford a means of detecting the presence of foreign substances in the ingots. For this purpose, the inventor employs a suitably formed knife actuated by hydraulic pressure (lever pressure may be used if preferred). This knife operates towards an anvil, against which the ingot is supported. He employs means for regulating the edge of the anvil in its position with respect to the edge of the cutting knife, so that the piece to be cut off the ingot is supported by the anvil or block partially only and in such manner that, as the knife is forced into the metal, the front part of the ingot which overhangs the front edge of the anvil.—Patent completed.

756 G. SMITH, Headingley. *Finishing woollen cloths.* Dated March 11, 1869.
The materials employed are British and foreign gums; dextrine and gum senegal or gum tragacanth, with refined sulphate of indigo, which are ground and sifted into a very fine powder, in which state they may be sold for use.—Patent abandoned.

757 F. R. AIKMAN, Brompton-crescent. *Firearms.* Dated March 11, 1869.
This relates to a patent dated July 8, 1867 (No. 1934). The inventor attaches to the gun in any convenient position a small barrel, such as that of a rifle or pistol. He mounts this barrel on a horizontal pivot or axis, and applies to it a scale for vertical adjustment with a screw or other convenient apparatus for setting it so that its line of fire can be made parallel to the line of sight of the gun to which it is attached, or can be elevated or depressed as desired.—Patent abandoned.

758 T. BEELEY, Chester, and D. HANSON, Dukinfield. *Welding and flanging tubes.* Dated March 11, 1869.
This consists in a machine by means of which the blows necessary for welding the seams of boilers and other constructions are struck, instead of employing a number of labourers for this purpose as at present. This is accomplished as follows:—The machine consists of a number of stampers or strikers which are arranged side by side in a row. The stampers or strikers, are so arranged that they may be raised to a certain definite height, and then be allowed to fall by their own weight, or the force of the blow may be increased by means of a spring. Below this row of strikers or stampers is placed the anvil, which may be similar in shape to that now in use for this purpose, or curved to the requisite form for welding or flanging.—Patent completed.

759 W. R. LAKE, Southampton-buildings. *Spinning fibr* (A communication.) Dated March 11, 1869.
The spindle is stepped in a foot rest which projects from the lifting rail, which is made to traverse by any suitable mechanism. The upper end of the spindle is furnished with a square and flange in order to provide a means for driving the bobbin by the application of the driving power to its upper instead of its lower end.—Patent completed.

760 W. COXHEAD, Gresham-street. *Goloshes.* Dated March 12, 1869.
This consists in modifying the shape or form of india-rubber goloshes or shoes so as to adapt them to the peculiar conformation of feet and shoes of the Chinese and other eastern nations.—Patent abandoned.

761 E. F. R. LUCAS, Middlesborough-on-Tees. *Manufacture of phosphate of lime.* Dated March 12, 1869.
The coprolites, cair ashes, phosphorites, or other phosphates are first dissolved in hydrochloric acid. The solution thus produced is evaporated by any of the well-known means to the crystallising point, and the liquor is then run off into cooling vessels of stone or wood. In cooling, the greatest part of the soluble phosphate of lime is crystallised, the mother liquor is drawn off from the crystals; evaporated again it gives a second quantity of crystals of soluble phosphate of lime. The crystals are then dried by means of air, centrifugal apparatus, or pressed in a filter press. The last mother liquor contains chloride of calcium, chloride of iron, and only a small quantity of phosphate of lime, which phosphate of lime is precipitated by means of caustic lime, and redissolved in hydrochloric acid, together with a fresh quantity of phosphate.—Patent abandoned.

762 H. J. B. KENDALL, Great Winchester-street. *Paint for ships' bottoms.* (A communication.) Dated March 12, 1869.
The composition consists of the following ingredients:—Arseniate of copper, oxide of iron, carbonate of lime, crystallised strychnine, concentrated anhydrous extract of tobacco, and crystallised borax. To these ingredients coal tar or other base or medium, or coal tar with other base or medium, is added, according to the colour required, and the whole is ground together.—Patent completed.

763 J. PORTEOUS, Edinburgh, and H. GIBSON, Musselburgh. *Tobacco.* Dated March 12, 1869.
This consists of a shaft or spindle on which circular flanges (by preference with openings formed in them) are placed, the distance between these flanges being equal to the length of the rolls which are to be coiled. On the end of the above-mentioned spindle a worm or screw is fitted, and this gears into a worm wheel carried on a stud or cross shaft. To the body of the worm wheel a heart or other shaped cam is fixed which acts against an anti-friction roller carried on a horizontal guide rod, this guide rod being jointed to a lever to which the vibrating action due to the cam is communicated. In lieu of the cam a double cut screw may be employed for giving the requisite movement to the lever and guide rod. Attached to the upper end of the vibrating lever is a horizontal sliding bar, to which the reciprocating movement of the lever is communicated; as the cam above mentioned revolves on that end of the sliding bar next to the flanges, between which the tobacco is coiled, a tube or eye piece is fitted, through which the twisted tobacco passes, so that it is unwound from the bobbin on which it was wound on the twisting machine, the reciprocating movement of the tube or eyepiece causes it to be coiled closely and regularly between the flanges on the main spindle.—Patent completed.

764 D. S. PRICE, Great George-street, S.W. *Paving.* Dated March 12, 1869.
This consists in the use of blocks of cast iron, the surface or surfaces of which are hardened by the process of "chilling," or which are made of the description of cast iron for which letters patent were granted to the same inventor, and E. C. Nicholson, dated November 20, 1865 (No. 2618).—Patent abandoned.

765 E. PRITCHARD, Fenchurch-street. *Button or stud.* Dated March 12, 1869.
The inventor forms the button or fastening in two parts, which, when connected together, present the appearance of a shirt stud. He forms the shank of the button in two parts, and of short tubes, one tube being fixed on one part of the button, and the other tube on the other part thereof, and in the centre of one of these tubes the inventor fixes a screwed pin, and in the hole of the other tube he forms

a female screw capable of fitting on to the screwed pin.—Patent abandoned.

766 G. Bray, Deptford. *Disengaging hook.* Dated March 12, 1869.

The inventor provides the pole head of the carriage with divided eyes or rings which do not require any shackle connection, as they can be made to form parts of the pole head itself. These eyes or hooks are so made that one part moves upon a pin or joint against one end of which a spring catch is fixed, by operating on which the ring or eye is opened so that a link of a chain or other connector can be passed on to the ring or eye, and by again pressing the spring catch it will be closed, and the connection rendered complete.—Patent completed.

767 J. Cooke, Lincoln. *Ploughs.* Dated March 12, 1869.

This consists in manufacturing an improved beam for ploughs of a combination of wood and iron or of wood and steel.—Patent completed.

768 H. J. Cenant, Tubize, Belgium. *Steam cocks.* Dated March 12, 1869.

Instead of using a conical plug fitted to a corresponding seat, the inventor provides the cock with a flat-faced valve seat which is pierced with holes for connecting the supply with the exit passage of the cock. To this flat-faced valve seat he applies a disc valve pierced with corresponding holes, which, when brought into coincidence with those of the seat, will open the exit passage for the discharge of steam or water through the cock. This disc is secured to the end of a stem which carries a handle for operating the cock.—Patent abandoned.

769 C. E. Brooman, Fleet-street. *Manufacture of salt.* (A communication.) Dated March 12, 1869.

This relates to the manufacture of salt, and has for its object a process for the manufacture of a crystallizable salt in special vessels, which process is founded partly on the employment of mechanical means and partly upon the theory of the tension of saturated vapours, in order to constitute an evaporising apparatus utilising one, two, or more consecutive times the latent heat of the vapours condensed away from the air, and in consequence economizing the combustibles used in the manufacture.—Patent completed.

770 L. Labadie, Bordeaux. *Magnetic regulator.* Dated March 12, 1869.

This consists in the employment of substances very sensible to magnetism, such as iron, cast iron, steel, or nickel, in order to compensate for the disturbing effects of the iron of the ship upon the compass needle. The inventor has found that a cylinder composed of the metals above named is a good conductor of magnetism, and has the property of preserving the magnetized needle from the influence of the currents proceeding from the iron composing the ship, and at the same time of preserving its freedom of action.—Patent completed.

771 J. Duffey, Chelsea. *Railway brake and coupling.* Dated March 12, 1869.

This consists in arranging curved brake surfaces connected together and pendant in front of each pair of wheels from a point of the framing above the latter. The brakes are connected together by suitable rods, so that they may be applied to all the wheels of the engine or carriage at once upon releasing a hand lever, which holds them back from the wheels.—Patent abandoned.

772 A. M. Clark, Chancery-lane. *Pulp for paper.* (A communication). Dated March 12, 1869.

This relates to the production of pulp from the hop bine suitable for the manufacture of paper. For this purpose the inventor first cuts up the bine into suitable lengths by mechanical means, whether in a green or dry condition, and then subjects it to a series of washings in water until the ligneous fibres are perfectly purified.—Patent abandoned.

773 H. C. Bartlett, Garlick-hill, and A. G. Southby, Bulford. *Paper making.* Dated March 13, 1869.

The inventors use for the purpose of separating, beating, washing, or mixing fibrous substances mixed with more or less water, a cylinder box, containing either plates or bars or projections fixed to the side or sides, so that the plane of the plates or bars or projections shall be at a right or other angle to the axis of one or more shafts running through from end to end of the cylinder or box having on the shaft or shafts radiating or spirally disposed bars or plates or projections the converse of those on the inner part of the cylinder or box and working between them.—Patent completed.

774 W. H. Harfield, Royal Exchange-buildings. *Capstans.* Dated March 13, 1869.

In order to work a windlass by means of a capstan through toothed gearing, where the cable is taken to the under side of the windlass, the inventor proposes to employ skew bevel gearing (in place of the ordinary bevel gearing heretofore used) so as to enable the vertical shaft to pass the horizontal shaft.—Patent completed.

775 J. B. Palmer, Bow. *Matches.* Dated March 10, 1869.

This consists in using, as the igniting composition in ordinary friction matches and fusees, chloride of potash, and amorphous phosphorus in the proportion of sixteen parts of chlorate of potash to one part of amorphous phosphorus. These substances are combined with about twenty parts of the nitrate sulphite, sulphate, or the oxides of lead or the hyposulphite or sulphite of iron or zinc, or the sulphate of zinc or other sulphite or sulphate, or the twenty parts may be made up of two or more of the above substances in optional proportions. The above composition is mixed with about two parts of gelatine, glue, or gum, or any other suitable adhesive matter dissolved in water.—Patent abandoned.

776 H. Delattre, Roubaix. *New tissue.* Dated March 13, 1869.

The invention consists in making use of a web or warp of suitably twisted or twined worsted or woollen yarn, some of which warped yarns are twisted in one and the others in the opposite direction so as to alternate in a symmetrically regular manner over the entire breadth of the web. By this means a peculiar sort of shrivelling or shrinking will take place in the fabric, which will present a form hitherto unattained.—Patent abandoned.

777 P. B. O'Neill, Paris, and W. H. H. McNeight, Dublin. *Raising and lowering blinds.* Dated March 13, 1869.

A roller supported at each end in bearings is placed above the blind, one end of which is provided with a ratchet wheel. Into the teeth of this ratchet a spring pawl takes, and it always has a tendency to do so, but sometimes the ratchet and pawl is dispensed with. Outside the ratchet a groove is formed on the roller round which a cord is wound so that by pulling the cord a rotary motion is communicated to the roller. The laths composing the blind are united by tapes secured to the laths in the ordinary way, but at top they pass over the roller and are there supported on rollers or guides.—Patent abandoned.

778 E. W. and M. Slade, Wilton. *Portable oven.* Dated March 13, 1869.

This consists of an oven made preferably of a semicircular form, and of metal. When made of a non-metallic material it is lined inside with metal, as usual, for the purpose of reflecting and concentrating the heat from the fire before which it is placed. This improved oven is open at the side next the fire, and may be built up in sections one on the other in grooves formed around the upper edges of each section, so as to accommodate a number of joints at a time, according to the size of the fire. The oven may, however, be made in one piece, instead of removable sections. Each section is provided with one or more shelves or ledges for supporting a dish or pan or tray carrying a grating, on which is placed the joint to be cooked. The pan or tray also serves as a dripping-pan, and may be provided with a well in addition.—Patent completed.

779 J. Thomas, Birmingham. *Repeating firearms.* Dated March 13, 1869.

This consists in constructing and arranging the parts of repeating firearms so as to extract simultaneously the whole of the cases of the exploded cartridges from the chambers of the revolving barrels or cylinders of the arm, and also for effectually supporting the revolving barrels or cylinders during the discharge of the firearms.—Patent completed.

780 C. Vero, Atherstone. *Hardening hats.* Dated March 13, 1869.

The inventor covers the acting surfaces of the cones with fine wire gauze, to prevent the fibres spreading out. The cone of wire gauze for the inner cone upon which the hat body is placed, is woven by hand to the form desired, fresh wires being inserted into it at intervals, as the cone enlarges in diameter. This cone of wire gauze is placed upon the perforated metal cone, and is firmly bound to it at its base, or felt or cloth might be placed between the two. The conical lining of wire gauze for the upper cone is similarly woven to shape, and is placed within the metal cone and connected to it both at its base and apex, being at the base turned over and bound to its exterior, and at the apex attached by sewing to a small cup of perforated metal, similar to the cup to which the cloth lining heretofore employed was attached.—Patent completed.

781 J. Thomlinson, Carlisle, and W. Thomlinson, Loughborough. *Preparing gypsum.* Dated March 13, 1869.

In order to prepare gypsum for incorporating with paper pulp, previous to its being made into sheets, or for incorporating with textile fabrics, or for using, in other manufactures in the same manner as what is known as china clay is now used, the inventors calcine the gypsum in ovens or kilns or retorts, or in a cla mp or otherwise, with so high a degree of heat as to depri ve it of its cementing qualities. A full red or a white heat is required. The fuel for burning may in some cases be mixed with the gypsum, but when freedom from colour is desired it should be burnt in ovens or kilns fired externally.—Patent completed.

782 W. T. Carpenter, Westminster, Kent. *Manufacture of gas.* Dated March 13, 1869.

This consists in forming each of the retorts (which may be round, oval, or other convenient shape in transverse section) of an increasing diameter from the mouth to the back end, which is open and communicates with a chamber common to the whole setting.—Patent abandoned.

783 W. R. Lake, Southampton-buildings. *Breechloaders.* (A communication.) Dated March 13, 1869.

In using this arm there are only three movements to perform—first, the hammer is to be raised, and at the same time the trigger or sear is to be pushed forward; second, the charge is to be taken and introduced into the aperture in the barrel, which is uncovered by raising the hammer, the charge being pushed into the barrel with the thumb; and, third, the trigger is to be acted upon as in discharging any other firearm.—Patent abandoned.

784 J. Tenwick, Grantham. *Annealing ovens.* Dated March 13, 1869.

The inventor constructs the ovens and kilns of any required size, and of a circular form inside. The outside covering is made of iron or steel or any other metal suitable for the purpose, lined with firebricks, or other convenient material which can resist the fire; and firebars, ashpans, regulators, or dampers, and other accessories of the kind used in the construction of annealing ovens are provided.—Patent completed.

785 J. Henderson and T. Brown, Kirkcaldy. *Water cocks.* Dated March 15, 1869.

This consists in forming the body of the cock as a hollow cylinder, through which the spindle or stem of the valve passes. The inner part of the body of the cock consitutes the valve seat, and the stem or spindle passes out through the front end of the cylinder or body.—Patent abandoned.

786 W. A. Martin, Union-street, Borough. *Steam generators.* Dated March 15, 1869.

This consists in causing the highly heated steam from the upper part of the boiler to pass downwards nearly to the bottom of the boiler, where the water is comparatively cold and sluggish, for the purpose of assisting to heat and thereby to promote the circulation of the water. This is done by providing near to the boiler bottom a steam space, or steam or steam spaces, having a communication or communications extending upwards into the upper part of the steam space above the water level or nearly to the crown of the boiler.—Patent abandoned.

787 E. Sands, Manchester. *Rotary engine.* Dated March 15, 1869.

The inventor makes use of two or more fixed axles placed in the same vertical line and plane; on each of these axles is a pair of three-armed levers; connected with these levers and at any convenient distance from them are two or more pairs of toothed wheels, mounted on separate axles, whose lower periphery gear into stationary racks attached to the framework of the machine.—Patent abandoned.

788 J. C. Shaw, Patricroft, Lancaster. *Card grinder.* (A communication.) Dated March 15, 1869.

The inventor uses an ordinary hollow grinding cylinder, but the axle is composed of two distinct shafts. At each end of the cylinder is a long boss to which it is secured. The bosses are so connected to the shafts that they are capable of a rotary and lateral motion simultaneously. To the shaft at the driving end of the cylinder is fastened a pulley, and in the same shaft is cut a straight groove equal to the length of the traverse. A screw or other equivalent is fastened in the boss with its point projecting into the groove of the shaft, thereby transferring the rotary motion of the shaft to the boss, and, consequently, to the grinding cylinder.—Patent abandoned.

789 C. D. Abel, Southampton-buildings. *Weaving healds.* (A communication.) Dated March 15, 1869.

This consists in constructing healds of thin metal bands tapering in thickness from near the middle of their length towards each end. At the middle they are flattened in a direction at right angles to their width, and are there formed with an eye through which the warp thread is passed; they are formed with hooks at their ends, and are connected to the top and bottom staves of the frame by means of helical springs or coiled wires, into the loops of which they are hooked, and which are carried upon rods or bars passing through loops fixed to the staves.—Patent completed.

790 H. D. Rawlings, Nassau street, W. *Filling bottles.* Dated March 15, 1869.

The neck of the holder of the bottles or other receivers used during the filling and corking processes is capable of being open through a suitable tap or valve to the exhaust apparatus, as well as to the aerated liquid to be supplied to the bottle or other receiver. The atmospheric air contained in the receiver may, therefore, first be withdrawn and then, whilst the interior of the bottle or other receiver is in a state of exhaustion, the aerated liquid supplied thereto.—Patent abandoned.

791 J. G. Jennings, Palace-road, Lambeth. *Preparing sewage for irrigating land.* Dated March 15, 1869.

In order to separate from sewage, stones and other masses of solid matter which it brings down with it, the inventor conducts it through a pipe or channel on to a grating, which may be either horizontal or inclined upwards from the end on to which the sewage is delivered. The bars of the grating are arranged to run longitudinally from one end of the grating to the other, and in order to keep the spaces between the bars clear, and carry off from the upper surface of the grating the solid matters stopped by it, the inventors employ clearers, which are caused to rise up between the bars at the end at which the sewage comes on to them, and such clearers are then caused to travel up to the opposite end of the grating, carrying forward with them the solid matters resting upon the grating; the clearers then travel back and again rise up between the bars of the grating, at the end of which sewage comes on to it; the solid matters are thus caused to fall over the edge of the grating into a pit or receptacle.—Patent completed.

792 G. P. Evelyn, Pall Mall. *Sails, yards, and rigging.* Dated March 15, 1869.

The sail is laced to a boomyard, which is divided at about two-thirds of its length by double jaws or a strong metal ring which embraces the mast. The gaff yard embraces the mast in a similar manner, and the sail is divided at the mast and attached to it by rings or hoops which slide up and down it. The mast is supported by revolving stays or shrouds.—Patent abandoned.

793 J. R. Cooper, Birmingham. *Breech-loaders.* Dated March 14, 1869.

The inventor effects the opening and closing of the breech by means of a block raising and falling vertically. The block when raised closes the breech, and when dressed leaves it open. Through the block and in a line parallel with or inclined to the axis of the barrel is a hole in which a striker works for igniting the cartridge. The raising and lowering of the block is effected by a lever which may constitute the trigger guard of the gun. By the motion of this lever, the cocking of the hammer of the gun and the extraction and ejection of the empty cartridge case are effected.—Patent abandoned.

794 W. R. Lake, Southampton-buildings. *Steam vessels.* (A communication.) Dated March 15, 1869.

This consists in fitting a longitudinal truss or deep keelson rising vertically within the vessel to a height sufficient to stiffen her and prevent injury by the weight, whether riding upon or between waves. By this construction, the vessel presents less hydrostatic resistance and draws less water for the same capacity of burden, and is very strong to resist the effects of strain or torsion.—Patent completed.

795 W. R. Lake, Southampton-buildings. *Multiple drilling machine.* (A communication.) Dated March 15, 1869.

This consists chiefly in constructing and arranging the drilling mechanism in such a manner that the required number of holes may be drilled at the same time, at any desired distance apart, in a rail bar or other article, and so that in drilling these holes the drills will adapt themselves to such variations or deviations from a straight line or plane as are produced by the twisting or warping of the rail or other article, and will form the holes at right angles to the immediately surrounding portion of the rail or other article.—Patent completed.

796 J. Taylor, R. and J. Ingham, and J. Sharplis, all of Crawshaw Booth, Lancashire. *Carding engines.* Dated March 16, 1869.

The inventors divide the doffing cylinder so as to meet a double exigency, viz., first to obtain a continuous fleece, so as to dispense with piercing machinery, and second, to obtain a sliver neither twisted, half twisted, or rubbed.—Patent abandoned.

797 W. A. Lyttle, Hammersmith. *Insulating telegraph wire.* Dated March 16, 1869.

The inventor uses enamelled iron, either wrought or cast, in forming the stems which support the "inverts" or other insulating caps such as are now employed.—Patent completed.

798 W. M'Adam and S. Surman, Glasgow. *Packing bottles.* Dated March 16, 1869.

The cases made of pulped material are formed with grooves, flutes, or indentations of various shapes, either on their inner or outer surfaces, which are intended to reduce the surfaces of contact of a series of points or lines, thus imparting a certain amount of elasticity to the cases.—Patent completed.

799 O. Whittaker and H. and I. Wallwork, Hurst, near Ashton-on-Lyne. *Saddles and hangers for spinning machinery.* Dated March 16, 1869.

This consists principally in dispensing with the use of

brass gun metal or other metallic alloy for the bearing surfaces of these parts of preparing and spinning machinery, and substituting therefor hard wood, such as lance or box wood, with the end of the grain towards the bearing surface.—Patent completed.

800 F. Render, Manchester. *Carrying minerals.* Dated March 16, 1869.

The inventor erects the line of rail elevated above the ground by placing it upon the swerved trunks of trees when they exist, or by driving piles. Upon this single rail he places a frame provided with two or a greater number of wheels situate in a line before each other, and from this frame he extends downward arms which carry on each side of the rail an engine and boiler of equal weights.—Patent abandoned.

801 W. Campion, Nottingham. *Sewing machines.* Dated March 16, 1869.

Motion is imparted to the needle slide by one end of a lever the other end of which is actuated by a cam mounted on a vertical axis, to which motion is given by means of a toothed ring formed on or fixed to a fly wheel mounted on an axis at right angles to such vertical axis. At the lower end of this vertical axis is carried a crank pin for working the shuttle slide to and fro in a line with the length of the machine, such crank pin being connected to the shuttle slide by a link or connecting rod as usual. The vertical axis also carries a double cam to act on one end of the feed lever, which is mounted upon a compound axis so as to permit of the movements of the feed lever to feed the fabric as required.—Patent abandoned.

802 W. Robertson, Queen's-chambers, Manchester. *Mules and turners.* Dated March 16, 1869.

The chief improvement refers to the backing off. In place of the wheels and friction cones, which are usually placed on the headstock and operate through the twist band, the inventor places a pulley on the second, third, or other similar motion from the loose pulley communicating motion in a backward direction to a pulley placed loose on the tin roller shaft, and having a friction cone on one side thereof, which is brought into contact with another cone on the tin roller pulley and moves it in a backward direction.—Patent completed.

803 L. Engel, Mumford-court, E.C. *Umbrellas.* Dated March 16, 1869.

In order to avoid the covering of silk or other material being worn by the end of the stretcher where it is jointed to the rib and by the pin or rivet of the joint, the inventor attaches to the rib at this point a guard of metal which is formed with two side plates to overlap the joint which connects the stretcher with the rib, and by so doing keeps this joint from rubbing against the covering. —Patent completed.

804 J. L. Norton, Belle Sauvage-yard, E.C. *Weaving looms.* Dated March 16, 1869.

In constructing the shedding motion of looms the inventor arranges the mechanism for working the heddles so that the frame work and slides for the knives, as usually constructed, are rendered unnecessary. In place of the framework a simple upright bracket is used, which can be easily attached to any ordinary loom frame. To this upright bracket is fixed the mechanism for working the heddles, and the knives and levelling levers are arranged for producing a proper ◁ shed. The lever for actuating the knives and levelling levers works on a stud fixed to the loom frame, so that vibration in the upright bracket is as nearly as possible avoided and stays or supports are not required.—Patent completed.

805 W. and C. S. Catt, Ipswich. *Joints of carriage shafts.* Dated March 17, 1869.

In making a combined joint and stop according to this invention the inventors construct and arrange the parts as follows:—That part to which the shaft is to be jointed consists of two plates of steel or iron fixed to the carriage, between which plates a filling up piece of wood is secured by bolts. The outer ends of these plates are of a nearly circular figure, and holes are made in their middle. The curved and perforated ends project beyond the filling-up piece of wood and constitute the outer eyes or knuckles of the shaft joint. At the junction of the outer knuckles, with the steel or iron plates from which they are made, are shoulders which form stops against which the other part of the joint abuts when the shaft is raised. To the end of the carriage shaft a forked plate is riveted, the solid end of which carries a knuckle or eye of a size proper to fit between the outer eyes or knuckles.—Patent completed.

806 E. Roper, Garrick-street, and G. Shaw, Stoke-on-Trent. *Printing blocks.* Dated March 17, 1869.

The inventors transfer on to the plates of compressed chalk, in the ways hereinafter described, prints or mouldings from casts or reliefs, or intaglios produced by photography or otherwise, or they copy these reliefs or intaglios on to the plates by means of any suitable pentagraph or other suitable copying apparatus, and thus adapt the graphotype process to the reproduction and multiplication of drawings, woodcuts, engravings, photographs, lithographs, or other printed matter.—Patent completed.

807 J. James, Princes-street, Lambeth. *Compressing powder in pellets.* Dated March 17, 1869.

The inventor mounts on a framing a punching slide, which is worked up and down by an eccentric, cam, crank, or other convenient mechanism. Under this slide he mounts a disc, which can turn on a vertical axis. In this disc he perforates numerous holes, each of the shape desired for the transverse section of the pellet, and makes the thickness of the disc to suit the length desired for the pellet. All these holes are equally distant from the centre of the disc, and are spaced at equal intervals around it. On the axis of the disc a ratchet wheel is fixed with teeth suited to the holes in the disc, and to this ratchet wheel the inventor applies a pawl, which is worked with reciprocating movement by a cam or eccentric on the driving shaft of the apparatus, so that the movement of the disc one division at a time is suitable to the movement of the slide.—Patent abandoned.

808 E. W. P. Gibbs, Westbourne Park-crescent. *Velocipede propulsion.* Dated March 17, 1869.

This consists in the use of two levers with unequal arms, which levers are attached on opposite sides of the rear wheel by nuts or pivots to cranks, which pass through and are firmly fixed to the axle of the rear or hind wheel The crank on one side of the wheel is to be at opposite angles to the crank on the other side of the wheel, or, in other words, the two cranks are fixed in opposite directions in parallel planes.—Patent abandoned.

809 B. Latham, Westminster-chambers. *Filtering and straining sewage.* Dated March 17, 1869.

This consists in causing the sewage or other fluid to be filtered to pass, on its way along or as it issues from a conduit, against and through a travelling screen or sieve, or combination of screening surfaces arranged at right angles, or at any other convenient angle to the flow of the fluid, whereby the sewage or other fluid, as it passes through the screening surfaces, deposits its solid matter upon the latter. In travelling along the screening surfaces carry such matter away to a point where it is removed from them, and they then again pass into the stream of sewage to intercept fresh matter.—Patent completed.

810 T. Rickett, Birmingham. *Velocipedes.* Dated March 17, 1869.

This consists in constructing velocipedes with two large very light wheels which run loose on one plain axle, and from the axle between the wheels the inventor suspends a seat, and attaches a cushion on or immediately above, the axle; the height of the seat is adjustable, and is made so that when the operator sits upon it he may lean upon the axle cushion with his arms. The seat slings are attached to the axle by a hook or button, so that the operator, having detached one side of the seat, places himself, when erect, between the axle and the seat. He then reattaches the sling to the axle and sits upon the seat. The carriage, therefore, in its simplest form, consists of a pair of wheels and axle, with a seat slung from it proportional, so that the entire weight of the body may be balanced on the seat, or the feet may be used for propelling, and the weight of the body be carried partly by the seat and partly by the arms resting on the axle, or under certain circumstances wholly by the axle. But it is preferred to construct these carriages also with a brake, a rest for the feet, and a provision for carrying small articles. For this purpose the inventor constructs a pair of light, triangular, but carved frames, the apex or top of each frame being connected to the axle, and the under side or base forming in the front a foot rest by a stay connecting the two frames together within the radius of the wheels, and at the back of each frame terminating in a brake block which projects beyond the radius of the wheels and bears upon the ground when desired. These frames, being free to swing, may in some cases carry the seat. A pair of rails or handles are detached to the hinder parts of the frames convenient for the hands, so that in descending an incline, or whenever it is desired to retard or arrest the motion of the carriage, the upper part of the body is thrown back, and the hands are placed upon the framing rails behind.—Patent abandoned.

811 J. J. G. Damitte, H. D. Dubois, and J. M. Agnellet, Paris. *Pulp.* Dated March 17, 1869.

This consists in the employment of the plant known in botany as the "Gallega Officinialiis" and "Galega Orientalis" plant, and in France as the Galega Rue de Chevre, Lavaneze or faux indigo plant for the manufacture of pulp suitable for paper. The plant is prepared and treated in a green state or in a dry state, in a similar manner to other fibrous materials for the same purpose.—Patent abandoned.

812 H. Claughton, Dumbarton. *Screw propellers.* Dated March 17, 1869.

This consists in constructing screw propellers with folding blades, that is to say, the blades are jointed or hinged to the boss or its equivalent in such a manner that they can be folded into a fore and aft position, and, without impairing the steering qualities of the ship, offer little or no resistance to her progress through the water when under canvas, or they can be folded more or less and thereby adjusted to suit the power applied and speed desired.—Patent completed.

813 J. Heywood and J. Wild, Tonge, and F. Murphy, Middleton. *Tapes for blinds.* Dated March 17, 1869.

The inventors form the tapes with tags or holders woven in the body of the tape for holding the laths, and thus prevent the liability of breakage. The tags are formed either of cords or small tapes, and are woven either in a line or at each side of the tape in a zigzag direction, and the cords can be woven either in an ordinary swivel loom or more efficiently in an improved loom. —Patent abandoned.

814 M. Rourke, Manchester. *Combining fabrics with pulp.* Dated March 17, 1869.

This consists in combining textile fabrics with paper in the paper making machine. The textile fabrics consist of calico, linen, cloth, Hessians, or any suitable material, and when the combined material is covered with oil, tar, or other liquids, it can be used as oil or tar cloths, floor cloths, table covers, packing, and for a great variety of purposes. The mode of operating is to supply the fabric to the pulp on the machine wire of the paper making machine, either under the dandy roller or a little in advance of it, and the pulp and fabric pass between the couch rollers, which press them together, and then they follow the course of the paper in ordinary paper making machines, and come out combined together.—Patent completed.

815 J. Carter, Nottingham. *Deodorising.* Dated March 17, 1869.

This consists in the employment of a dry chemical powder, composed of ground or crushed sulphate of lime or gypsum, used alone or in combination with certain proportions of dried clay or sand for water closets, privies, night chairs, or other commodes, instead of using water, ashes, or dry earth. This powder when brought into contact or combination with any kind of excrement or night soil, has the effect of completely and effectually deodorising such excrement or night soil, and rendering it entirely free from any offensive smell or effluvia, and at the same time it forms or produces a chemical manufacture of great fertilising properties, especially when applied to grass land or other green crops.—Patent abandoned.

816 H. Starr, Moorgate-street. *Harness hook.* (A communication.) Dated March 17, 1869.

The guard or tongue is pivoted between jaws in such a manner that when closed its free end covers the point of the hook. Between the jaws is a cavity or chamber wherein is enclosed a short spiral spring so arranged that its pressure tends always to close the guard, the spring being always completely covered and protected, whether the guard is opened or closed. At the back of the joint or pivot of the guard the hook is formed with a link or loop, whereby it is secured to a strap, cord, or rope.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated September 28, 1869.

2814 W. Chambers, United University Club, Suffolk-street, Middlesex. An improved method of, and means for, ventilating.

2815 J. Taylor, Sheffield. Improvements in the manufacture of bradawls.

2816 W. Whiteley, Lockwood, near Huddersfield. Improvements in machinery or apparatus for roving and spinning wool, cotton, and other fibrous substances.

2817 R. and H. Harrild, Farringdon-street, City. An improved composition for the manufacture of printing rollers.

2818 C. D. Abel, Southampton-buildings, Chancery-lane. The production of a new or improved green colouring matter for dyeing and printing.

2819 J. Buchanan, Hebburn, Durham. Improvements in obtaining and applying a substitute for soda crystals, soda ash, or refined ash.

2820 J. Bullough, Accrington, Lancashire. Improvements in looms for weaving.

2821 H. Swan, Hammersmith, Middlesex. Improvements in the construction of millstones.

2822 J. W. Billiatt, Grantham, Lincolnshire. Improvements in elevators.

2823 H. J. D. Scott, Ealing, Middlesex. Improvements in pottery, lime, and other kilns.

2824 A. V. Newton, Chancery-lane. Improvements in the manufacture of horseshoe nails, and in the apparatus to be employed therein.

2825 W. R. Lake, Southampton-buildings, Chancery-lane. An improved method of, and apparatus for, preventing alteration of values in monetary instruments.

2826 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in harvesting machines.

Dated September 29, 1869.

2827 W. H. Noble, Holly House, Plumstead, Kent. An improved aerial carriage.

2828 A. J. Dulake, Redhill, Surrey. An improved pot or vessel for containing and conveying butter, lard, jellies, or other similar substances, and for an improvement in the form of lid or covering for such pots or vessels.

2829 J. Williams, Birmingham. Improvements in lifting jacks.

2830 W. Walker and D. Davies, Manchester. Certain improvements in furnaces for steam boilers and other purposes.

2831 W. Blunn and J. Wild, Kilnhurst, near Rotherham, Yorkshire. An improved furnace cistern for melting material from which glass is made, and for keeping the same in working condition during the process of blowing.

2832 D. Duthie, Edinburgh. An improved machine for tenoning timber.

2833 L. Wray, Ramsgate, Kent. Improvements in machinery or apparatus for crushing stone and other hard substances.

2834 W. and A. Kempe, Holbeck Mills, Leeds. Improvements in scrays or tables, applicable to gig mills, brushing mills, and other like machinery.

2835 H. Hughes, Homerton, Middlesex. Improved means of rolling or reducing metal rods, bars, or tubes.

Dated September 30, 1869.

2836 A. F. Wilson, Victoria-street, Westminster. Improvements in the mode of, and apparatus for, utilising waste heat from the furnaces of gas retorts.

2837 J. Anderson, Glasgow. Improvements in treating and separating the constituents of maize, and in obtaining oil, starch, spirit, and other products.

2838 J. P. Kerr, and W. M'Gee, Paisley, Renfrewshire. Improvements in winding thread or yarn upon pirns, and in apparatus therefor.

2839 H. Woolf, Houndsditch, City. An improvement in hat brims.

2840 W. Horton, Smethwick, Staffordshire. Improvements in steam boilers.

2841 J. Reeves, Sparkbrook, Worcestershire. Improvements in the bearings of the wheels of velocipedes.

2842 A. E. Fridlander, Coventry, Warwickshire. Improvements in watches and chronometers.

2843 J. Lund, Malsis Hall, near Kildwick, Yorkshire, and E. Townend, Cononley, near Kildwick, Yorkshire. A self-acting means or apparatus applicable to carriages, carts, waggons, and other common road vehicles, whether with four or two wheels, for adjusting the load in ascending or descending.

2844 A. Gaine, Birmingham. Improvements in the manufacture of knobs and furniture for doors, drawers, and other similar objects.

2845 G. Hinton, Ancaster, Wentworth, Ontario, Canada. Driving water-power machinery, so constructed as to economise the water by using over and over again as expended, and driving water wheels of any size with a small body of water, the said improvement being known as Hinton's improved combined water power.

2846 J. Dewe, Toronto, York, Ontario. Improvements in the construction of locks, and in apparatus for indicating the number of times the lock has been opened.

Dated October 1, 1869.

2847 H. L. Bolger, Arthur-road, Brixton, Surrey, and J. Meekin, Milton-road, Dulwich, Surrey. Improvements in apparatus for splitting rocks and other masses.

2848 R. Crickmer, Doris-street, Surrey. An improved mode of, and apparatus for, preventing priming in steam boilers and for regulating the supply of steam therefrom.

2849 F. S. Barff, North Audley-street, Grosvenor-square, Middlesex. Improvements in absorbing and utilising the noxious vapours and gases arising from locomotive engine and other furnaces.

2850 J. Bonn and J. Nitsch, New North-road, Middlesex. An improved instrument to be used for ruling lines on paper and other substances.

2851 J. H. Johnson, Lincoln's Inn-fields. Improvements in screws and in the method of casting the same.

2852 E. A. A. Hugo, Aubervilliers, Arrondissement of Saint Denis, near Paris. Improvements in the manufacture of pressed leather.

2853 R. L. Hickes, Liverpool-street, Old Broad-street, City. Improvements in the construction, arrangement, and fitting of breech-loading firearms.

2854 G. A. Huddart, Brynkir, Carnarvonshire. Improvements in joining or fishing the rails of railways.

2855 W. E. Newton, Chancery-lane. Improvements in sewing machines.

2856 A. J. Ell, Euston-road, Middlesex, and H. Sawah Camden Town, Middlesex. Improvements in apparatus

for indicating and registering the distances travelled by vehicles.

Dated October 2, 1869.

2857 G. S. and H. Whitechurch, Serle-street, Lincoln's Inn-fields. Improvements in stoves and fireplaces.

2858 J. Butcher, Southport, Lancashire. Improvements in fountain pens and penholders.

2859 A. Bodart, Huye, Belgium. An improved balance for ascertaining the specific gravity of liquids, also applicable for other purposes.

2860 W. Edmondson, Manchester. Improvements in machinery for etching or engraving cylinders used for printing and embossing.

2861 T. Buck and G. Messenger, St. Pancras, Middlesex. An improved penholder or reservoir writing instrument.

2862 E. Ludlow, Birmingham. An improvement or improvements in sporting cartridges for breech-loading firearms.

2863 A. Keen, Edgbaston, Warwickshire. A new or improved buckle or tie for fastening hoops or bands of metal around bales of cotton, and for other like purposes.

2864 C. A. Maugin, Boulevart Richard Lenoir, Paris. Improvements in the apparatus used in silvering looking glasses of all sizes.

2865 E. D. Farcot, Boulevart Beaumarchais, Paris. An improved mode of propelling and constructing ships and boats and their accessories.

2866 R. Broadbent, Islington, Birmingham. Improvements in gas governors.

2867 A. Heathorn, Brayford Wharf, Lincoln. Improvements in the preparation of yeast or barm.

2868 J. Reid, Glasgow. Improvements in waterproof coats and leggings.

2869 B. F. Stevens, Henrietta-street, Covent Garden. An improved mode of covering, lighting, and ventilating areas, vaults, and similar underground spaces, applicable also as a footway.

Dated October 4, 1869.

2870 P. R. Hodge, Adam-street, Adelphi, St. Martin's-in-the-fields, C. Hengst, Fulham-road, Chelsea, and N. Wilson, High Holborn. Certain improvements in the manufacture and cementation or welding of steel and iron, iron and iron, and steel and steel together, and in adapting such improvements to various useful purposes.

2871 J. A. Hartmann, Mulhouse, Boulevart de Strasbourg, Paris. Improvements in the process of engraving on metals.

2872 F. Grau, Boulevart Sebastopol, Paris. Improvements in lamp sockets having a double air current for burning paraffin, petroleum, and other mineral oils.

2873 J. Critchley, Manchester. Improvements in the construction of umbrellas, parasols, and sunshades.

2874 G. Rose, Birmingham. Improvements in the construction of annealing pots or pans and muffles, parts of which improvements are also applicable to melting furnaces, heating furnaces, puddling furnaces, and other similar furnaces.

2875 Sir C. T. Bright, Westminster Chambers, Victoria-street. Improvements in electric telegraphs.

2876 C. Mather and W. Rossetter, Salford, Lancashire. Improvements in warping or beaming machines.

2877 F. R. A. Glover, Brading, Isle of Wight. Improvements in anchors, and in the gear for facilitating the weighing and boarding of anchors.

2878 F. F. Villepigue, Brewer's-lane, St. Martin's-in-the-Fields, Middlesex. An improved method of, and apparatus for, piercing or boring holes in rock, mineral, or other material of a similar nature, applicable in tunnel, mine, quarry, and other such work.

2879 J. B. Bradshaw, Whiston-grove, Rotherham, Yorkshire. Improvements in the manufacture of coopers' hoops.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2516 D. Imhof
2518 J. Gueunier-Lauriac
2526 A. M. Dix
2530 T. Berney
2533 J. Oetzmann
2534 D. Barker
2540 W. Hope and H. Browning
2539 J. R. Swann
2541 T. Forster
2562 J. Ferrabee
2563 F. W. Kaselowsky
2564 F. W. Kaselowsky
2623 A. H. Brandon
2652 A. Albini and F. A. Braendlin

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2509 T. Molineux
2736 H. A. Marinoni
2784 J. B. G. M. F. Piret

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," October 5, 1869.

1578 C. J. Foster
1585 E. T. Hughes
1592 W. Furness
1597 E. T. Hughes
1608 A. M'Neile and J. Slater
1609 L. Roman
1615 T. Vaughan and E. Watteeu
1619 C. F. Chew
1621 C. Hanson and J. Bottomley
1624 G. H. Ellis
1629 J. Snape
1639 B. T. Newnham
1640 J. Wilson
1641 J. Wilson
1652 A. T. Fairgrieve
1653 J. Frazer and L. and R. Simon
1662 A. A. Sax
1670 J. Hanworth and H. Horsfall
1672 B. Littler
1685 F. A. Calvert
1701 B. J. B. Mills
1719 W. V. Morgan
1762 W. E. Newton
1872 J. G. Tongue
1886 H. Bauerrichter
1985 J. H. Johnson
1992 T. Jones
2027 J. Knight
2066 F. Baker
2071 F. J. Manceaux
2253 R. G. Lowndes and J. Reid
2346 B. J. B. Mills
2460 W. R. Lake
2565 W. Young
2615 W. S. Clark
2625 S. F. and A. B. Ibbotson
2649 W. Baines
2652 F. Forder and J. Traves
2667 B. Kershaw
2684 J. J. Bodmer
2696 C. G. Hill
2712 A. Collingridge
2718 T. J. Denne and H. Billingsley
2751 E. Hill
2784 J. W. Morgan
2789 H. A. Bonneville

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed October 2, 1869.

1020 G. A. Ermen
1023 J. U. Askham
1024 J. Fletcher
1025 F. Tommasi
1026 W. G. White
1031 J. Greenslade
1039 R. B. Hooper and T. and H. R. Nickson
1042 W. Goodreds
1048 W. E. Gedge
1051 J. and J. Menzies
1060 L. Mond
1068 A. Stewart and J. Wotherspoon
1070 J. Pattinson
1073 A. Fryer
1076 J. Aspinall
1080 J. Denis
1085 C. Lungley
1091 P. Jensen
1094 E. Brasier and J. E. Hodgkin
1099 J. M. Hetherington
1100 J. B. Spence
1101 P. Headridge
1107 J. Parry and R. Morris
1103 E. C. C. Stanford
1108 E. T. Hughes
1111 J. Wadsworth
1112 D. Johnson
1113 J. H. Dales and J. F. Maygrove
1128 W. Brock
1130 C. Turner
1158 C. E. Brooman
1160 H. J. Worssam
1165 A. W. C. Williams
1198 J. E. Ward
1208 R. C. Rapier
1209 W. E. Gedge
1230 C. E. Brooman
1252 S. Smith
1263 A. Muir
1305 J. A. Haberkorn and B. Rudolph
1362 W. Seed
1380 W. M'Kean
1388 T. Welton
1612 M. Benson
1626 F. H. Lloyd
1906 T. and R. Nuttall
2304 J. M. Clements
2416 W. R. Lake

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2334	2619	2649	2671	2686	2699	2712	2730
2518	2638	2651	2673	2687	2700	2713	2732
2526	2625	2653	2675	2688	2701	2714	2734
2539	2631	2655	2676	2689	2702	2715	2736
2578	2633	2657	2678	2690	2703	2717	2737
2581	2635	2659	2679	2691	2704	2718	2738
2605	2637	2661	2680	2693	2705	2722	2739
2607	2639	2663	2681	2694	2707	2723	2751
2611	2641	2665	2682	2696	2708	2725	2755
2613	2643	2667	2683	2697	2710	2726	2757
2615	2645	2669	2684	2698	2711	2728	2759
2617	2647						

LIST OF SPECIFICATIONS PUBLISHED

For the week ending October 2, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1051	0 4	441	0 8	494	2 0	538	0 8	575	0 10	604	0 10
2400	0 4	443	0 10	496	1 0	539	1 0	578	0 4	605	0 4
354	2 4	445	0 10	497	0 8	541	0 8	579	0 4	606	0 4
363	3 2	448	0 8	499	0 8	542	0 6	580	0 4	607	0 10
370	0 8	458	0 6	502	0 10	544	0 8	581	0 4	608	0 4
387	1 0	465	0 10	508	0 8	557	0 4	583	0 4	609	0 4
395	0 10	469	0 10	511	0 10	562	0 4	584	0 4	613	0 4
416	0 6	474	0 6	514	0 6	565	0 4	588	0 4	614	0 4
427	0 10	481	0 10	515	0 8	568	0 4	593	0 4	615	1 2
431	1 0	482	1 0	520	0 10	569	0 4	597	0 4	641	0 4
432	0 10	486	0 6	527	0 8	571	0 10	600	0 4	728	0 10
435	0 10	487	0 10	535	1 4	572	0 4	601	0 4	739	1 0
438	0 10	492	0 8	537	0 10	574	0 4	603	0 4	794	0 8
440	0 10	493	0 10								

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, OCTOBER 15, 1869.

ON THE LAWS OF TEMPESTS.

THE word tempest may be used to include all such atmospheric disturbances as are known by the terms gale, storm, cyclone, or hurricane. The knowledge collected concerning these meteors has only been systematised within the present century. The rapid extension of navigation and consequent impetus given to commerce rendered it imperatively necessary to grapple with the mysteries of the tempest, to watch and register its signs and details, its characteristics and its results, to generalise these data, ascertain their laws, and found a system or science capable of connecting them in relation of cause and effect. The system so gradually developed may be termed the Laws of Tempests. It is a science elaborated by philosophers, but already it has become an art whereby seamen are enabled to prepare for or to baffle the tempest, or, under suitable circumstances, to reap the full advantage of its force.

Romme, in France, studied the records of tempests in various parts of the world, and arrived at the induction that the wind in storms has a circular character, in short, that they are whirlwinds. Then followed Capper in England, Brande in Germany, and Redfield in New York, who established the law that a tempest is a progressive whirlwind—that the whole meteor moves outward rectilinearly while it is revolving on its own axis. Redfield, indeed, went much further, and stoutly maintained, although he was without means to prove it satisfactorily, that all winds are controlled by the same law of rotation. Dové, in Germany, has succeeded, by the help of the law of gyration, in referring the trade winds, the monsoons, and the so-called variable winds to one common general principle, which Hadley had first applied to explain the origin of the trade winds. Sir W. Reid demonstrated the law of rotation, and established that, in the northern hemisphere, the storm wind turns from right to left, whilst, in the southern hemisphere, it turns from left to right. These, briefly stated, are the fundamental laws of the tempest. The laws relating to the tracks of cyclones in the torrid zone, the curvation of the track near the tropics, and poleward path through the temperate zone, have not been conclusively established, and, as being of less importance, this allusion to them may suffice. Piddington, Thom, Lloyd, Fitzroy, Ballot, Le Verrier, and many others, have, by their investigations, tended to confirm and develope the science of storms. Sir John Herschel has also theorised upon storms with the lucidity characteristic of his writings. He says of cyclones or revolving storms "that they are in the nature of vortices or circulating movements, participated in by masses of air of from 50 to 500 miles in diameter, revolving the more rapidly the nearer the centre, up to a certain distance or radius within which there is a calm. The place of this centre of rotation meanwhile advances steadily along a definite line upon the globe, with a velocity varying from two to thirty or forty miles an hour, or even more."

Tempests are accompanied by great oscillations of atmospheric pressure as exhibited by the barometer. It is during tempests that the mercury in a barometer undergoes its greatest depression, falling with the first part of the storm and rising with the latter. Synchronous observations made upon storm tracks have shown that the pressure at or near the centre of the whirlwind or storm is the least. Hence the barometer falls while the storm centre is approaching towards it, and rises as it recedes from it. To epitomise —the laws of tempests are that gales, storms, and hurricanes are masses of air whirling round a central nucleus while advancing bodily onwards; that the greatest force of wind is at a comparatively short distance from the central nucleus, which is itself a calm; that under the nucleus the barometer is low, being higher the nearer it is to the circumference of the meteor; that they revolve against the sun in northern latitudes, and with the sun in southern latitudes.

Admiral Fitzroy's experience led him to assert that:—"It is sometimes found that cyclones, instead of passing horizontally or parallel to the earth's surface, are inclined at an angle (more or less acute) with the horizontal plane, and we, therefore, feel only parts of them; there may be several such circulations passing or following in the same direction, and revolving similarly, like eddies, with their lower portions, on one side only of the circulating meteor, touching the earth's surface, the other parts circling above our heads, so that we only feel a part of the change, and not the whole of the movement." No gale ever blows upon the coasts of the British Isles violent enough to involve danger without acting upon the barometer, and if the barometric indications were studied and attended to, the disasters to shipping during storms would be lessened. The barometer is a thoroughly scientific instrument, simple in construction, and can be readily used, but it is necessary that its indications should be carefully taught to our seafaring population. How the barometer may forewarn for a coming storm has been well pointed out by Admiral Fitzroy:—"Supposing that a storm is rising, and that a seaman wishes to know where the greatest strength of wind is. If he faces the wind in northern latitude, the centre of the circulation or cyclone will be square to his right; and, in the southern hemisphere, if he faces the wind, the centre will be square to his left; therefore he knows in which direction to go to avoid that part where the greatest strength is, and must shape his course according to circumstances. He can hardly have a simpler rule. His position with reference to distance from the centre, whether it is near the ship or far off, can be ascertained by watching the falling or rising of the barometer, and the way in which the wind shifts. It requires only a sketch upon paper—a rough figure, with an hour or two's observation of the veering of the wind, to know exactly in which direction to steer."

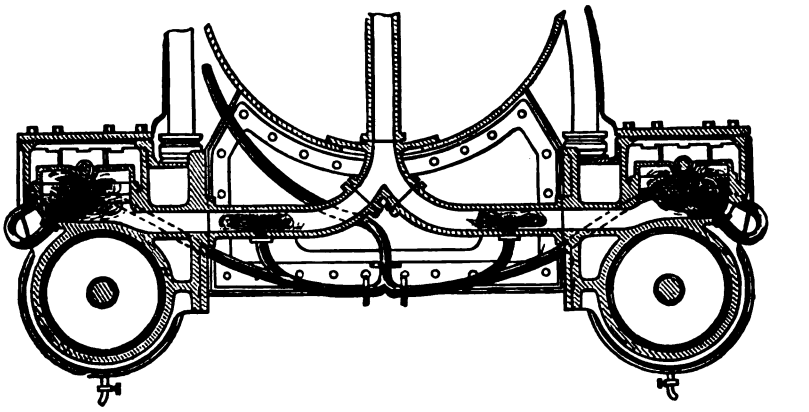
To this we will add a conjecture as to the reason for the barometer being an indicator of storms. Suppose a storm to be represented by a cylinder of air turning on its axis, and advancing (like a wheel) at the same time. The base in contact with the land or sea encounters friction and obstructions, especially from hills, trees, and buildings, &c. From such causes, the motion of the base of the cylinder will be retarded, and, consequently, the upper portion will lean forward. The storm, therefore, may begin at a considerable elevation above a place before the lower part has actually reached the place. This view obtains some support from the fact that the fall of a barometer during the first part of a storm is usually more gradual than the rise of the mercury during the latter part. If the axis were perpendicular to the place of the storm's centre on the surface of the earth, the barometer would there stand lowest. The leaning forward may produce the lowest barometer before the surface centre arrives at the place. From these considerations it may be easily conceived how the barometer may be affected some time before the storm has reached it, and thus afford a warning to those who are acquainted with its use and can appreciate its indications. The barometer is not only an indicator of the coming, but of the progress of storms also. Their approach is usually marked by a fall of the barometer. If the centre of the storm does not pass over the place, the barometer will fall until the part of the storm nearest the centre passes the place, after which it will rise. Dové is of opinion that, in those storms originating in the encounter of polar and equatorial aerial currents, the depression of the barometer is accompanied by a considerable change of temperature also.

The great storms which strike our shore have been considered by some scientific men as meteors having origin in the torrid zone, travelling westerly towards the tropics, there re-curving, and thence advancing north-easterly towards the polar regions, where they are supposed to die out. They are more generally believed to be the result of the encounter of polar with equatorial winds, to be confined to a comparatively small portion of the earth's surface, and to be limited in duration to a few days. Supposing the air over a considerable extent of the earth's surface to become much reduced in weight by copious precipitation of aqueous vapour, and heated by the latent heat given out by the vapour in its condensation, then the normal currents of the temperate zone would tend to restore the reduced pressure. But, in consequence of the rate of rotation of the parallels of latitude being slower the nearer they are to the earth's pole, the polar current has a westward tendency, and the equatorial an eastward tendency. In this way they act as a mechanical couple upon the area of low pressure, and produce a whirlwind which must have an invariable direction of rotation. Meteorologists assert that the northern portion of each whirl maintains the distinguishing features of a polar wind, namely, heavy, cold, and dry air, but this has never been shown to be the case for a number of consecutive whirls, nor has it been satisfactorily explained. The cyclone once formed, the area of low pressure must rapidly be filling up, and the passage of the polar wind to the south, and the equatorial to the northward, must soon restore equilibrium of pressure, temperature, and humidity and the poleward and equatorward portions of the whirl, at each rotation, must exhibit less and less difference of these characteristics. Although the whirlwind character of every tempest which strikes our shores is borne out by the official daily observations, yet prejudice and misapprehension still prevail, for many self-opinionated seamen may be met with who deride or deny the laws of tempests, and who reckon as nothing the experience of hundreds of navigators, which affirms they have undoubtedly been the means of preserving many a ship from disaster.

COUNTER-PRESSURE STEAM AS A LOCOMOTIVE BRAKE.

THE name of M. Le Chatelier has long been familiar to the engineering profession in connection with investigations bearing upon the economic working of the locomotive engine and other important matters. He now comes before us as the practical exponent of a principle which has received attention for some years past at the hands of several engineers. This is no less than enabling the driver of a locomotive, when reversing steam, to utilise the work done during the inverted action of the engine for regulating and checking the speed of trains. In other words, M. Le Chatelier has perfected a steam brake, and, although it comes to us as a novelty, it has already been applied to nearly 3,000 locomotives on the continent. With regard to the attempts which have from time to time been made to effect this object, we may first mention that in France M. Beugniot and in Austria M. Zeh have experimented with closed exhaust nozzles; the one so as to cause a vacuum

M. LE CHATELIER'S STEAM BRAKE.



behind the piston, the other to establish a pressure behind the piston, and thus avoid drawing in the heated gases of combustion from the smoke box. Early in 1865 Mr. De Bergue experimented with a system of brake by compressed air, so arranged as to prevent the introduction of the fixed gases into the boiler. This system gave satisfactory results for short runs of two or three minutes, but did not answer when the action was prolonged. In July, 1865, M. Le Chatelier directed experiments to be made on this important subject on an entirely new principle, and his ideas have been put in practice with complete success both in France, Spain, and Germany. The principles, mode of application, and the results obtained from M. Le Chatelier's experiments are embodied in a small treatise,* which has lately reached us, and from which we take the following particulars of this important invention.

The principle as worked out by M. Le Chatelier is exceedingly simple, although of course perfection has not been arrived at without long and anxious study accompanied by careful experiment. It simply consists in leading a small tube from the boiler to the bottom of the exhaust pipe near the cylinders. Through this tube from eight to forty pounds of hot water are delivered per minute, under the pressure in the boiler, and this water is instantly converted into a fine spray by contact with the hot metallic surfaces of the cylinders and pistons. While cooling them, and absorbing the heat produced in the motion of the parts, the steam produced acts not merely as an elastic brake, but it may be made to cause a discharge from the blast pipe sufficient to keep out any gases from the smoke-box. The apparatus—if so simple an arrangement can be so called—may, therefore, be said to consist of a pipe from 1in. to 1¼in. diameter, and a common tap; it is as simple as the principle itself. We give in the annexed engraving a view of the arrangement, from which it will be seen that the tube communicates between the boiler and the exhaust pipe, the supply being regulated by a distributing cock. Our illustration represents two arrangements. In the one the insertion is made on the branches of the exhaust tube, and the wet vapour has two distinct ways to traverse to reach the cylinders, viz., the part of the pipe near the cylinders and the admission ports. This wet vapour does not get into the cylinders until after the steam, more or less dry, has been discharged from them at the end of the expansion, nor until that at the end of the cushioning has returned. If there be excess of injection water, it is projected through the blast pipe nozzle by the funnel. In the other arrangement the insertion is made under the slide valve itself in the side of the discharge port. In this case the wet vapour has only to traverse the passage to the ports; one part enters directly at the moment of induction, the other mixes with the discharged steam, returns in part to the cylinder, and goes off in part with it to the nozzle.

In the practical working of this brake it is proved by experience that, for equality of injection, much more water is projected by the funnel, and falls in rain on the engine, in the first arrangement than in the second. This arises from the greater quantity of steam generated in the first arrangement; whereas in the second the water is held in suspension by a greater quantity of steam. The process is found to act almost simultaneously, three or four seconds being ample after letting on the water jet, and without even opening the regulator, to make the change from full forward gear to full backward gear.

We need not here insist upon the value and importance of M. Le Chatelier's invention—they are self evident. This system of working counter-pressure steam places the control of the speed of the train directly into the hands of the driver, giving him a means of instantaneously using all the load on the driving wheels as a brake, without danger to himself or stoker, and with little physical effort. It gives a higher degree of security against collisions and over-running stations than has hitherto existed, and greatly facilitates all shunting operations. It economises rails, by dispensing in a great measure with the use of the brakes of the tender and brake vans. It economises wheel tyres and grease. It allows of the number of brakesmen being permanently reduced. Again, it has to scientific engineers the interest of being an illustration of the dynamic theory of heat; the work of retardation being converted into heat, which is in great part sent to the boiler, instead of being wasted in abrading rails and tyres, heating pistons, stuffing boxes and wheels, and thereby wasting grease and oil. Finally, the apparatus can be applied to any construction of locomotive at small cost, and without any other alteration of the engine than that of fixing the apparatus upon it. Unquestionably, M. Le Chatelier deserves the gratitude of all railway companies for this valuable contribution to the practical development of the locomotive engine.

* "Railway Economy. Use of Counter-pressure Steam in the Locomotive Engine as a Brake." By M. L. Le Chatelier, Ingenieur en chef des mines. Translated from the Author's manuscript by Lewis D. B. Gordon, F.R.S.E. Edinburgh: Edmonston and Douglas. 1869.

THE HULL BOILER EXPLOSION VERDICT.

The inquest held in consequence of the steam boiler explosion which occurred at Messrs. Hodges' seed-crushing mill, Holderness-road, Hull, on the 16th ult., marks an era in such proceedings. It shows that coroners and jurymen are beginning to realise the difference between a purely uncontrollable accident and an occurrence which by care and forethought might have been prevented. The case before us involves a most important alteration in the form of the verdict. The jury adopted the term "no malice aforethought" instead of the old stereotyped word "accidental." The use of the word "accidental," although explosions have occurred from clearly preventible causes, is most contradictory, and has done a great deal of harm. The recommendation that the word "accidental" should be disused and the term "no malice aforethought" substituted, was made by Sir William Fairbairn's boiler explosion committee at the last meeting of the British Association, at Exeter, and the present is the first occasion upon which it has been adopted. Its general use would certainly prove highly advantageous, and we hope to see it adopted in future wherever verdicts of this nature have to be found. The fundamental object of a coroner's inquiry in case of a sudden or violent death is to determine whether that death was occasioned by personal malice or not. It may be legally correct for the jury to return a verdict of "accidental death" from a steam boiler explosion, though the boiler may have been so worn out that in an engineering and a common sense view the explosion was no accident at all. Thus the jury use the word in one sense, but the public accept it in another, and the term is taken to be an exoneration of the owner of the boiler. We think, however, that the obligations of juries will be fulfilled, and at the same time the prevention of steam boiler explosions promoted, if juries, instead of returning a verdict of "accidental death," would state that they consider there had been "no malice aforethought." The applicability of the term in the present case is clear from the report made by Mr. L. E. Fletcher, chief engineer of the Steam Users' Association, to the coroner on the above explosion, and which will be found on another page. We do not overlook the fact that juries have a third course open to them, which lies between the announcement of "accidental death" and that of "wilful murder." They have the power of committing owners of boilers for manslaughter, a power which, in many cases, they are bound in discharge of their duty to exercise, and that, too, much more frequently than they do. The task, however, of committing a boiler owner for manslaughter is frequently an invidious one for a coroner's jury, and in practice verdicts of manslaughter are rarely brought in by them. If, however, the practice of introducing the term "no malice aforethought" were fully carried out, coroners' juries would be extracted from an unpleasant position, and the truth with regard to steam boiler explosions would be more fully and freely spoken. We are glad the Hull jury have taken the initiative in the matter, and trust their example will be widely followed. It is one step in the right direction towards the protection of life and property from the dire results of parsimony and carelessness.

DR. LIVINGSTONE.

Our last impression contained a telegraphic notice from Falmouth, which was gladly read by many, as it gave hopes of the safety of Dr. Livingstone. The following is the foundation for the statement. A Miss Jones, who has been four years at the Central African Mission with Bishop Tozer, landed with a Mr. and Mrs. Lea at Falmouth on Wednesday morning, October 6, from the Hamburgh ship "New Orleans," after a very protracted voyage of more than seventeen weeks from Zanzibar, and proceeded same day to Plymouth, to the house of a friend to pass the night. Mr. Lea accompanied her from the station, and in the course of conversation Dr. Livingstone's name was mentioned. Miss Jones stated no one believed him to be dead; at least when they left (June 6) some natives knew quite well there was a white man up country, and that would probably be Dr. Livingstone; and in conversation Dr. Reik's

name was mentioned. The Plymouth friend appears to have conveyed the substance of the conversation to a local paper, and hence the telegram.

The circumstance could not, of course, fail to attract the attention of the veteran explorer's old friend Sir Roderick Murchison, from whose pen a few lines have appeared on the subject. Sir Roderick is naturally unwilling to throw any doubt upon the news recently announced as to the arrival of Dr. Livingstone on the eastern shore of the Lake Tanganyika, but he states that this is only one of the many rumours regarding the great traveller which have from time to time been brought to Zanzibar. Sir Roderick has recently received two letters, one through the Admiralty, by Commodore Heath, of the East African station, and the other from Dr. Kirk, the British political agent at Zanzibar, both dated the 31st of August, and both stating that an Arab had arrived that same day with a letter from his brother, the Governor of Unyanyembe, in which it was stated that a servant of the Governor had seen "the white man" at Ujiji, on the Lake Tanganyika. According to Dr. Kirk's estimate, four months must have elapsed since the man who brought the information left Ujiji. If this news should be correct it would certify that the illustrious traveller was in safety at the end of last April. But so long as no direct news from Dr. Livingstone himself has been received, it will naturally be surmised that this last report may have no better foundation than the numerous preceding rumours. It is, however, gratifying to state that if the news rests upon a true foundation our suspense will soon be relieved, for the same letter informed Sir Roderick that a caravan from Ujiji was expected to reach Zanzibar in a month.

Since Sir Roderick Murchison's letter was penned, the following important and welcome telegrams have been received:—

BOMBAY, OCT. 6.

Dr. Kirk has received a letter from Dr. Livingstone, dated Lake Banglewo, 8th of July, 1868, saying:—

"I have found what I believe to be the sources of the Nile, between 10deg. and 12deg. south."

Dr. Livingstone was in good health and spirits when the letter was despatched.

BOMBAY, OCT. 11.

A letter of Dr. Kirk to the Bombay Government has been published, stating that a caravan which has reached Zanzibar reports Dr. Livingstone's arrival at Ujiji. The road between the coast and Ujiji was open and safe. Small parties of men and another caravan were expected.

THE WINTER INSTRUCTIONS OF THE GAS REFEREES.

ANYONE who has watched the gradual development of an infant's powers, who has seen it execute wild movements and make wide snatches in the air in the endeavour to lay hold of something just before it and immediately within its grasp, until by degrees it acquires power of going straight to the desired object, will be able to form an idea of the progress exhibited in each successive publication of the Gas Referees. By degrees the referees are acquiring the power of instructing gas examiners in the performance of duties which the examiners perfectly understand; and this, as is the case in the infant's progress, is partly the result of the development of the imitative faculty. We must congratulate them on the advance made, while we point out to our readers in what it is shown. In the first place, the referees appear to have discovered the absurdity of making two experiments for sulphur and taking the mean result to represent the amount in the gas. They now order but one experiment to be made. In operating upon the condensed liquid also, they seem to have found that the use of the large quantity they formerly directed involved a waste of re-agents, so they now order but half that quantity to be used. So, too, in making the calculations of illuminating power, they have become convinced that the roundabout method they first prescribed involved what we may call an unnecessary waste of figures, so they have adopted the short and simple method followed by Mr. Heisch, which, in their reply to that gentleman's report, they by implication condemned. These things show teachableness and exhibit progress, and therefore deserve recognition. There is one matter, however, in which the referees seem to make no advance. They have not yet fixed upon the amount of sulphur to be allowed. No doubt this is a difficult point to settle; but the referees have before them the returns of three companies, and those of the Great Central Company show them how far gas may be purified from sulphur by ordinary processes and appliances. Surely from these data they might fix upon some standard, which they still have the power to vary from time to time; or they might at once adopt the old standard of twenty grains in 100ft. They have advertised their willingness to examine any new processes for purifying gas from sulphur. Several no doubt will be submitted to them; they will require time for examination and experiment, and after all may turn out of no value. In the meantime the referees expose themselves to much invidious comment by not acting on information they have now before them.

PHOTOGRAPHY.

SCIENTIFIC PRINCIPLES APPLIED TO PHOTOGRAPHY—THE STRUCTURE OF COLLODION FILMS—THE ALKALINE WET PROCESS—ETHNOLOGICAL PHOTOGRAPHS—MR. MUMLER'S PROCESS.

THAT great discovery of modern science, the law of the conservation of energy, which demonstrates that force can neither be created nor destroyed, but only turned into particular channels or modes of manifestation by man, may be of some little use when applied to photographic experiments. The force which sets up molecular disturbance on the sensitive plate is wave motion, and it probably acts by setting up a motion of separation between the atom of iodine and the atom of silver. This much is certain, namely, that the energy of radiant light is transformed into the energy of molecular disturbance, whatever the precise nature of that disturbance may be. Any chemical rays, therefore, which pass through the sensitive film and the glass plate without doing work represent so much lost power, which lost power must either necessitate longer exposure to get a picture, or be a cause of less energetic and less intense development. Nearly all wet and dry plates used in photography permit some of the actinic rays to pass through the film. These rays thus wasted often do a certain amount of positive harm in addition, for the back surface of the glass often reflects them once more upon the film, so as to produce a blurred and indistinct picture. In practice, wet red blotting paper is often placed in optical contact with the back of the glass plate, to prevent this blurring by reflected light. Manifestly, then, the most perfect films are those which absorb nearly all the chemical rays, and as few such films are employed in photography, except in rare instances, when they are obtained by accident, there is plenty of room for experiment in this direction. Plenty of yellow iodide of silver in the film is chemically more opaque than plenty of bromide of silver, and this is another reason why photographers should once more give iodized collodion a trial, as recently recommended in this journal. In dry plates, the use of deeply coloured organifiers well deserves a trial.

Having obtained a film which utilises all the mechanical power of the chemical waves of light, it is desirable that every part of the sensitive surface should come into immediate contact with the developer when it is applied. When bromide of silver is held in suspension in a very weak solution of gelatine, and some of this solution is allowed to dry upon an accurately levelled glass plate, a rough film results, held to the plate only by a mere trace of gelatine. Such a film gives an intense picture very rapidly when an alkaline developer is applied. But if the bromide of silver be held in suspension by a very strong solution of gelatine, and the same experiment tried, no picture whatever can be developed; in fact, the particles of bromide of silver might as well have been imbedded in the solid glass of the plate. Again, a wet sensitized collodion plate developes readily, but the same plate dried requires longer exposure and tedious development. Wet collodion films are soft and pulpy, but when once they have been dried they form a tough skin, and never return to their former state. Hardwich has pointed out that iodide of silver is much more sensitive to light in the interstices of wet collodion than in the interstices of wet paper or other medium, and he attributes this sensitiveness to the loose state of cohesion in which it is held in wet collodion. It is easy, therefore, to see that a tough sample of collodion may allow development to proceed more rapidly on the upper surface of the film than on the surface in contact with the glass. There is, in fact, ocular evidence that chemical action proceeds with unequal velocity at the two surfaces of collodion films, because pictures which appear to have been quite fixed by cyanide of potassium, when viewed from the one side, are often seen not to be fixed when viewed through the glass from the other side. When a developer does not at once penetrate the film, a picture of low intensity is probably the result. This reasoning points to the conclusion that the best collodion films should let no actinic rays pass through them, and should be of a soft and spongy and not tough consistency. Other qualities, well known to photographers, are likewise necessary in good collodion. There is plenty of room for experiment in this direction by some good photographer versed in the manufacture of collodion, who should keep these principles in view, and ascertain the nature of the structure of the film given after sensitizing, by each of his samples of collodion, the microscope being the medium of examination. Very probably, in the best dry plate processes of the future, collodion will be entirely abolished; at all events, a layer of dry bromide of silver, containing a trace of organic matter, and not imbedded in a collodion or any other skinny film, gives a picture which comes out under the alkaline developer with marvellous facility.

Mr. Sutton's new alkaline wet process, as set forth in his pamphlet recently reviewed in these columns, is scarcely receiving fair treatment at the hands of many of the photographic journals. Instead of trying the process to see whether it possesses the merits claimed, they content themselves with criticising point after point of the process, and saying that each point "is not new." But what does this matter? As a whole, it is new, for where has any process been published wherein all the chemicals and baths are alkaline and neutral, and the alkaline plates thus produced are used wet? Where also (assuming Mr. Sutton's statements to be accurate) has any alkaline wet process been published which gives twice the rapidity of the best wet free nitrate plates? The question at issue is, "Does the process possess all the advantages claimed by the inventor?" If so it will be of the greatest value in instantaneous photography, but in no other branch is it likely to compete with the ordinary wet process. Mr. Sutton, by an injudicious course of action in the matter of the sale of the collodion, has raised a barrier which will prevent many photographers from trying his process, and this throws the onus of the proof of its merits for the most part upon himself. If the process is so much more rapid than the wet one, he is able to take pictures of street scenes and moving figures and vehicles with much more rapidity than anybody has done yet. He should, therefore, take some street views, and send them, negatives and all, for examination at one of the London photographic societies. If the process has all the rapidity stated the street views taken instantaneously by Blanchard and others will be thrown into the shade, and those who are somewhat abusing Mr. Sutton, rather than investigating the merits of his process, will be silenced. As yet, nothing in the way of instantaneous pictures by Mr. Sutton's process has been brought publicly under the view of London photographers, and until these pictures do make their appearance the claims made for the process are not proven.

The Ethnological Society, under the presidency of Professor Huxley, is making arrangements to take photographs of specimens of all races of men in all parts of the globe. Such photographs should be taken before a background, ruled off by plainly visible lines into spaces 6in. square, so that all the pictures shall show the dimensions of the individual photographed, and be directly comparable. The "sitter" should stand upright, and be in contact with the background. When photographs of such value are collected from all parts of the earth, it is ten thousand pities that they should be printed on paper by the ordinary silver process, to fade away in the course of years, and never perhaps to be replaced, as many tribes of savages are dying out before the progress of civilisation. The negatives should all be sent to England, and be copied by a permanent carbon process, or upon collodion films, cemented between two plates of glass with tough Canada balsam. It is very much to be regretted that the Ethnological and the Anthropological Societies do not sink their petty differences and unite into one strong body, to carry on their work with more power and efficiency.

The "Illustrated Photographer" has raised the question whether the alleged spirit forms in Mumler's pictures had distinguishable features. Some copies reached England, and were examined by three photographic experts. Some of the pictures had recognisable features, and some of them had not. In one of them a lady draped in white stood behind Mr. Livermore, the New York banker, and from behind held a bunch of flowers down in front of his dress. This form had recognisable features, which Mr. Livermore swore to be those of his wife, who, he said, had been dead some time, and had never been seen by Mumler. This picture, more than any other, procured Mumler's acquittal, as photographers cannot do the same thing without collusion on the part of the sitter. A very bad copy of this picture, without distinguishable features, was published in the "Illustrated Photographer," but the original had features plain enough to fit one person only, and not anybody conjured up by the imagination of the observer.

TELEGRAPHIC NOTES.

THE storage of the Anglo-Indian cable on board the "Great Eastern" progresses rapidly and satisfactorily, there being at the present time upwards of 1,700 miles coiled in the iron tanks. The filling of the main tank was completed on Tuesday last, and the tank was fastened down the same day. It contains about 1,100 miles of the cable. The after tank at present contains over 600 miles, and the workmen are now busily engaged in completing it; after which the fore tank, which is at present empty, will be taken in hand. The tests which pass daily through the wire show it to be in excellent condition. The bottom of the great ship, during the past few weeks, has been cleaned by divers from the diving smacks "Sealark" and "Ann Elizabeth,', of Whitstable, under the superintendence of Mr. John Pierce, of that town. It is the first occasion of the bottom of this great vessel being cleaned by divers. The bottom of the ship was in a very foul state, mussels having gathered on her in some places more than a foot thick. After the bottom was cleaned, it was found that the iron was very little rusted, and the surveyors from London have expressed their satisfaction at the able manner in which the work of cleaning has been performed. It is estimated that 50,000 gallons of mussels and rubbish were removed from the ship beneath the water line. The utmost exertions are being used by Captain Halpin, Mr. Beckwith, and the officers and men under their command to get the "Great Eastern" completed for sea by the 23rd inst., the date fixed for her departure from Sheerness *en route* to Aden.

We recently noticed the intention on the part of an American Telegraph Company—the Western Union—to apply to Congress to buy them up and carry on the business upon our new plan. In view of this, the following particulars relating to American telegraphs may prove interesting. The first line of telegraph in the United States, which was between Washington and Baltimore, was laid down in 1844; but the experiment was so unsuccessful that the Postmaster-General, in his report of 1845, expressed his opinion that the revenue could never be made equal to the expenditure under any rate of charges which might be adopted. The Western Union Company alone now works 52,099 miles of line, and 104,584 miles of wire, this company having amalgamated by far the larger portion of the telegraphic lines of the United States. Mr. Orton, the president of this company, has issued an elaborate report, in which he estimates the aggregate for all the United States' companies as follows:—Miles of line, 73,088; miles of wire, 130,695; number of stations, 5,029. Of his own company, he states that its net earnings for the past three years have been 8,161,645dol., or 2,720,548dol. per annum, which is over 6¼ per cent. upon the capital. Its gross receipts this year have averaged 600,000dol. a month, its expenses about 375,000dol. The aggregate amount of news delivered to the newspapers of the United States by the lines of this company during the past year was 369,503,630 words, for which it received 883,509dol. currency, being at the rate of two and three-tenths mills per word. This immense amount of matter was not transmitted to each paper separately, but, through a combination of wires only possible to a vast system like this, was sent to a large number of places simultaneously with only one transmission.

A steamer has been for some time at Valentia with the necessary appliances for lifting the Atlantic cable of 1866 with a view to repair it. As yet the efforts which have been made have not been successful, and, on Monday week, an accident occurred which will render the operations more tedious and difficult. The cable was grappled and brought up, but, while the crew were hauling it in, it broke, and fell again to the bottom, 150 fathoms deep. This is the fifth time it has been broken.

We understand that Mr. Scudamore and several officials from the General Post Office and the Telegraph Office were in Newcastle-on-Tyne last week, and met the principal postmasters in the district to impart instructions and make inquiries as to requirements of the two north-eastern counties of Durham and Northumberland in anticipation of the telegraphs being transferred to the Post Office in January next.

A deputation from the West India and Panama Telegraph Company (Limited)—Mr. M'Gregor, Mr. Chambers, and the engineer of the company, Sir Charles Bright—waited on the First Lord of the Admiralty, on Wednesday, with reference to telegraphic communication with all the British Colonies in the West Indies and their connection with North and South America.

The number of messages through the French Atlantic Cable during the week ending October 9 was 982, the cable charge upon them being £2,600—showing an increase of £890 over those of the preceding week, partly to be accounted for by the delay caused to the messages of the Atlantic Company through damage to the land lines with which they are in communication.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

NEW USES FOR GLYCERINE—SUBSTITUTE FOR WASHING SODA—USE OF GRAPHITE IN THE BESSEMER PROCESS—MODE OF MAKING A QUICKLY DRYING PAINT—NEW WAY OF REMOVING THE GUM FROM SILK—HOW TO MAKE PAPER HATS.

WHAT will be done with wine next, with the view of improving it, is hard to say. The last notion is adding glycerine to it. This body is a natural product of the fermentation of grape sugar, and is present, though in extremely small amount, in all natural wines; but Herr Kolb proposes to add from one to three per cent., which, he says, and he is probably right, will reduce to the smallest possible limits the tendency to change which all wines from their inner nature possess. It is hardly necessary to say that the author of this suggestion directs perfectly pure glycerine to be employed. Certainly that disagreeable-smelling, acrid-tasting article commonly sold is not likely to improve the flavour of a wine, or assist in producing a fruity port. Glycerine is said to be largely used by the compounders of artificial champagnes and also by liqueur makers.

A German scientific journal recommends laundresses to use hyposulphite of soda in place of common washing soda. It does not attack the fabric in any way, and at the same time exerts some bleaching action, which greatly improves the appearance of linen and calicoes.

In the Bessemer process very good results are obtained with grey pig iron, but far inferior with white pig. The difference in the two irons is mainly in the proportion of graphitic carbon they contain. Hence it has occurred to Herr Brunner to make use of some graphite in the first stage of the Bessemer process, but the results do not seem to have been very satisfactory. Better, it would seem, are obtained by sending wood charcoal dust, with the blast, according to the plan of Herr Stockher.

We recently noticed the varnish made by the solution of shellac in ammonia, and had occasion to observe that a varnish could also be made by dissolving the same substance in borax. A solution of this kind, which forms a strong and quickly drying varnish, can be made in the following way. Twelve parts of shellac and four parts of borax are added to 100 parts of water; heat is carefully applied, while the mixture is continually stirred, and soon a complete solution is obtained which is colourless or brown according to the colour of the shellac employed. This solution, as we have said, forms a varnish perfectly impermeable to water, and not acted on by the atmosphere. It can be used with oil paints to make them dry quickly by adding an equal part of the varnish with a little turpentine to the oil colour, and rubbing them together until a homogeneous fluid mixture is obtained. This mixture dries in from ten to fifteen minutes, and hence only a small quantity must be prepared at a time.

Dyers have been in the habit of removing the gum from the surface of raw silk by boiling with soap. A French patent makes known the fact that the end is more easily and cheaply obtained by the use of ammonia. To a kilogramme of silk they use ten litres of water and from 250 to 500 grains of ammonia, according as the silk is white or yellow and hard. The silk is kept in the solution heated to 80deg. or 90deg. C. for an hour, and then it is boiled for half an hour. By this treatment silk loses from 22 to 28 per cent. of weight. To finish the process it must be rinsed in a boiling bath containing 1 or 2 per cent. of soap, which bath may be used many times over. The carbonate may be used in place of liquid ammonia.

Paper hats may some day be in vogue here; they have been introduced in America, and this is how they may be made. Take a straw hat of the size and shape you require, cover it inside and outside with wax, do the wax over with plumbago, and then take an electrotype mould. Continue the deposition of the copper until you have a mould sufficiently thick to stand the pressure to which it will be presently exposed, that is, after the pulp has been poured in. The little details which it will be necessary to attend to in this manufacture are not supplied to us, but they will be readily seen and understood. The paper hat is of course the exact image of the straw one, and may be coloured to represent its original. It can be made waterproof by ordinary means and will be cheap and durable.

ON Saturday Edwin Goddard, one of the employes at Mr. Soper's engineering works at Vauxhall, travelled on a bicycle of his own make from the metropolis to Newbury, in Berkshire, (a distance of about 60 miles), in 10 hours. Goddard, whose parents reside in Newbury, left Vauxhall at 6 o'clock a.m., took breakfast at Hounslow, and dined at Reading, having accomplished nearly 40 miles of the journey. After a short rest he again mounted the machine, and safely reached his destination. The weather on Saturday was unusually warm for the time of year, but Goddard's physical powers are good, and he completed the journey without the slightest inconvenience to himself.

STATEMENT OF PAYING OUT FRENCH-ATLANTIC CABLE.

Date.	Greenwich time.	Position of Ship. Lat.	Position of Ship. Long.	Distance run Total.	Distance run In last 24 hours.	Cable payed out. Total.	Cable payed out. In last 24 hours.	Rate per hour in last 24 hours.	Slack. Tota	Slack. Per cent	Depth of water.	Remarks.
				Naut. miles.	Naut. miles	Naut. miles.	Naut. miles.	Naut. miles	Naut. miles		Fa-thoms.	Shore end laid from "Chiltern."
June 21	3.30 a.m.	...	...	...	...	...	...	...	...	...	...	Commenced paying out from "Great Eastern" from Brest.
„ 22	12.0 „	48·30	8·55	171	129	177	...	...	6	3·5	...	Electrical condition perfect.
„ 23	„ „	48·30	12·00	294	123	310	133	5·5	16	5·4	...	Ditto
„ 24	„ „	48·30	14·07	377	83	405·7	95·7	4·0	28·7	7·6	2,000	3.26 a.m., first fault; recovered after picking up 1·25 knots.
„ 25	„ „	48·34	17·00	497	120	542	136·3	5·7	45	9·0	2,300	Electrical condition perfect; 8·38 p.m. second fault.
„ 26	„ „	48·37	18·57	574	77	636	94	3·9	62	10·8	...	Third fault picked up, and recovered ·9 knot.
„ 27	„ „	48.22	22·01	697	123	775	139	5·8	78	11·2	...	Insulation over 2,000 megohms per knot.
„ 28	„ „	48·22	25·11	823	126	916	141	5·9	93	11·3	...	Signals good.
„ 29	„ „	48·06	27·50	930	107	1·038	122	5·1	108	11·6	1,900	Ditto
„ 30	9.0 „	47·56	30·03	...	...	...	...	...	...	...	2,000	Fourth fault at 7.0 a.m. picked up; heavy gale; cut and buoyed.
July 1	...	...	...	...	...	...	...	...	...	...	...	Weather rough.
„ 2	12.0 „	47·57	30·10	1,020	...	1,143	...	...	123	12·1	...	Fourth fault recovered; insulation 2,000 megohms per knot.
„ 3	„ „	47·26	33·10	1,145	125	1,281	138	5·8	136	11·9	...	Signals splendid.
„ 4	„ „	46·54	36·04	1,269	124	1,420	139	5·8	151	11·9	...	Ditto
„ 5	„ „	46·03	38·47	1,397	128	1,562	142	5·9	165	11·8	2,400	Ditto
„ 6	„ „	45·30	41·42	1,524	127	1,700	138	5·8	176	11·5	2,760	Ditto; strong gale blowing.
„ 7	„ „	44·36	44·05	1,639	115	1,840	140	5·84	201	12·3	2,400	Insulation high; weather improving.
„ 8	„ „	43·50	46·33	1,754	115	1,977	137	5·7	223	12·7	2,200	Ditto
„ 9	„ „	42·51	49·13	1,885	131	2,122	145	6·05	237	12 6	...	Ditto
„ 10	„ „	43·23	52·08	2,023	138	2,287	165	6·88	264	13·0	...	Ditto
„ 11	5.30 p.m.	...	...	...	...	...	...	...	...	...	200	Ships in sight.
„ 12	12.53 „	...	...	...	...	2,552·6	...	...	...	...	...	Cut cable and buoyed.
„ 13	...	...	...	...	...	...	...	...	...	...	...	Cable spliced to shore end at St. Pierre.
	...	...	...	...	...	2,584	...	...	...	...	...	Total length of cable from Brest to St. Pierre.
„ 24	...	...	...	...	...	749	...	...	...	...	...	Total length from St. Pierre to Duxbury.
...	...	...	...	...	...	3,333	...	...	...	...	...	Total length of French-Atlantic cable.

SIR JOHN FRANKLIN.

THE document respecting the fate of Sir John Franklin, which is reported to have been picked up on the Californian coast at San Buenaventura, August 30, was enclosed in a worn-out, battered-looking bag, made of sealskin, and hermetically sealed. The paper was 13in. by 10in., and much mutilated. Besides the statement in six commercial languages requesting the finder to forward it to the nearest British Consul, or to the British Admiralty, the paper contained the following, which is a transcript of its contents, as well as they can be deciphered :—

Her Majesty's ships "Erebus" and "Terror, May 28, 1847. Wintered in the ice in lat. 70deg. 5min. N., long. 98 deg. 23min. W.

Having wintered in 1845-6 at Beechy Island in lat. 74deg. 43min. 28sec. N., long. 91deg. 39min. 15sec. W., after having ascended Wellington Channel to lat. 77deg., and returned by the west side of Cornwallis Island.

Sir John Franklin commanding the Expedition. All well.

Party consisting of two officers and six men left the ships on Monday, 24th May, 1847.

GRAHAM GORE, Lieutenant.

CHARLES F. DES VOEUX, Mate.

Around the margin and on the available space outside the printing the following is inscribed :—

Her Majesty's ships "Erebus" and "Terror" were deserted on the 22nd of April, five leagues N.N.W. of here, having been last seen September 12, 1846. The officers and crews, consisting of 105 souls, under the command of Captain F. R. M. Crozier, landed here in lat. 69deg. 37min. 42sec. N., long. 98deg 41min. W. Sir John Franklin died on the 11th June, 1847, and the total loss by death in the Expedition has been to this date nine officers and fifteen men.

F. R. M. CROZIER, Captain and Senior Officer.
JAS. FITZJAMES, Captain, Her Majesty's ship "Erebus."

And start on to-morrow, 26th, for Back's Fish River.

Other intelligence also comes to us from the Arctic Sea, through the "Times'" correspondent in the United States. Mr. C. F. Hall, an American explorer, who for five years past has been making land journeys through the Arctic regions, has returned in a whale-ship to New Bedford, Massachusetts. He brings with him several Esquimaux, and reports some interesting intelligence about Sir John Franklin's party. None of them, he states, ever reached Montreal Island. He saw natives who were the last to look upon Crozier and his party. Mr. Hall brings with him the remains of a young man belonging to the expedition, and also numerous relics. He promises a full account of his journeys, and also says he will return to the Arctic regions next spring and further prosecute his explorations. To Mr. Henry Grinnell, of New York, the thanks of the public are due for furnishing Mr. Hall the means to make these discoveries. Another American exploring expedition, that of Hayes and Bradford, returned on September 27 to St. John's, Newfoundland, so that for a time accounts of Arctic explorations will be numerous.

THE "HINDOSTAN."

YESTERDAY week the new screw steamship "Hindostan," built and engined by Messrs. Day and Co., of the Northam Ironworks, Southampton, for the Peninsular and Oriental Company, was taken to Stokes Bay for a trial of her speed on the measured mile. There was a moderate easterly breeze blowing, with a smooth sea, the barometer standing at 30·55. The true mean speed attained was 14·392 knots per hour, with a 30lb. pressure of steam, vacuum 21, and the engines making 55 revolutions per minute. The engines, which are of 600-horse power nominal, indicated 3,194 during the trial. She had on board a total weight, of coals water, and stores, of 734 tons, and her draught of water was 16ft. 2in. forward, and 17ft. 8in. aft, mean draft being 16ft. 11in. The machinery worked with the greatest ease thoughout the day, and we are able to congratulate the builders on the successful results of the trial. The following are the leading dimensions of the "Hindostan":—Length between perpendiculars, 349ft. 10in.; length on loadwater line, 344ft. 4in.; length over all, 382ft. 8in.; breadth moulded, 42ft. 3½in.; depth of hold, 33ft.; tonnage, builders' measurement, 3,086 tons; and engines of 600-horse power. She has accommodation for 176 first and 55 second-class passengers, and will be able to carry 800 tons of coals and 1,400 tons of cargo. The hull of the vessel is built of the best Staffordshire iron below the water-line and steel above. The "Hindostan" was in charge of Captain Robert Curling, who is appointed as her commander, and she will shortly be dispatched to India, where she is to be employed in the company's mail service.

ROYAL NATIONAL LIFE-BOAT INSTITUTION.

A MEETING of the above institution was held on Thursday at its house, John-street, Adelphi, Mr. Thomas Chapman, F.R.S., in the chair. There were also present—Admiral Sir W. H. Hall, K.C.B., F.R.S., Mr. W. H. Harton, Sir Edward Perrott, Captain Richards, R.N., F.R.S., hydrographer of the Admiralty, Captain de St. Croix, and several other gentlemen. The secretary having read the minutes of the previous meeting, rewards amounting to £218 were voted to pay the expenses of different services of the lifeboats of the institution on the occasion of shipwrecks during the recent heavy gales. The city of Bristol lifeboat, the "Albert Edward," stationed at Padstow, rescued four men from the lugger "Isabelle," of St. Malo. The "Arundel Venables" lifeboat, at Arklow, saved 21 men from the screw steamer "Hellenis," of Dublin. The lifeboat "Jane," at Worthing, brought ashore the abandoned smack "Active," of Selsey. The lifeboat "Cheltenham," at Burnham, saved three men from the schooner "Prudence," of Watchet, and assisted into Bridgewater a distressed Dutch schooner and her crew. The "Willie and Arthur," tubular lifeboat, at New Brighton, saved 18 persons from the barque "Empress," of Prince Edward's Island. The "Havelock" lifeboat, at Fraserburg, North Britain, saved seven men from the steamship "Viking," of Dundee. The lifeboat "Western Commercial Traveller," stationed at Cadjwith, had also assisted the disabled brig "Phillis and Mary," of Blyth, and her crew of eight men into Falmouth Harbour. The "Quiver" lifeboat, at Margate, assisted to save the schooner "Lady Anne," of West Hartlepool, and her crew of five men. The "Christopher Ludlow" lifeboat, at Dungarvon, took the yacht "Emetic," of Dunmore East, and her crew of three men, safely into harbour. The "Appleyard" lifeboat, of Saltburn, brought one man ashore from the schooner "Bonnie Lass," of Wick. The Wexford large lifeboat, the "St. Patrick," rendered valuable assistance at the wreck of the ship "Electric Spark," of Boston, United States, and saved 21 men. Fourteen other lifeboats of the society also went out to distressed vessels during the past month. Altogether the institution's boats saved 94 lives in that period, besides five vessels.

The second service clasp was presented to Richard Jones, chief boatman of the coast-guard at Tramore, Ireland, and coxswain of the lifeboat placed there, on the occasion of his retirement from that station, in acknowledgment of his general gallant services in saving life from shipwreck. The thanks of the institution, inscribed on vellum, were also voted to John Cummins, the coxswain of the Arklow lifeboat, for his skilful and highly meritorious services in that boat. Various rewards were also granted to the crews of different shore boats for saving life from wrecks on our coasts. The recent services of the "Hans Busk" lifeboat, at Ryde, were alluded to in terms of admiration. The benevolent donor of the boat has long been known as a warm and steadfast friend of the lifeboat cause. Payments amounting to upwards of £3,000 were ordered to be made on various lifeboat establishments. The Emperor of Austria had presented a donation of £25 to the institution, and various honorary rewards to the coxswain and some of the crew of the "Appledore" lifeboat, in acknowledgment of the services rendered on the occasion of the wreck of the Austrian barque "Pace" on December 28 last. A benevolent gentleman signing himself "Benjamin" had also sent the society a liberal contribution of £100. A legacy of £1,800 had been received from the executors of the late Mrs. H. Richardson, of Greenwich, for the purpose of forming and permanently supporting a lifeboat station. The late Mr. William Sinclair, of Sowerby, had also bequeathed to the institution £200 free of duty. The committee expressed their sincere regret at the decease of Mr. Alexander Botefeur, who had been for many years an active member of the committee of management of the

society. He had also been a munificent supporter of the lifeboat cause. New lifeboats had recently been forwarded by the institution to Salcombe, Sidmouth, Porthonstock, Mevagissey, Llandulas, Port Isaac, Duncannon, and the Isle of Whithorn; and at each place demonstrations had been organised to welcome the boats to their stations. Reports were read from the inspector and assistant inspector of lifeboats to the society on their recent visits to different lifeboat stations. The proceedings then terminated.

ORNAMENTING GLASS.

Mr. George Rees, of Holloway, has lately patented an invention for producing ornaments or devices by vitrifying pounded glass upon glass and glazed ware, or by cementing together fragments of coloured glass or glazed ware by vitrifying a layer of pounded glass on to the fragments. The glass, after it is pounded, is sifted through sieves, the meshes of which correspond to the sizes of the particles of glass to be used on the surface of the glass or glazed ware. The *modus operandi* is as follows:—Take a sheet of glass and prepare the surface by brushing a gummy or other adhesive liquid thereon. Then sprinkle pounded glass over the gum, which adheres to it. The glass thus prepared is placed in a furnace, or under heat in any suitable manner, in order to vitrify the pounded glass upon the surface of the sheet glass. The pounded glass may be of one or a mixture of colours, or the sheet glass may be of a white or other colour. When it is required to form a pattern on the surface of the sheet of glass, cover the intended part with gum, and then sprinkle the required coloured pounded glass on it. The other portions of the pattern are likewise similarly prepared, and pounded glass of a different colour is sprinkled on those. These operations are repeated until the required number of colours are sprinkled on. The sheet of glass is then heated to the required degree to reduce the pounded glass to almost a liquid state; when the glass is removed from the furnace the pounded glass is found to have fixed itself into or on to the surface, and forms a rough face. If the sprinkled sheet of glass be left under heat for a longer time the pounded glass runs and intermixes itself in the surface, and thus produces a smoother face.

In carrying out the second of the above described methods of this process the inventor takes broken or shaped fragments of coloured or plain glass, or glazed ware or metal, and arranges them in any desired pattern, placing them in a metal mould. He then spreads over them a layer of pounded glass or other vitreous substance in such a manner that the powder shall enter the interstices between the fragments forming the pattern, and shall cover the entire back surface of the pattern to such a depth as may be convenient. He then removes the whole to a furnace and vitrifies the mass, thus cementing together with a thorough vitrified cement the coloured device and giving it a solid back.

STEAM ENGINE GOVERNOR.

BY MR. W. BELLIS.

FIG. 1.

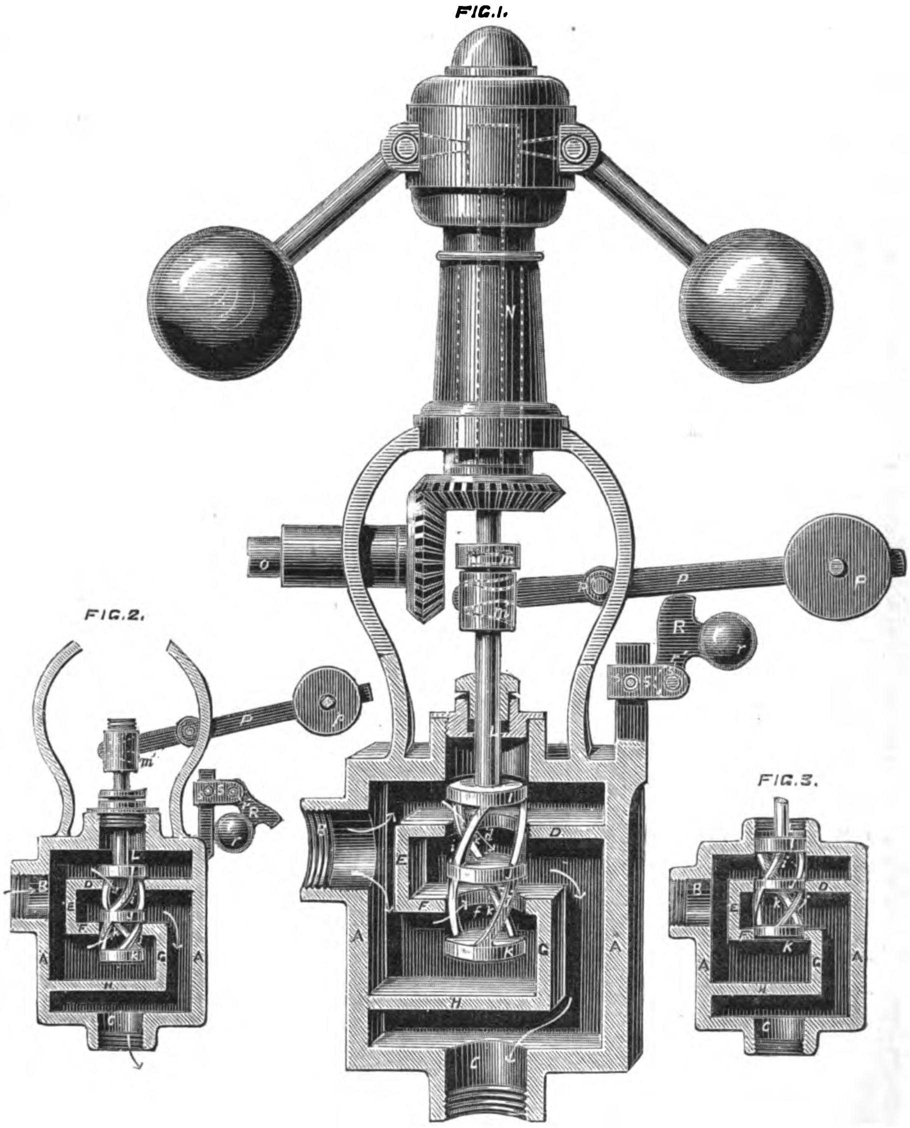


FIG. 2. FIG. 3.

The annexed engraving refers to an invention by William Bellis, of Richmond, U.S., and recently patented in England. The invention relates, firstly, to a peculiar form of governor valve, which, in addition to the advantages of great compactness and mobility, possesses the facility of closing automatically in the event of the snapping or running off of the governor belt, or the sudden suspension of the governor action from any other cause or accident. Secondly, to a device for holding such governor valve open when the steam inlet valve or throttle is shut, so as to enable the engine to be started by the opening of the said throttle.

In our engraving, fig. 1 is an axial section of a valve and its accessories embodying this invention, the governor being at rest, the valve open, and the steam just entering from the open throttle. Fig. 2 shows the same valve with the gravitating catch or tumbler released, the valve being under control of the governor. Fig. 3 shows the valve automatically closed in consequence of the running off of the belt or other accident to the governor. The valve chamber A is of a rectangular external form, and has the customary inlet neck B and outlet neck C, which are separated by an S-formed diaphragm D E F G H, of which the portions D F and H form horizontal shelves connected by the vertical walls E and G. Of these parts the shelves D and F are traversed by circular ports d and f of equal size. The governor valve proper consists of three precisely equal parallel and equidistant discs I J K, of which the upper and lower discs I and K are separated from the middle disc J the precise distance which separates the shelves D and F. The several discs are connected by ribs i j k, which are made flush with the peripheries of the discs and of a spiral form, in order that in the vertical oscillation of the valve it may be guided easily and truly with the opening of the seats, and that every part of the seats may be equally subjected to wear. L is the valve stem, which is connected to the governor stem M by a swivel m; N is an ordinary governor, of which O is the driving shaft.

The stem coupling m^1 is slotted, as shown, to receive the lever P, which is fitted with an adjustable weight p, and works on a centre at p^1. This weighted lever may be used to give a variety of speeds to the engine, or to adjust its velocity to a certain number of revolutions; but it is also used to sustain the valve I J K in the open position when the engine and governor are at rest. This is accomplished by the aid of a tumbler R, which is weighted at r and pivoted at r^1 to a sliding block S, which is adjustable by a set screw s. When the engine is to be started, the valve I J K is held open by the weighted stop R being turned up under the lever P. The stop R is held in position by the weight of the governor balls and weighted lever P. The steam being applied, the governor begins to operate, and as soon as it attains sufficient velocity the balls rise and release the stop R, the weight on which immediately causes it to drop out of the way, and leaves the governor and valve to operate in the usual manner.

It will be observed by reference to the construction and arrangement of the valves I J K and apertures d f, that the ports are closed both by the extreme extension and by the extreme contraction of the governor balls, so that the ports d f may be closed or partially so as may be required to check the engine in the regular legitimate action of the governor while in motion; or the ports may be suddenly and completely closed, and the engine stopped by the breaking or running off of the governor belt. With this arrangement it is always necessary either to prop the lever P in the manner described, or to elevate it by hand before starting the engine. When the governor valve is closed by the extreme extension of the balls, the discs I J close or fill the ports d f and prevent the passage of steam, and when it is closed by the extreme contraction of the balls, the discs J K occupy the ports d f and equally prevent the passage of steam.

In addition to the feature of closing in either direction, the provision of double ports and the peculiar construction of the triple valve I J K with an open centre admits of the employment of a valve of small diameter. Thus an ordinary governor valve of 2in. in diameter has an area of 3·1416 square inches. The area can be obtained by the use of 1½in. valve of the improved construction, the area of the two discs being 3·534, from which deduct ·375 for the bars or wings i j k, and an area of 3·159 is left for the passage of steam. A small valve has less friction, and as it requires less power to operate it than a larger one the governor is more sensitive and mobile. This valve further possesses the advantage of being completely steam balanced, whether open or shut, and under every pressure of steam.

The Suez Canal Company has issued a statement showing the position of the works on August 15. It appears that 5,103,159 cubic metres then remained to be extracted from the canal. During the month ending August 15 the extraction effected amounted to 1,548,206 cubic metres. With a slight acceleration of the extraction the canal will thus be completed by the middle of November.

ON THE MONCRIEFF SYSTEM OF WORKING ARTILLERY AS APPLIED TO COAST DEFENCE.

By Captain Moncrieff.

(Continued from page 261.)

THE next requirement in a coast battery, viz., to be able to follow an enemy amidst clouds of smoke, and to lay the guns on him with precision and despatch, formed a more embarrassing difficulty still. On the one hand, the ports must be constructed for muzzle-pivoters to give protection. On the other hand, if they are made so small it is difficult to see through them, to fire correctly and quickly at different elevations, and on different sides on a moving enemy. The battery is in the position of a knight who must either expose his vitals to his enemy's lance or put on armour that paralyzes his sword arm. There is as much protection in the power of being able to strike as there is in being able to guard. As naval actions are likely to be short and decisive, it must have appeared extremely doubtful whether it was worth purchasing increased safety at the expense of losing the attacking power.

The last of the three requirements in coast defence stated was the necessity of using the most powerful cannon. This did not present the same difficulty as the other two, because the designers of our defences had been presented by my friend Captain Coles with the means of mounting the heaviest guns to fire in any required direction. When very large and valuable guns are used, it is not advisable to cramp their action and restrict it to a small area. The turret was therefore preferred to the casemate when lateral range was required; and though apparently very expensive it was in reality cheaper than casemates, because, although the mounting of the guns in this manner cost more, they were enabled to do much more work, and there was thus an economy both of guns and men.

Having thus far endeavoured to describe the extraordinary difficulties which the new improvements in artillery inevitably entailed on the engineers, I shall now direct your attention for a short time to the difficulties in which the same improvements involved the artillerymen themselves. These difficulties, though not quite so important as the engineering ones, were very serious indeed, and have not yet been quite overcome. They consisted chiefly in the difficulty of making carriages and platforms strong enough for the new and powerful rifled guns. These pieces burnt enormous charges of powder, and hurled bolts as heavy as an old field-piece at 1,000ft. a second. The recoil of such guns represents a violence of force the like of which man has never had to deal with before. Imagine 12, 18, or 25 tons of compact iron started in an instant into rapid motion with a violence that mocks the blow of a steam hammer. This force has to be controlled and restrained. It is no wonder, then, that, when met directly and stopped by friction, as is now done in the ordinary system, the difficulties are enormous. The horizontal strain on the platforms, pivots, and racers is so great that it has not yet been quite successfully met; constant changes and inventions are being made to render this force more harmless.

I hope I have now conveyed to your minds some idea of the embarrassment and difficulties which have fallen upon both the artillery and engineers by the rapid improvement of these formidable engines of war; and of the persistent and able struggle which both have maintained to meet directly the terrible forces with which they have to contend. They have both succeeded to a wonderful extent, but their success is blighted by that curse of the science they practise, the law that up to this time has existed—viz., that what was gained in protection was lost in efficiency, and the converse. Happily I had the good fortune to conceive and develope an idea which abrogates this law. The very force the existence of which has been so great a difficulty in the artillery question has been compelled to perform a service that at once sweeps out of existence a great many of those other difficulties that embarrassed fortification. When two evils co-exist, it is sometimes good policy to make them destroy each other. I shall now refer shortly to the train of ideas that led me to think of solving the important problem in quite a different manner from that in which it had been attempted, which had led to the adoption of a most expensive class of works. My solution gives a system capable of mounting the heaviest artillery, while it simplifies the vexed question of fortification. It gives protection without the expense of using iron, and free lateral range to the guns without exposure.

The system is indeed a simple one; it does not require either brute strength or heavy expenditure for its application; nor does it need mighty forges to weld iron walls to protect our guns and gunners; it only calls to our aid the simplest and most docile forces of nature. Instead of trying to meet force by force, I make my guns bow to the inevitable conditions which science has imposed; and instead of wasting energy, money, and skill in attempts to raise a buttress against the new artillery, I employ the hitherto destructive force of recoil to lower the gun below the natural surface of the ground, where it can be loaded and worked in security and in comfort; and, at the same time, I have made that destructive force so much my servant that I compel it at my pleasure to raise the gun again into the fighting position whenever it is required. In 1855, while watching the interesting operations before Sevastopol, and endeavouring, as well as I could, to understand the conditions under which the siege-artillery was used, I conceived the idea which is now realised. It was then that I saw the value of earth and the importance of simple expedients. It was plain that the weak point of a battery was the embrasure, which formed a mark to fire at, an opening to admit the enemy's shot, and required constant repair even from the effects of its own gun, which in firing injured the revetments of the cheeks. I also came to the conclusion in my own mind that a remedy for some of these defects could be devised. Afterwards I worked at various plans, of which sketches were made or models; but each design had defects which discovered themselves to me as my experience increased.

The real difficulty of the thing arose from the necessity of providing for the enormous strain of the recoil. These early designs, which were sometimes excellent in other respects, broke down at this difficulty, and although some of them no doubt would answer with small guns, they were not calculated to meet the tremendous recoil of large rifled pieces. At last I hit on a simple principle that would meet this difficulty to advantage, the interposition of a moving fulcrum between the gun and platform. Then I knew that the problem could be solved; and feeling the great importance of the subject, I resolved to devote my efforts to working it out completely. While directing my attention to this simple and then apparently obscure matter, I was, as you may imagine, neither an idle nor disinterested watcher of the progress of artillery. Every step in advance was riveting the certainty in my mind that the system would one day be required, and with this conviction I refused to allow either discouragement or delay to make me desist. I shall now endeavour to explain shortly the system which bears my name, as far as it relates to coast defence. It consists of three parts:—1st. The mechanical principle of the gun carriages. 2nd. The form internal and external of the batteries. 3rd. The selection of ground for placing the batteries, and the arrangement for working them to the greatest effect; or, in other words, the tactics of defence for positions where the system is employed.

The principle on which the carriage is constructed is the first and most important part of the new system, because on it depends the possibility of applying the other parts. This principle may be shortly stated as that of utilising the force of the recoil in order to lower the whole gun below the level of the crest of the parapet so that it can be loaded out of sight and out of exposure while retaining enough of the force above referred to to bring the gun up again into the firing or fighting position. This principle belongs to all the carriages; but the forms of these carriages, as well as the method in which this principle is applied, vary in each case. For instance, in siege-guns, where weight is an element of importance, the recoil is not met by counterpoise. With heavy garrison guns, on the other hand, which when once mounted remain permanent in their positions, there is no objection to weight. In that case, therefore, the force of gravity is used to stop the recoil, because it is a force always the same, easily managed, and not likely to go wrong; and as these carriages are employed for the most powerful guns, it is a great advantage to have the most simple means of working them.

It has been already mentioned that the principal difficulty arose from the enormous and hitherto destructive force of the recoil of powerful guns; and here I shall point out the manner in which that difficulty is overcome. That part of the carriage which is called the elevator may be spoken of and treated as a lever; this lever has the gun-carriage axle at the end of the power-arm, and the centre of gravity of the counterweight at the end of the weight-arm, there being between them a moving fulcrum. When the gun is in the firing position the fulcrum on which this lever rests is almost coincident with the centre of gravity of the counter-weight, and, when the gun is fired, the elevators roll on the platform, and consequently the fulcrum, or point of support, travels away from the end of the weight-arm towards the end of the power-arm, or, in other words, it passes from the counter-weight towards the gun. Notice the important result of this arrangement. When the gun is fired, its axle passes backwards on the upper or flat part of a cycloid. It is free to recoil, and no strain is put upon any part of the structure, because the counter-weight commences its motion at a very low velocity. As the recoil goes on, however, the case changes completely, for the moving fulcrum travels towards the gun, making the weight-arm longer and longer every inch it travels. Thus the resistance to the recoil, least at first, goes on in an increasing progression as the gun descends, and, at the end of the recoil, it is seized by a self-acting pawl or clutch. The recoil takes place without any jar, without any sudden strain, and its force is retained under the control of the detachment to bring up the gun to the firing position at any moment they may choose to release it. The recoil, moreover, however violent at first, does not put injurious horizontal strain on the platform. In my experiments at Edinburgh with a 32-pounder, I found that so slight was the vibration on the platform caused by firing that the common rails on which the elevators rolled in that experiment, and which were only secured in the slightest manner, did not move from their position, nor even when heavy charges or double shot were used did sand and dust fall off their curved tops.

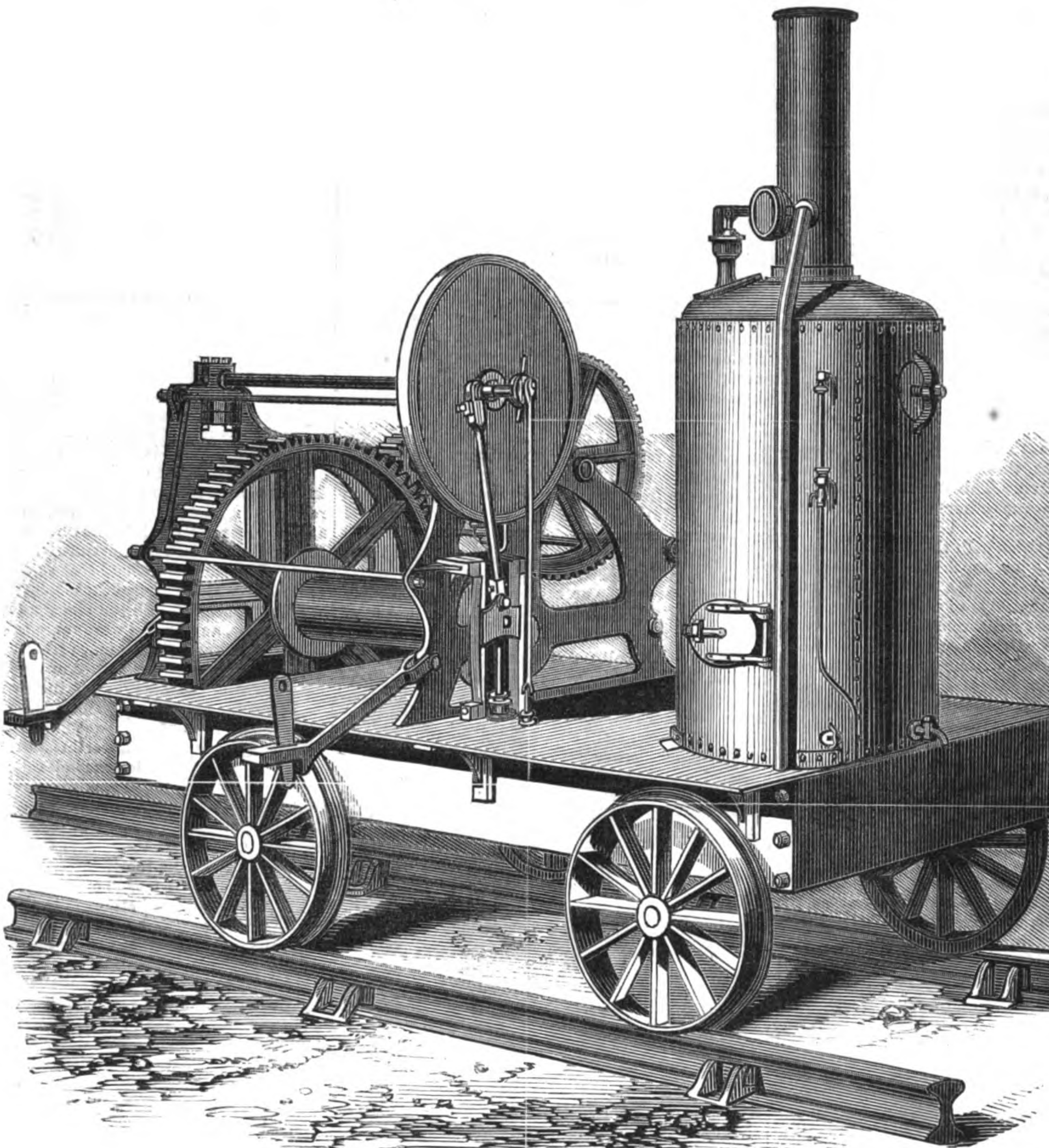
At a still earlier experiment made with a model of a 95cwt. gun, the model was fired on the ice with excessive charges, and nevertheless remained stationary. This valuable concomitant of the system cannot be appreciated fully without referring to the difficulties that have been experienced, and are now felt, in getting pivots, platforms, &c., on the ordinary system, strong enough to mount the new artillery, where the recoil is stopped by friction applied directly by means of what are technically called "compressors" attached to the platform. I shall not detain you by detailing these difficulties, but will only state that the first two 12-ton guns on ordinary carriages that were fired in casemates (which happened a few months ago) at Gilkicker Fort were both *hors de combat* the first shot. This alarming event showed that, with all the experience of ancient and modern artillery (and the carriages referred to were the legitimate exponents of the results of that experience), there was still room to doubt whether the problem of meeting recoil had been at that time completely solved by the existing system. The accident referred to was serious, because it might occur in action, and, in that event, would disable the gun *pro tempore* as completely as if it had been dismounted by a shot.

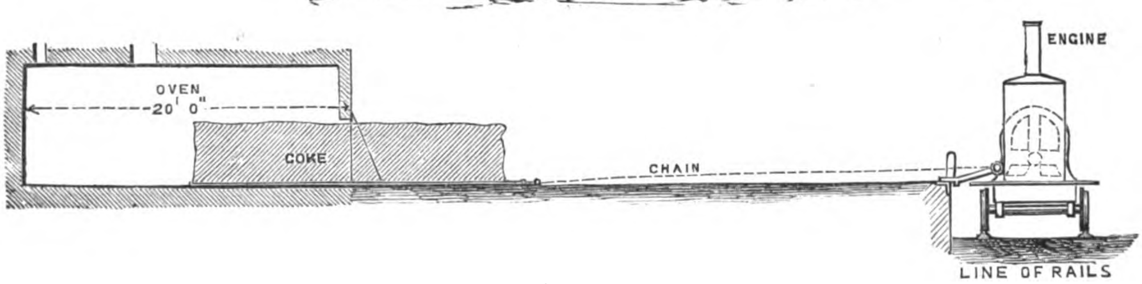
Some credit may be claimed for the new system on the ground that it provided a carriage for a heavy piece of artillery on an entirely new principle, in which not a single part was copied from anything that had been formerly used, dealing with new conditions and performing new functions that no other carriage had done, and yet this new carriage (the first complete one of its kind) has now fired two hundred rounds. This practice has been carried out with only a few accidents which pointed to defects in the gearing, which were easily remedied. By treating this violent force in the manner above described, a good deal of the strength that is required in other systems becomes unnecessary, and, at the same time, the recoil, however violent, can not only be met, but utilised. Together with the carriages there are some improvements of minor importance, such as trunnion pointers, reflecting sights, graduated racers, and so on, which it would be out of place to discuss at present, but which contribute to the efficiency and completeness of the system, and are more or less required for carrying it out as a consistent whole for coast defence.

THE word dun (to ask for a debt) owes its origin to a famous English bailiff, named John Dunn, in the time of King Henry VIII., who plied his hard trade of collecting doubtful debts with remarkable success. When every other resort had failed, creditors would threaten to put Dunn on their debtors, and hence the phrase of dunning which is so common now-a-days.

COKE-DRAWING MACHINE.

BY THE NORTH STAFFORDSHIRE ENGINEERING COMPANY.





COKE-DRAWING MACHINE.

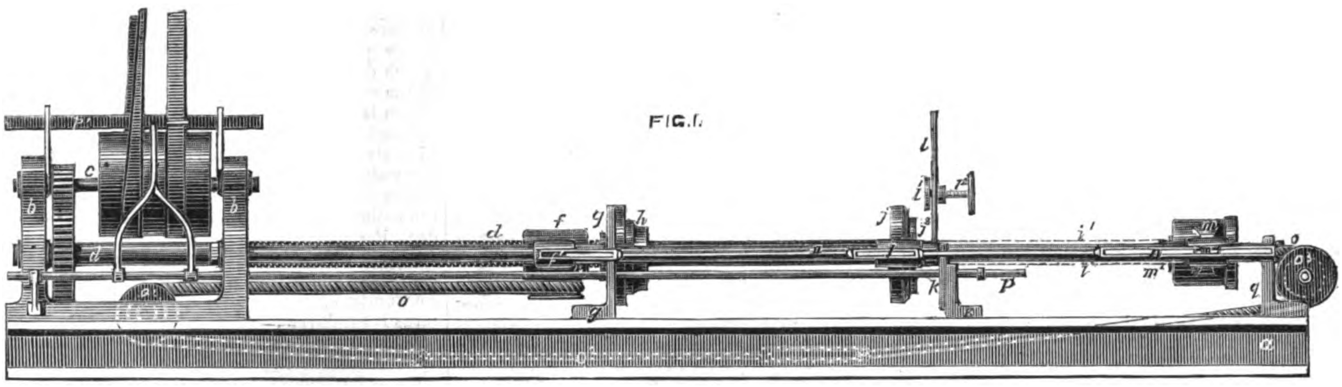
THE severe work of coke drawing by manual labour has been superseded by the machine illustrated in the accompanying engraving. The apparatus has been manufactured and erected by the North Staffordshire Engineering Company, of Stoke-upon-Trent, for the firm of Messrs. Stanièr and Company, of Newcastle-under-Lyne, and has now been at work for several months at their iron works. We are assured that these machines could not give more satisfaction to those engaged in drawing coke ovens on account of the facility with which they are handled by the workmen, and also in an economical point of view. The machine draws from 100 ovens, each oven being 20ft. 7in. by 7ft. 6in., and arranged in two rows of fifty each, back to back. The average weight of coke to be drawn from each oven is about 4 tons, which load is drawn in the short space of three minutes. A line of rails is laid down opposite each row of ovens, along which road the machine travels, propelling itself by gearing from the fixed engine. The thrust from the crab, when the oven is being drawn, is taken by the hinged struts. These struts when in position rest on an iron curb, which is fixed on the wall of the sunken roadway. The cylinders are 6½in. diameter, with a stroke of 12in. The total weight of coke drawn by this machine is upwards of 725 tons within six working days, and the cost of that amount of work, including labour, coal, &c., does not exceed one halfpenny per ton.

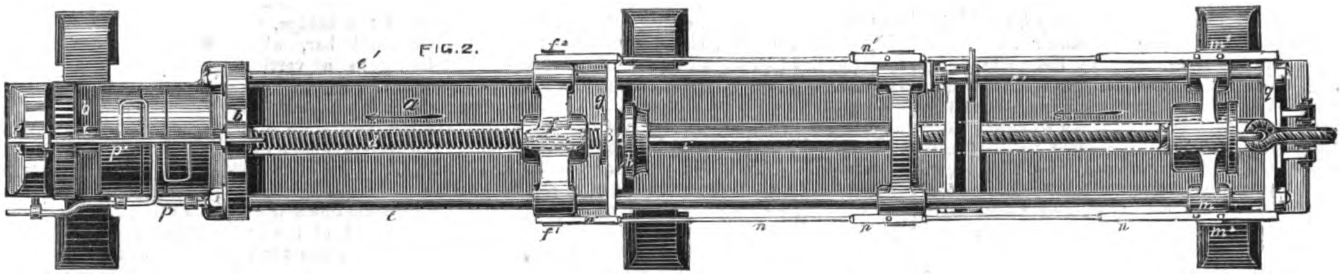
STEAM FIRE ENGINE FOR THE MIDLAND RAILWAY COMPANY.

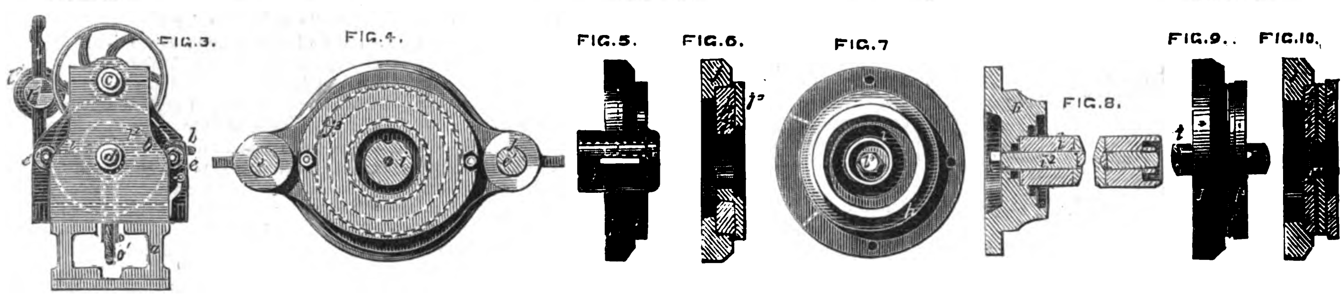
A NEW and powerful long stroke double-cylinder steam fire engine has recently been supplied to the Midland Railway Company's Locomotive Works at Derby by Messrs. Merryweather and Sons, of London. This engine is of the same size and construction as the engine with which these makers so successfully competed at Elswick Works, Newcastle-on-Tyne, in July, 1868, before a jury of eminent engineers, who afterwards selected the engine then tried as the best for the Corporation of Newcastle-on-Tyne. The new engine has two horizontal steam cylinders, each 6¾ft. diameter, and two direct and double-acting pumps, each 5¼ft. diameter, with 18in. stroke of pistons. On delivery at Derby, it was submitted to the usual tests and kept working for some hours, and was much admired for the easy manner in which it maintained steam whilst working at full pressure, and the ease with which it was managed. It delivers over 500 gallons per minute, and projects a stream to 180ft. high or several streams at one time. We hear that Messrs. Merryweather and Sons sent off four such engines, but with single cylinders, a short time since to the Madras Railway Company, and they are now completing two more for the Oude and Rohilcund Railway Company. Such powerful engines as these will prove of immense service should fires occur on the works of the companies who have provided themselves with them.

MACHINE FOR MANUFACTURING SHEET METAL ROLLERS

BY MR. THOMAS REEDER.







MACHINERY FOR MANUFACTURING SHEET METAL ROLLERS.

THE invention illustrated in the accompanying engraving has been patented by Mr. Thomas Reeder, of the Green Bank Brass and Tin Plate Works, Preston. It is in satisfactory operation at Mr. Reeder's works, and is particularly beneficial when used for making rollers of tinned sheet iron, but it may be used in making other sheet-metal rollers, the object being to produce rollers that are perfectly cylindrical from end to end. In practice, the edges of a plate of sheet metal are first bent over, and then the sheet is formed into a tube or cylinder with the bent edges locking into each other as usual. This tube is then put on a mandril having a longitudinal groove for the joint. A die of the exact diameter of the finished roller is then drawn over the tube on the mandril, and the action of this die equalises the irregularities in the thickness of the sheet metal, thereby producing a roller of uniform diameter throughout its length.

Fig. 1 in our engraving is a side elevation of Mr. Reeder's machine; fig. 2 is a plan, and fig. 3 is an end view of the same; figs. 4, 5, and 6 are detached views of the die and die holder; and figs. 7 and 8 are detached views of the mandril and the chuck, which supports the same on an enlarged scale. *a* is the bed of the machine; *b*, the headstock carrying the driving apparatus; *c* is the driving shaft, on which is a pinion gearing into a wheel on the screw shaft *d*. This shaft is supported in bearings on the headstock *b*; *e* e^1 are two stationary guide bars bolted to the frame *b* at one end, and to a frame *g* at the extremity of the bed *a*; *f* is a screw nut made to traverse by the screw *d*; this nut slides on the guide rods *e* e^1. A frame or rest *g* is bolted to the bed *a* for the purpose of supporting the end of the screw *d*, and also to hold the chuck or block *h* to which the mandril *i* is bolted, as shown detached in figs. 7 and 8. The die is also a support to the mandril. *j* is a crosshead sliding on the guide rods *e* e^1; to this crosshead *j* is attached the die j^1 and die plate j^2 (see figs. 4, 5, and 6); *k* is a stationary frame through which the guide rods *e* e^1 pass; *l* is a lever hinged to the rod e^1 and in contact with the frame *k*—its use will be presently described; *m* is a crosshead sliding on the guide rods *e e* connected by the rods *n* n^1 to the screw nut *f* and crosshead *j*. A rope *o* secured to the under side of the screw nut *f* passes over the grooved pulley o^1 and is coupled below to an adjustable screw rod o^2; from the nut at the other end of this rod, the rope *o* is taken over the grooved pulley o^3 and fastened to the back part of the crosshead *m*.

In making sheet metal rollers the operation is as follows:—A sheet of metal is cut of the length and width required to make the roller, the edges are then bent, and an unfinished tube is made by locking the bent edges into one another as usual. The engraving represents the machine in position ready to receive the unfinished tube. In figs. 1 and 2 the tube is shown in dotted lines, marked i^1. The attendant rests one end of the tube on the end of the mandril *i*, which is made taper at the extremity, the joint of the tube being placed over the longitudinal groove in the mandril *i*. The machine is then set in motion by moving the rod *p* connected to the starting rod p^1 so as to bring one of the driving straps on the driving pulley. By this means the screw is caused to revolve, and, as the screw nut *f* traverses it, draws with it by the rods *n* n^1 the crosshead *j* carrying the die j^1, and also the crosshead *m* in the direction of the arrow. At the front of the crosshead *m* is a small projection m^1 which enters the tube i^1, and, by the motion of the various parts of the machine, the tube is forced on to the mandril *i*, the crosshead *j* and die j^1 moving over the mandril slightly in advance of the tube i^1. After the tube i^1 is forced on the mandril, the direction of the screw *d* is reversed, and the die j^1 is forced over the tube, which remains stationary on the mandril. In case the die should have a tendency to push the tube i^1 off the mandril instead of passing over it, the operator makes use of the lever *l* and plate l^1 which is secured to a screw working in the lever *l*. The lever *l*, being hinged to the guide rod e^1, is brought into a horizontal position, resting on the guide rod *e*; the plate l^1 is then opposite the end of the mandril, and it is brought up against the end of the tube by means of the screw and hand wheel l^2; the stationary frame *k* maintains the lever *l* in position. The lever *l* is shown by dotted lines in fig. 3 in the position it occupies when brought against the tube i^1.

When the die j^1 has passed over the entire length of the tube i^1, the latter is ready to be soldered, which is done while the machine is at rest; after soldering, the machine is again started so as to move the die in the direction of the arrow in fig. 2, the die j^1 removing all surplus solder and finishing the tube so that it is perfectly cylindrical and ready to be taken off the mandril. To accomplish this there is a ring of metal in two pieces, which ring fits the mandril *i* accurately, and is held in position in front of the die j^1 by the strap or plate j^3. On reversing the motion of the machine, this ring is pushed over the mandril, coming in contact with the end of the tube l^1, and forcing it off the mandril *i*. It will be seen, by referring to figs. 1 and 2, that the connecting rods *n* n^1 are at liberty to slide over the lugs or projections f^1 f^2 on the screw nut *f*; the connections of the rods *n* n^1 to the crossheads *j* and *m* are rigid by the pins, as shown. When forcing the tube off the mandril, in some cases, the tube is so firm that it might be injured by the continued action of the pushing-off apparatus; to obviate this the connecting rods *n* n^1 are at liberty to slide on the projections f^1 f^2.

While the machine is at work pushing off the tube, or, at other times, when forcing the die over the tube, the motion is conveyed direct from the screw nut *f* by means of the rope *o* and screw rod o^2 to the crosshead *m*, which, by the action of the connecting rods *n* n^1, only draws the crosshead *j* over the mandril; but, should the resistance be greater than the rope readily overcomes, then the rope *o* yields, which allows the connecting rods *n* n^1 to slip over the projections f^1 f^2, and thus slightly ease the pressure of the crosshead *j* and die j^1. The tubes may be soldered, but, in some cases especially when sheet iron is employed, Mr. Reeder dispenses with solder and draws the dies over the tube; he then removes it off the mandril and rivets the joint. It may be found advisable sometimes to put a clamp over the tube on the projection m^1 of the crosshead *m* to facilitate the drawing of the tube off the mandril. The rod *p* is provided with two set washers, by which the machine is stopped at either end of the stroke. The length of each stroke depends on the tube to be made. The stroke can be altered by altering the position of the projections m^2 m^2 in the slot

of the connecting rods n n^1, and securing them as shown; the length of the rope must be altered to correspond, and this is done by means of the screw rod and nut o^2.

Figs. 4, 5, and 6 represent an elevation, edge view, and plan of the die and its frame. e e^1 are the guide rods; j, the crosshead; j^2, a flat plate fitted by grinding into the crosshead j; j^1 is the die ground to fit into the plate j^2; j^3 is a plate or strap bolted to the crosshead j securing the die j^1 and plate j^2 to the crosshead j; and i is the mandril, seen best in figs. 4 and 8. Figs. 7 and 8 represent the chuck or block h and the mode of securing the mandril i to it. This chuck h is bolted to the stationary frame g; in its interior it is formed into annular recesses, into one of which the mandril i fits and is secured by means of a long bolt i^2, which passes through the block h and mandril i, and is drawn tight by a nut in a countersunk recess at the other end of the mandril i.

Figs. 9 and 10 represent a spring die made of a piece of hardened round steel wire r long enough to go once round the tube, bearing against a piece of india-rubber fitting into the plate j^2, into which the die r is held by the circular disc r^1, the whole being held in the crosshead j by the plate j^3 as already described. This spring die is used in cases where the thickness of the metal under operation is very unequal. The solid die can be employed to follow the spring die on the same tube. Tubes made by this improved machinery are adapted for all purposes in which sheet metal tubes or rollers have been previously employed, and particularly where great precision and exactitude are necessary, as in beams for looms, rollers for warping machines, drums of spinning machines, and other purposes.

THE HYDRAULIC SWING BRIDGE OVER THE OUSE.*

By Sir William Armstrong.

The formation of the Hull and Doncaster section of the North-Eastern Railway necessitated the crossing of the River Ouse by an opening bridge, so as to admit the passage of the important traffic carried on in large sailing vessels. It was also necessary that there should be not more than one pier in the navigable channel, with a clear opening of not less than 100ft. on each side. The requisites of the railway and river traffic necessitated a construction that admitted of being opened and closed very rapidly. It was also necessary that the power applied should be capable of controlling with great accuracy the momentum of so ponderous a mass, and hydraulic power was therefore selected as the agent. The instances in which hydraulic power had been previously applied to the opening and closing of movable bridges are very numerous. Most of these bridges have been erected for the passage of railway traffic, and they may be divided into three classes. First, swing bridges on which the bridge is lifted from its solid bearings by a central press previously to being turned; second, swing bridges on which the bridge rests upon a circle of two rollers; third, drawbridges on which the movable platform is drawn back and pushed forward in the line of the roadway.

In addition to the hydraulic bridges comprised in these three classes, there is one example of a bridge on the bascule plan being worked by hydraulic power. This is at Liverpool, over one of the dock entrances. The first hydraulic swing bridge was erected in 1852 over the River Severn, on the Gloucester and Dean Forest Railway, and the first hydraulic drawbridge was erected in 1853, over the River Tovey, on the South Wales Railway, near Carmarthen. All the swing bridges which turn on a centre pier, and span an opening on each side, have been made to turn on live rollers without being lifted; because in bridges of that construction neither extremity can have any steadying support in the act of turning, but in some instances a central press has been applied to relieve the rollers of part of the weight. Where single-leaf swing bridges are lifted by a central press, the deflection is taken off by letting down the bridge upon its solid bearings when closed; but in the case of drawbridges and swing bridges not lifted by a central press, hydraulic machinery is applied to lift the over-hanging end or ends so as to take off the deflection after closing. The openings crossed by these various forms of bridges have varied from 30ft. to 100ft. span.

The heaviest bridge to which the central lifting arrangement has been applied is one over the Regent's Canal, near the London Docks, in which instance the weight lifted and turned amounts to 450 tons. In bridges with the central press, the head of the lifting ram fits into an inverted cup upon the bridge to allow of oscillating movement, and the bridge in swinging turns upon the water by carrying the ram round with it. The pressure of water employed in the central hydraulic press is about 800lb. per square inch; and in the largest of these bridges the diameter of the ram turning upon the water is 51in. In most cases the bridges are in connection with a system of hydraulic pressure applied to cranes and other machines in the vicinity, the pressure being supplied in the usual manner by steam engines pumping into accumulators. But in some few instances, where there is not such a supply of power at hand, the pressure is supplied by hand pumps charging the accumulator, and thus storing up the power ready for application whenever required. At the Ouse Bridge there was no supply of hydraulic power at hand, and in that instance the total power required was too large to be supplied by hand labour. It was further necessary, on account of the position of the swing bridge, either to convey the power to the centre pier by a pipe under the bed of the river, or to produce it upon the pier by placing a steam engine within the pier itself, and the latter plan was adopted.

The total length of the bridge, fixed and movable, is 830ft. The fixed portions consist of five spans of 116ft. from centre to centre of piers. The bridge being for a double line of railway, each span is composed of three wrought-iron girders of the bowstring form, the centre girder having a larger section to adapt it for its greater load. These girders have single webs, and are 9ft. deep in the centre. The total width of the bridge, from outside to outside, is 31ft. Each of the piers for the fixed spans consists of three cast-iron cylinders, of 7ft. in diameter, and about 90ft. in length. The depth from the under side of the bridge to the bed of the channel in the deepest part is about 61ft. The headway beneath the bridge is 14ft. 6in. from high water datum, and 30ft. 6in. from low water. The swinging portion of the bridge consists of three main wrought-iron girders, 250ft. in length, and 16ft. 6in. deep at the centre, diminishing to 4ft. deep at the ends. The centre girder is of larger sectional area than the side girders, and, instead of being a single web, is a box girder 2ft. 6in. in width, with web plates 7-16in. to 5-16in. in thickness and the top and bottom booms contain about 132 square inches of section. The roadway is carried upon transverse wrought-iron girders, resting upon the bottom flanges of the main girders. In the centre of the bridge the main girders are stayed by three transverse wrought-iron frames, securely fixing them together; and over the top of these frames a floor is laid, from which the bridge-man controls the movements of the bridge. An annular box girder, 32ft. mean diameter, is situated below the centre of the bridge, and forms the cap of the centre pier; this girder is 3ft. 2in. in depth, 3ft. in width, and rests upon the top of six cast-iron columns, each 7ft. diameter, which are arranged in a circle, and form the centre pier of the bridge. Each of these columns has a total length of 90ft., being sunk about 29ft. in the bed of the river. A centre column, 7ft. diameter, is securely braced to the other columns by a set of cast-iron stays, which support the floor of the engine-room. This centre column contains the accumulator, and forms the centre pivot for the rotation of the bridge. The weight of the swing bridge is 670 tons.

There is no central lifting press, and the entire weight rests upon a circle of conical live rollers. These are twenty-six in number—3ft. diameter and 14in. width of tread—and are made of cast iron, hooped with steel, and they run between two circular roller paths, 32ft. diameter. These roller paths are 15in., and are made of cast iron, faced with steel; the axles of the rollers are horizontal, and the two roller paths are turned to the same bevel. The turning motion is communicated to the bridge by means of a circular cast-iron rack, 12½in. wide on the face, and 6¼in. pitch. It is shrouded to the pitch line, and is bolted to the outer circumference of the upper roller path. It gears with a vertical bevel wheel, which is carried by a steel centre pin, supported on the lower roller path. This is driven by a pinion connected by intermediate gearing with the hydraulic engine. There are two of these engines, duplicates of one another, either of which is sufficient for turning the bridge. The force required to turn the bridge is equal to about ten tons applied at the radius of the roller path. Each hydraulic engine is a three-cylinder oscillating engine, with simple rams of 4½in. diameter and 18in. stroke. These engines work at forty revolutions per minute, with a pressure of water of 700lb. per inch, and are estimated at 40-horse power each. The steam engines for supplying the water-pressure are also in duplicate, and are double cylinder engines, drawing three-throw pumps 2·8in. diameter, and 5in. stroke, which deliver into the accumulator. The diameter of the steam cylinder is 8in., and the stroke of the piston is 10in., each engine being 12-horse power.

The accumulator consists of 16½in. ram, with a 17ft. stroke, and is loaded with a weight of 67 tons, the weight being composed of cast-iron segments suspended from a crosshead and working down in the cylindrical casing formed by the centre cylinder. For the purpose of obtaining a perfectly solid roadway when the bridge is in position for the passage of trains, and also for securing the perfect continuity of the line of rails, the following apparatus is employed:—Each extremity of the bridge is lifted by a horizontal hydraulic press, acting upon levers forming a toggle joint, the piers having rams acting in opposite directions upon two toggle joint levers, which act one upon each side of the end of the bridge, and they are connected by a horizontal bar, which is confined by a stud sliding in a vertical guide, so as to ensure parallel action of the two toggle joint levers, and producing exactly parallel lifting of the two sides of the bridge. Three resting blocks, one under each girder, are pushed home when the end of the bridge is lifted, by means of two separate hydraulic cylinders, and the bridge is then let down upon the resting blocks by the withdrawal of the toggle joint levers, and the bridge ends are then perfectly safe for trains to pass over.

The hydraulic cylinders for this fixing gear at the two ends of the bridge are worked by the bridge-man from the centre platform by means of two levers, and for the purpose of enabling him to regulate the stopping of the motion of the bridge at the right place an indicator is provided, consisting of a dial upon a pedestal. This dial has two pointers, which are actuated by the motion of the bridge. One of these pointers makes two revolutions, and the other forty-two revolutions for one complete rotation of the bridge. These pointers are similar to the hour and minute hands of a watch, the slower pointer being analogous to the hour hand, and the quicker one to the minute hand. The bridge has no stop to its movement, and would swing clear past its right position if the turning power were continued, but the bridge-man, being guided by the indicator, knows when to stop and reverse the hydraulic engines, for the purpose of stopping the bridge in its right place When this is done, a strong bolt, 3in. thick, in each end of the bridge, pressed outwards by a spiral spring, is shot into a corresponding notch in the fixed girder work, so as to lock the bridge; and when the bridge is required to be opened these bolts are withdrawn by a wire cord leading to the platform on which the bridge-man is stationed.

As the accumulator is stationary, and the fixing gear at the ends of the bridge travels with the bridge, the communication of water power is made by a copper pipe passing up in the axis of the bridge, through the middle of the centre girder, having a swivel joint at the lower end. Also, as the hand gear for the bridge-man rotates with the bridge, while the hydraulic turning engines are stationary, the communication for working the valves is made by a copper rod passing down through the centre of the above pressure pipe in the axis of the bridge. This rod is connected by levers direct with the regulating valves of the hydraulic engines, and the engines are reversed in either direction by the action of a small hydraulic cylinder, which is governed by the movement of a three-port valve, actuated by this rod from the bridge-man's platform. The cylinders for working the fixing gear at the ends of the bridge are worked by valves placed upon the centre platform, in reach of the bridge-man, the pipes between the valves and the cylinders passing along the side of the roadway of the bridge. The time required for opening or closing of the bridge, including the locking of the links, is only half a minute, the average speed of motion at the extremities of the bridge being 6½ft. per second. For the purpose of ensuring safety in the working of the railway line over the bridge, a system of self-acting signals is arranged, that is actuated by the fixing gear at the two ends of the bridge, and a signal of "all right" is shown by a single semaphore and lamp on the fixed part at each end, but this cannot be shown until each one of the resting blocks and bolts is secured in its proper places.

* Institution of Mechanical Engineers.

THE HULL BOILER EXPLOSION.

WE annex a copy of Mr. Lavington E. Fletcher's report to the coroner on the steam boiler explosion that occurred at Hull on Thursday, September 16, 1869. It is dated Manchester, October 6, 1869, and runs as follows:—Sir,—In accordance with your communication, dated September 18, and addressed to Sir William Fairbairn, requesting him to come over to Hull, and investigate the cause of the explosion that occurred at Messrs. Hodges' Seed Crushing Mill, Holderness-road, on Thursday, the 16th ult., or, in the event of his not being able to do so, to appoint some one else to undertake the duty—in accordance with these instructions, I beg to inform you that I have examined the exploded boiler, as Sir William Fairbairn's state of health at the present time, I regret to say, quite prevents his leaving Manchester.

I visited the scene of the catastrophe on Wednesday, the 22nd ult., when I found that the exploded boiler was what is termed a "breeches" boiler. In this class of boiler, the two furnace tubes in which the fires are placed run into a single flue at a short distance behind the fire-bridge, being united by a combustion chamber, which tapers down from the width of the two furnaces to that of the single flue tube, and it is on account of this peculiar shape, the two tubes running into one, that the term "breeches" boiler has been adopted. On measuring the boiler I found that it was as nearly as may be 30ft. long and 7ft. in diameter, while the furnace tubes were 7ft. long by 3ft. in diameter, the combustion chamber 5ft. long by 3ft. 6in high, and the flue tube 18ft. long by 3ft. 6in. in diameter, the general thickness of the plates being from ⅜in. to 7-16in., with the exception of the one at which the primary rent occurred, which was barely ⅜in. The boiler had but one safety-valve, which was enclosed in a box, and fitted with a lever. At the end of this lever there were two weights, one of which amounted to 26lb. and the other 30lb., while there was also a dead weight of 70lb. within the box, bearing directly on the valve, so that, as the lever had a proportion of 6 to 1, and as the diameter of the valve was 3⅜in., the pressure of steam at which the valve would begin to blow, provided it were in good working order, would be as nearly as may be 45lb. per square inch, though it would rise if the steam were allowed to blow off strongly.

The boiler gave way in the flue tube, behind the furnaces and combustion chamber, the tube collapsing at the crown for a length of from 6ft. to 8ft. at about the middle of its length, and crumpling up as if made only of cardboard. The large opening formed by this rapture allowed the steam and hot water to rush out at each end of the boiler in a torrent, and it was this that caused the disastrous consequences already fully known to the jury. It was from this rush of steam and hot water that the furnace mountings were swept away, the fire-bars scattered like grapeshot over the garden beyond the boiler-house, and some of the fragments thrown to as great a distance as 140 yards, while it was also from this cause that the poor fireman was blown over the adjoining buildings and dashed against the roof of the coach-house.

With regard to the cause of the explosion.—The "breeches" type of boiler is an antiquated one, and has long since been discarded. Its use has been attended with a series of most disastrous explosions, and with the very rarest exceptions it is now never adopted. It is important to call general attention to this fact, so that those steam users who still have boilers of this class in use should at once have them thoroughly examined, to see whether they are safe for the pressure at which they are worked. Added to the peculiarities of the "breeches" type, the flue tube, though of so large a diameter as 3ft. 6in., was not strengthened as it should have been with encircling rings, flanged joints, or any other means; while it was not plated circumferentially as is the ordinary custom, but longitudinally, which does not give so much strength. Also the flat ends were stayed with diagonal rods, depending on a pin at each end, measuring 1¼in. in diameter; while the manhole was not guarded by any mouth-piece. In addition to this, there was no duplicate safety-valve, while the one provided was of very inferior and unreliable construction, so that it may be stated, without going into further particulars, that the boiler was decidedly second-rate in its construction as well as in its fittings, and that it was not adapted for high-pressure work.

While, however, the catastrophe might be attributed generally, and at the same time correctly, to the second-rate construction and equipment of the boiler, it may be pointed out that now that the explosion has occurred, and now that the flue tube has been crumpled up, and the fittings have been unseated, it is not easy to determine with certainty the final and exciting cause of the boiler's giving way, but, nevertheless, it may be desirable in conducting the present inquiry to go somewhat further into detail in this matter.

As already stated, the boiler failed from the collapse of the flue tube, and this, it is clear, could only have arisen from weakness of the tube, or excessive pressure of steam, or from the two combined. Sir William Fairbairn, some years since, instituted a series of experiments upon the power of flue tubes to resist external pressure without collapsing, and he found that the length of a flue tube is a most important element in its strength. Taking advantage of the result of his investigations, it appears that the flue tube under consideration, which was 18ft. in length, 3ft. 6in. in diameter, and may be taken as ⅜in. in thickness, should not have collapsed at a pressure of 45lb., at which the safety-valve appears to have been loaded. This is on the assumption, however, that the tube was circular, or very nearly so, and that the plates were well put together. To ascertain whether this tube had been truly circular or not, I measured its diameter vertically and horizontally at each end, and I found that there was only a variation of about ¼in. It does not follow, however, that the flue was circular throughout, and though true at the two ends it might have been out of shape at the middle, which is frequently found to be the case, while it was midway in its length that the crown failed. Added to this it must be remembered, as already stated, that the plates were not laid circumferentially but longitudinally, and it was close to the edge of the overlap of one of these longitudinal seams which ran along on the crown of the flue tube for a length of 6ft. that the primary rent occurred, when the top of the tube was driven down with so much violence as to cut its way completely through the bottom for a length of some 5ft. or 6ft. The character of the rupture is altogether peculiar, and very different to that which is found to take place in flue tubes plated circumferentially, and it certainly appears not to be by any means in favour of this mode of plating, though it is difficult to estimate the precise loss of strength.

There are other sources of weakness to flue tubes than that of original construction. The plates may become overheated, and thus weakened so as to be bulged down out of shape by the ordinary pressure of steam. The general appearance of this collapse, however, is by no means that of one which arose from overheating, whether from shortness of water or from any other cause, added to which, the top of the combustion chamber, which is as high as the top of the flue tube, is covered with scale, and so is the flue tube, with the exception of those parts where it has been cracked off by the bending of the plates consequent on the collapse, while, though the crowns of the furnaces are 3in. lower than that of the flue tube, it may be mentioned that they were perfectly sound throughout. It is possible, however, that the boiler may have been allowed to run short of water on some prior occasion when the crown of the flue tube, though not then rent, may have been so weakened that it was only a matter of time when it would give way. Thus the flue tube may have been flattened by construction, by wear and tear, or by overheating through shortness of water on some prior occasion, but the collapse has rendered it impossible to say positively whether such was the case or not. With regard to the question of excessive pressure of steam, the boiler, as it has already been pointed out, had only one safety-valve, and that of a very unreliable character. It had evidently never been constructed for the service it had to perform. In the first place, the lever was loaded with two weights, while a third was sometimes added, which is clearly an irregular mode of procedure. In addition to this, there was introduced within the valve-box, and immediately on the valve, a weight of 70lb., while there was a space of only three-quarters or seven-eighths of an inch between the top of this weight and the cover, and the arrangement of the whole was such that nothing was easier than for the valve to be jambed fast, so that it was clearly one that should not have been used, more especially seeing that it was the only one fixed to the boiler. As, however, this valve had been removed from the boiler before I made my examination, I have no means of saying whether it was stuck fast or whether it was free at the moment of explosion. Possibly this may be determined in evidence.

While, however, there is some difficulty in determining precisely whether this explosion was due to excessive pressure of steam or to the weakness of the flue tube, there is no difficulty in determining how it might have been prevented, which is the most important issue of such an inquiry as the one now in hand, as this may lead to the prevention of similar catastrophes in the future. The experiments already referred to on the strength of the furnace and flue tubes by Sir William Fairbairn, led to his strongly advocating that all such tubes should be strengthened with encircling hoops, while there is also a system of flanging the plates at the ring seams of rivets in these tubes, which has the same object in view. Both these modes of construction have for years past been very widely introduced, and are, consequently, well known. They have been found to be entirely successful, and are adopted in all modern first-class boilers. Had either one of them been employed in the present instance, the tube would have been amply secured against the danger of collapse. To have prevented the occurrence of excessive pressure of steam, the boiler should have been fitted with two efficient safety-valves, and it is a practice adopted by many of the members of the Manchester Steam Users' Association, and one that cannot be too generally adopted, to have one of thes valves of external dead weight pendulous construction, which it is extremely difficult to overload or tamper with, and to have the other adapted for blowing off, either for high steam or low water, so that in case the water should at any time fall below the desired level, the valve would be raised and the pressure of steam allowed to escape, and thus the source of danger removed, and explosion rendered impossible. Hundreds and hundreds of safety-valves of the two descriptions just named are working satisfactorily, and they cannot be too generally adopted. Were they universally applied, many explosions would be prevented.

In conclusion, although there may be a difference of opinion as to whether this explosion resulted from weakness of the flue tube or from overheating of the plates through shortness of water, or whether from excessive pressure of steam, there can be no question whatever that had the flue tube been strengthened with flanged seams, encircling hoops, or any other equally efficient means, and had the boiler been fitted with two reliable safety-valves, one of them arranged for relieving the pressure of the steam as soon as the water fell below the proper level, that this catastrophe would not have happened, that the fireman would not have been killed, and that this inquiry would not have been necessary.—I remain, Sir, yours faithfully,

LAVINGTON E. FLETCHER,
Chief Engineer to the Steam Users' Association.

RAILWAY FARES.

IT is a difficult task to arrive at the equalisation of the coins of the different nations of Europe, but it will be much more difficult to equalise the fares of all the railways already existing or in course of construction, so that on leaving home, the traveller may be enabled, if he knows the distance to be traversed, exactly to calculate the sum which he has to spend in order to arrive at his destination. There is such a difference in the price of construction, of management, of fuel, as well as in the physical condition of divers countries, that for a long time to come a uniform railway fare must be considered a Utopia. The only progress which it is possible to arrive at in a given time is that of taking for a standard the railway fares which reconcile, in the best possible manner, the interest of the public with the necessities of the service, and to propose them as an example to less favoured nations. The final object is the same for all the world: facility for travelling at the smaller expense. The invention of railways has solved the first part of the problem; the facility of locomotion has arrived to such a degree of perfection that, with the exception of some ameliorations in the construction of carriages and the comfort of the seats, the travelling public has scarcely anything to desire on that score; the only important problem which remains to be solved is to harmonise as far as possible the prices of transport of the different companies and of all the nations by taking for a model the most moderate tariff, and that which is at the same time the most intelligent one, which takes care of the interests of the public, and protects in the best way the capital employed.

This model tariff neither France nor England can show, for the excessive costs and other useless outlays in the construction and administration of railways necessarily impose upon those countries fares which, far from favouring a free circulation, prevent it on the contrary, by making it impossible to the greater number of people to undergo the expenses of a distant journey. The honour of serving as an example to the whole of Europe belongs incontestably to Belgium, as she was able to bring her railway fares down to a level, which almost may be called one of perfection, and which ensures her the first rank in the competition to be established between the foremost nations of Europe. The following comparative table will serve to judge by:—

FARES OF THE PLACES.

From BRUSSELS to OSTEND.	From PARIS to ORLEANS.	From LONDON to DOVER.
Distance 124 kilometres	Distance almost equal 120 kilometres.	Distance 76 miles or 120 kilometres.
1st 5f. 00c. (4s)	1st 13f. 53c. (10s. 10½d.)	1st 18s. 6d. (23f. 10c.)
2nd 3f. 50c. (2s. 10d.)	2nd 10f. 15c. (8s. 2½d.)	2nd 13s. 6d. (17f. 05c.)
3rd 2f. 50c. (2s.)	3rd 7f. 45c. (5s. 11½d.)	3rd 6s. 6d. 7f. 05c.)

As will be seen the French fares are two and a half times higher than the Belgian. As to the English they are nearly twice as high as those of France, and, consequently, nearly five times as heavy as those of Belgium, a contrast the more salient as England and Belgium are, as regards fuel, by their abundance of coal on nearly even terms. The only extenuation which English railways can plead to excuse the evident exaggeration of railway fares, is the praiseworthy institution of parliamentary trains, as it has been forced upon the companies by Parliament in the interest of the masses. These popular trains, chiefly destined for the working classes, are comparatively cheap; they charge uniformly one penny per mile (10 centimes). But this reduced charge is yet far above the third-class fare in Belgium. It is, therefore, decidedly the Belgians who deserve the palm for facilitating the transport and lowering the fares of the railway traveller.—"Le Credit International."

ON THE CHEMISTRY OF COMBUSTION, &c.*

No. II.

By Mr. W. M. Henderson.

THE tensile strength of good iron boiler plate at 80deg. is about 56,000lb. per square inch. Its tenacity will be increased as the temperature rises, under the conditions of generating steam, up to 550deg. above the freezing point; its maximum strength then is 65,000lb. per square inch. From this it decreases in direct proportion; at double that temperature it loses one-half. As the temperature of the water in a steam-boiler rarely exceeds 400deg. its application to their construction is especially favourable. For the purposes of calculation its average strength may be assumed to be equal to 60,000lb. per square inch. The deduction to be made for single riveted plates is 44 per cent., for double riveted plates 30 per cent., or, ratio, plate being 100: single riveted 56, double riveted 70. From this data, the bursting pressure, equivalent to the ultimate strength of the single riveted joint, is reduced to 34,000lb. per square inch, and the double riveted joint, similarly, to 42,000lb. It is commonly believed the plates are strongest in the direction of the fibre, but experiments have proved they are about 2½ per cent. stronger crosswise of the fibre; it may therefore be safely assumed the strength of boiler plates is equal in all directions. The strength of the plates will be increased by the amount of hammering and drawing through the rolls they receive, and a decided increase of strength will be obtained by cold rolling under pressure. On the other hand, cold hammering is highly injurious, causing crystallization, and, consequently, impoverishing of the material. After such treatment the plates should be re-heated, and allowed to cool slowly, to recover their strength.

The strength of cylindrical boilers subjected to internal pressure varies inversely as their diameters; whilst there seems to be no general rule regarding variations in their length, the strength is affected so slightly that it may be almost entirely disregarded in practice. The strength of cylindrical flues subjected to external pressure varies inversely as their diameters, and also as their length. In the case of the pressure acting internally, the material of the boiler shell is extended equally throughout all its parts, and its cylindrical form is maintained at all stages of the pressure. This is very different when the pressure acts externally; the material being compressed, loses its cylindrical form by crumpling up in longitudinal lines near the middle of its length. This comparatively small portion of the tube then has to resist the main force of compression, since it will be seen the ends of the tube are rigidly held in position by the inflexible heads of the boiler. The pressure producing this collapsing force is always proportional to the longitudinal section of the flue, whilst the part where the collapse will take place is, to a certain extent, independent of the same. To meet this disparity of strength, the flues should be divided into shorter lengths, increasing their strength in uniformity with that of the exterior shell of the boiler by riveting at intervals to the joints T or angle iron rings, or by constructing them entirely of corrugated iron. This equalisation of the powers of resistance of the different parts of a steam boiler is of the utmost practical importance, as any increased strength of the outer shell is of no absolute value so long as the internal flues are liable to be destroyed by collapse at a pressure less than half that required to burst the shell which envelopes them, the extra thickness of metal in the shell being so much material thrown away, adding nothing whatever to the strength.

In the construction of steam boilers, it seems to have been tacitly admitted that the flues, if not the strongest parts, were at least quite equal in strength to the outside shell, and this would appear to be the case, judging by the natural course of analogous reasoning, such flues being of greatly reduced diameters, in proportion to the shell, and generally constructed of the same thickness of plate. It was only from the occurrence of frequent explosion by their collapse that attention was directed to the existing discrepancy, which led to a series of experiments, conducted by Mr. Fairbairn, the result of which established the fact that the flues in the Cornish and double-flue description of boilers were by far the weakest part of the construction, in many cases being only one-third as strong as the outside shell. Another matter developed in the course of these experiments, and one that even now is generally disregarded, is the manner of constructing the longitudinal joints of flues by lapping them over each other; such a departure from the true circle, which can easily be maintained by making a butt joint, with longitudinal covering plates, will impair to a considerable extent their powers of resistance—the loss of strength sustained from this simple matter has been ascertained to be as 7 is to 10, or nearly one-third. In every construction where tubes have to sustain an external pressure, the cylindrical is the only form to be relied upon, and any departure from it is attended with danger.

* Journal of the Franklin Institute.

Elliptical tubes should never be used, as their powers of resistance are reduced in proportion to the amount of departure from the true curve.

In the designing and constructing of steam boilers, care should be taken to so proportion the various parts that they may be, as nearly as practicable, equally strong in every direction. The flues, as has been shown, will require especial attention, being the weakest parts as at present constructed. Flat surfaces are known to require staying, and the necessary strength can be readily secured by calculation. Still after all this a cylinder boiler will be, estimately, just twice as strong, in the longitudinal direction, as in the curvilinear, from a mathematical principle involved in the construction of all cylindrical vessels, i.e., "the areas of circles are to each other as the squares of their diameters." The material offering resistance to rupture in the longitudinal direction being the area of the rim section of the shell, as against the pressure exerted on the area of the boiler head. In the curvilinear direction, it is the area of the longitudinal section of the plates, passing through the axis of the boiler, as against the pressure exerted on the area of the enclosed section. From this, it will be seen that boilers having increased dimensions should also have increased strength in the ratio of their diameters, i.e., one boiler twice the diameter of another should have double the thickness of plates, having to resist double the pressure in the curvilinear direction, and the heads being increased in the proportion of four to one, quadruple the pressure in the longitudinal direction. That this ratio of progression is correct, will be evident by considering that the circumference is doubled with the diameter, and the thickness of the plate also being doubled, gives four times the area of the previous cross section, the power of resistance increasing in strict uniformity with the demand. I have previously stated that the strength of steam boilers, in their longitudinal direction, is estimately twice that of the curvilinear: it would be precisely so were it not for the manner in which many cylindrical boilers are constructed. The shell being composed of short cylinders, formed from one plate, with one row of rivets joining the single lap, here it will be seen one side of the plate remains intact, while where these short cylinders are riveted one to the other, the full percentage of rivet holes are punched, or drilled out, giving an increase of strength in the curvilinear direction equal to about the double riveted joint, reducing the excess of strength possessed in the longitudinal direction from 2 to 1½, and by double riveting the longitudinal seam, this will be further reduced to about 1⅓.

In regard to the strength of the flat stayed surfaces of steam boilers, it has been found, by actual experiments, that at a temperature of 388deg. Fah., or 80lb. steam pressure, it required a force of 8·1 tons to draw out a ¾ iron stay screwed into a ⅝ copper plate, stripping the thread in the latter; 10·7 tons to draw out a ¾ iron stay screwed and riveted into a ⅝ copper plate; and 12·5 tons to draw out a ¾ iron stay screwed and riveted into a ⅝ iron plate.

Ratio iron and iron screwed and riveted	1,000
" and copper " "	856
" " "	648
Copper and copper screwed and riveted	576

Care should be taken to facilitate the uninterrupted ascent of the steam from the point of formation to the surface, with a proper circulation of the water to take its place. Vertical heating surfaces, as the inside box of the locomotive type of boiler, should be so angled that the globules of steam formed thereon may leave such surface on ascending, otherwise the multitude of these globules will form a stratum of steam between the water and the plates, exposing the latter to the danger of burning. The water spaces should be large enough to allow the steam generated to rise to the surface, with space for a down current of water outside, to take the place of that just disposed of. In contracted water spaces, the steam, in formation, drives the water out, preventing circulation, causing, forming, and endangering these parts to overheating and burning out; explosion in such case is only a question as to how long a time it will take to destroy the molecular construction of the plates, by alternately overheating and deluging them with water.

This phenomenon may be seen to perfection in the steaming of many of our steam fire engines, the water will surge and re-surge in the glass gauge, as it is displaced from and returns to the water legs, and it is not an unusual occurrence, after the fire has been withdrawn, for them to continue generating steam in great profusion. The palpable reason for this is, that the water then is allowed to descend into the legs of the boiler, and comes in contact with the superheated plates. An interesting experiment would be, to subject all the boilers of this construction to a test, by inserting a small cock in the outside box, to discover whether or not they are subject to this dangerous practice.

The water spaces, for practical purposes, should be from 2 in. to 4in., according to the size and description of boiler, and thoroughly secured by iron stays, screwed and riveted. In cases where boilers have internal flues, the outer shell will be relieved from a longitudinal strain equal to their area. Ratio of diameter to shell when one is used, as 1 to 2·5, in no case more than as 1 to 2: when two are used, as 1 to 3. When tubes are employed, the distance between them will vary with the calibre, and should be about one-half of their diameter. Where wrought-iron flat heads are used, they should be composed of plates at least one-half thicker than those forming the circumference, and be well secured with corner gusset plates of 45deg., and angle irons radiating to the inside circumference of the shell.

As a rule, no hole should be cut in a steam boiler larger than is absolutely required. Where a steam drum is riveted on it may not be necessary to cut the plate at all; a number of small holes of an aggregate area equal to the steam-pipe or safety-valve is all that is required; and where a man-hole is cut, the margin should be stiffened with strengthening rings, if the frame of the man-hole itself is not sufficiently strong to restore the strength of the plate cut away? Riveted joints exposed to a tensile strain are directly or nearly so as their respective areas, or in other words the collective areas of the rivets should be equal to the sectional area of the plate taken through the line of rivets.

The proportional size of rivets, pitch of ditto, and lap of joint, will be as follows:—Diameter of rivets for plates up to three-eighths is twice the thickness of plate. The pitch for three-sixteenth and one-quarter inch plates is six times the thickness of plate; for five-sixteenth and three-eighth inch plates it is five times. The lap for three-sixteenth, one-quarter, and five-sixteenth inch plates should be six times the thickness of plate, and for three-eighth plates five and a-half times. For double riveting, add two-thirds of the depth of the single lap. Diameter of half round heads one-fifteenth for one-eighth of diameter of rivet. Diameter of conic heads twice the diameter of rivet, and the height of both description of heads, three-fourths diameter of rivet.

As before remarked, the question relating to the strength of cylindrical tubes, when exposed to external pressure, as the flues of steam boilers, requires more than ordinary attention; it has been found by direct experiment that the strength varies in accordance with a certain power of the thickness, the index of which, taken from the mean of the experiments, is 2·19, or rather higher than the square. The formula for calculating the collapsing pressure is as follows:—Where D equal diameter in inches, L length in feet, K thickness of metal, and P the collapsing pressure, then $P = \frac{806800 \times K^{2 \cdot 19}}{L \times D}$

This formula, however, is not of easy solution; by taking 2 instead of 2·19 for the index of K, we get $P = \frac{806300 \times K^2}{L \times D}$ whence the collapsing pressure may be readily calculated by ordinary arithmetic. For thick tubes of considerable diameter and length, it will be found sufficiently exact. For small diameters and short lengths, up to 10ft., the theoretical formula is more correct, but it does not strictly apply to tubes over that length, and when we consider a safe margin is left by allowing only one-sixth for the safe load, the square of the thickness is near enough for all practical purposes.

Rule for calculating the bursting pressure per square inch of a steam boiler in the longitudinal direction. Multiply the area, in square inches, of the cross section of the rim of the boiler, by the value of the iron, as deduced from experiment, and divide by the area of the boiler head.

Formula S = area cross section, C = constant—A = area boiler head, and P = bursting pressure per square inch. Then $P = \frac{S \times C}{A}$.

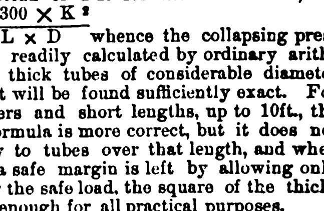
Example.—Given a steam boiler of 34in. diameter, with single riveted joint, and constructed of quarter inch plates. To find the pressure per square inch, that will tear the shell apart, in a longitudinal direction. Here the sectional area of the rim is equal to 18·66 square inches, the value of the iron for the single riveted joints is 34·000 per square inch, and the area of the boiler head is 452·39 square inches.

Then $\frac{18 \cdot 66 \times 34 \cdot 000}{452 \cdot 89} = 1{,}502 \cdot 4$lb. which is the bursting pressure per square inch.

Rule for calculating the bursting pressure of a steam boiler in the curvilinear direction. Multiply the area in square inches of the section of the plates taken through the axis of the boiler by the value of the iron, as deduced from experiment, and divide by the diameter of the boiler.

This will be better understood by reference to the

FIG 1.



foregoing diagram, representing a section of a steam-boiler, the pressure acting as indicated by the arrows, the resisting material being the side of the boiler T T. It is obvious the length is quite immaterial, a hoop of 1in. in length will give us all that is necessary to make the calculations, that 1in. being equal in effect to any other inch or aggregate number of inches, when multiplied by any such length taken.

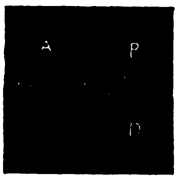
Formula.—Let T = thickness of plate, C = constant, D = diameter, and P = bursting pressure. Then $P = \text{twice}\ \frac{T \times C}{D}$.

Example.—Taken the same boiler, as given above, to find the bursting pressure per square inch, that will rupture the shell in the curvilinear direction. Here T = 25in. The two sides = 5in. The value of the iron as before, 34,000lb. per square inch, and the diameter is 24in.

Then $P = \frac{5 \times 34000}{24} = 708{\cdot}33$, which is the bursting pressure per square inch for the safe load, allow only one-sixth of the bursting pressure. It will be seen by comparing the results of these calculations that the boiler is, as before stated, twice as strong in the longitudinal as it is in the curvilinear direction.

The manner for proceeding to calculate the strength required in flat stayed surfaces of a steam-boiler will be readily understood by an inspection of the following diagram, showing the general arrangement of such staying, and the surface of pressure each stay has to sustain. It will be observed that the distance from the centre of one stay to the next, forming a square, is the only measurement of surface necessary to be calculated, each square of the entire surface being alike, and assuming this rectangle to be situated as shown by the figure A B C D,

FIG. 2.



we find that the whole of the pressure bearing upon this surface has to be sustained by the single stay S. All that remains then to be done, is to so proportion the area of this rectangle in reference to the pressure of steam to be employed, and to make the cross section of the stay, at the smallest part, strong enough to bear six times the pressure that will be brought to bear upon it, taking the ultimate tensile strength of iron stays at 60,000lb. per square inch, and assuming that such stays are screwed and well riveted on both sides. The additional strength secured by riveting the stays has been found to be about 14 per cent.

Safety valves—allow one square inch area of safety valve per each 3 square feet of grate surface. Calculations for the safety valve.

First. When the lever is parallel, multiply the weight of the lever by half the number of leverages. If the lever is not parallel, balance it upon a fulcrum and multiply the weight as before, by the number of leverages contained up to the point of balance, add the weight of the valve and attachments, and divide this product by the area of the valve in inches. The result will give the weight per square inch upon the valve seat, from the effect of the lever and valve, &c., alone. This is a constant weight entirely distinct from the effect produced by the sliding weight of the ball, which will vary with its position on the lever.

Second. Divide the weight used by the area of the valve in inches; this will give the direct weight per square inch, supposing it to be placed immediately over the valve; if it is placed upon the second notch, it will be twice as much; if upon the third notch, three times as much, and so on, depending upon the point of location distant from the fulcrum. Wherever it is placed, divide such distance from the fulcrum by the distance from the fulcrum to the centre of the valve; this will give the amount of leverage by which to multiply the direct weight previously found. The constant weight must always be added at all points where the lever is required to be marked, or the weight to be ascertained.

There is little further to add to this subject of steam boilers, rendered as brief as possible, commensurate with the extent of information attempted to be conveyed; if not, therefore, generally instructive, it will, at all events, like a short sermon, not prove tiresome to the reader.

One other item, without which the boiler is not complete, is the chimney, which we will now briefly dispose of. The draught or current of air passing through a furnace is occasioned by the difference in weight between the column of rarified air within the chimney and that of an external column of the same proportion. The area of the chimney or smoke stack, as already given, should be about two square inches per pound of coal consumed per hour, or twenty-four square inches per square foot of grate surface. The length should be about one yard per inch of the diameter. The general practice of decreasing the area towards the top is an error; they should be constructed of at least an equal area throughout; for, although it is true that the volume of the heated gases diminishes as they leave the furnace, the velocity is also proportionally reduced.

ON THE SUN.*

BY MR. NORMAN LOCKYER.

THE lecturer said that thousands of generations of men had flitted over our planet before the idea that the sun was the nearest fixed star was seriously discussed; indeed, men were still living, who had finally settled the question. This fact illustrated in full force the importance of a study of the sun, for if the sun was merely the nearest fixed star—brighter and bigger looking than the rest on account of his nearness—we must look upon him as a specimen of the millions of other stars, more remote, which together formed what might be called the skeleton of the universe—the scaffolding which doubtless supported other systems like our own, and other habitable worlds past, present, and to be. Galileo and others, with the first-made telescope, attacked the sun, and endeavoured to wrest some of his secrets from him. They found that the surface, which till then had been regarded as of spotless purity, had spots upon its surface; and after the first excitement of the discovery had worn off they determined the rotation of the sun upon its axis, like that of the earth, by them. This discovery was completed, and in 1769 Dr. Wilson discovered that the dark spot was below the brightly shining apparent surface called the photosphere. Sir Wm. Herschel, too, interpreted the darkest central portion of the spot to be a portion of a cool, habitable globe, a fitting abode for man, and reachable through a rent in the photosphere, from the light and heat of which the inhabitants were effectually screened by a highly reflective envelope suspended midway between the photosphere and the globe itself.

This theory had been much contested, and, during the last decade, an instrument much more searching than the telescope had been brought upon the field, and we learned that the sun and every star, so far from being cool and habitable, were glowing with the fiercest heat. This was the prism, or number of prisms so arranged as to form what was called "the spectroscope," an instrument which tells the composition of the light given off or radiated by bodies when they are burning or glowing—that the light radiated from different bodies gave spectra of different kinds, according to the nature of the radiating body. Dr. Wollaston, many years ago, discovered that the spectrum, or sun's light, was not a continuous one, but that it was crossed by black lines indicating reflective absorption of the light. Professor Stokes and Mr. Wm. Thompson found that a double absorption line in the sun's spectrum corresponded with a double absorption line in the spectrum of the light radiated by incandescent sodium vapours. They suggested that this might indicate the presence of sodium vapour round the sun absorbing its otherwise continuous spectrum. This had been established since by Kirchoff and Bunsen, who further showed that the light of the sun was being absorbed by the vapours of sodium, iron, magnesium, varium, &c.

According to the new theory of the sun, founded by Kirchoff and Bunsen, the photosphere was a liquid sea of molten substance, and over this was a transparent atmosphere, containing the vapours to the absorption of which the lines are due. The spots are merely opaque clouds cutting off the light from the molten sea. This theory did not satisfy astronomers in all particulars. They did not accept the theory that the spots were clouds above the photosphere, nor that the photosphere itself was liquid, for the evidence of the telescope that the former are cavities in the photosphere is overwhelming, and the changes in the light are so great, and its general appearance so cloud-like, that the assertion as to its being a liquid seemed to be contrary to the evidence. The theory of an enveloping atmosphere was accepted on all sides, and was supposed to cause the phenomenon of a halo of light, seen in eclipses, and called "the corona." Since the theory of Kirchoff and Bunsen was given to the world, two others had been proposed. Messrs. De la Rue, Stewart, and Loewy, representing English science, said that a spot is dark because the solar light is absorbed by the cool non-luminous atmosphere pouring down there on to the visible surface of the sun, in other words, on to the photosphere. M. Faye, representing French science, said that a spot is dark because it is a hole in the photosphere, and the feebly luminous, and therefore radiating, interior of the gaseous sun is there alone visible. Here was a clear issue which probably nothing but the spectroscope could solve.

The lecturer then examined and explained the various experiments which had been recently made in the more systematic and thorough examination of the sun by himself and other physicists; and he also explained the spectra of the sun during an eclipse, as well as the instruments by which they were taken, and the principles on which they were constructed for observing the sun in particular spots of its surface. The results obtained by Dr. Frankland, Dr. Balfour Stewart, and himself, had, as early as 1866, referred the strange red flames seen in an eclipse to masses of gas. An instrument was ordered by which to observe them, and this could not be obtained and the theory confirmed till after the eclipse of 1868 had been observed. The result was to prove that the red flames seen in an eclipse are composed mainly of hydrogen, and the instrument invented by the lecturer enabled astronomers to observe them without waiting for an eclipse.

Storms were frequently to be detected on the sun, and they were very easily observed by the new apparatus. The lecturer's calculation of the up and down rush of hydrogen in these storms was forty miles a second, while the velocity of lateral, or cyclonic movement, was 120 miles a second, and these numbers would give an idea of the enormous forces at work on the sun, and explain the rapid changes and intense action visible in the spots. The lecturer exhibited some beautiful spectra of the sun to show that the pressure of the sun's atmosphere increased in proportion as the tops of the protuberances were observed or the lower points to which the vapour reached, and said that the conclusion as to the nature of the sun to be drawn from all these experiments was, that the sun was a star, with a nucleus giving a continuous spectrum, surrounded by an atmosphere absorbing that spectrum, the photosphere—the visible star—being situated in that atmosphere. Fundamentally, their theory was the same as Kirchoff's, but there were very important differences. The lecturer had showed that the brilliant photosphere, instead of being a sea of molten metal, the continuous spectrum of which is absorbed by an enormous atmosphere outside it, is part and parcel of the atmosphere of the sun, and is situated actually above the region in which most of the absorption takes place.

The lecturer then glanced at the results of the observations of other stars by the method employed to observe the sun, one of which was to show that the term "worlds on fire" needed not be applied to some of the stars, as the phenomena they exhibited could readily be explained by what had been observed in connection with the sun. Sir William Herschel and Laplace's theory, as to the nebulæ, that they indicated the presence of a nebulous fluid in space, had been confirmed by the brilliant discovery that they were, in the main, masses of hydrogen gas. Dr. Frankland and himself had also been enabled to ascertain, by the spectrum analysis, that they existed in a state of the greatest rarefaction, and that their temperature is very much below that of the very last stratum of the sun's atmosphere. These were some of the results of the past year's workings, and it was to be hoped that there might soon be more workers to dig in this mine, for we might rest assured that the present results would soon be left far behind, and the future lectures of the British Association would tell of other pages in the book of nature, so beautiful, so brilliant, that the one he had read to them would pale its ineffectual fires, for now

"Science reaches forth its arms
To feel from world to world, and charms
Her secret from the latest moon."

The lecturer's explanations were very clear, and the experiments remarkably successful. The spectroscope was so arranged as to throw the spectra upon a canvas screen, and instances of absorptive and selective light were shown. The illustration of Frauenhofer's lines—indicative of the presence of sodium—was very fine and clear, as was also the representation of the *corona* and red protuberances which were first observed in the eclipse of 1706. The method of observing particular parts of the sun's surface—"taking the sun to bits," as the lecturer expressed it—was explained by throwing upon the screen a picture of the solar telescope, prepared with the slit so as to afford observations of different portions of the sun's surface. The different lines indicating the presence of hydrogen were all shown and explained. Another photograph, showing the protuberances seen outside the sun, was very beautiful, and the lecturer explained that they were caused by the vaporous atmosphere of the sun, some of them being nearly 28,000 miles high. A series of photographs were shown to illustrate what Mr. Lockyer has very properly called "solar storms," for he has calculated that the velocity of the vapour on the sun's surface ranges at such times from 40 to 120 miles per second. The method by which this was ascertained was beautifully and clearly exhibited in a series of photographs, by the deflection of the lines in the spectrum. The method by which the nature of the sun's atmosphere had been analysed and examined formed another interesting set of illustrations.

* British Association.

SENATOR SPRAGUE is said to be the largest employer of labour in the United States. He gives work to about 8,000 persons, and has recently raised their wages fifteen per cent.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, October 14.)

CHEMICALS.—With the commencement of the new quarter a satisfactory business has been done in this market in chemicals generally, and excepting one or two specialities of the trade, manufacturers have no reason to complain. The alkali trade does not yet show any signs of increased vitality, and unless some extraordinary demand for shipment should spring up, or the present overproduction is further reduced, producers must still submit to present unremunerative prices. Soda: prices remain the same for soda ash, with a limited home demand, at £7 to £7 7s. 6d. for 48. Crystals dull at £4 5s. Caustic, offered freely, at £13 10s. Bicarbonate, in moderate request, at £9 10s. Nitrate of soda: is steady, at £17, for immediate delivery; to arrive, business is done at £15 15s. Potash: muriate remains firm at £7 7s. 6d. for 80; present contracts will take up the bulk of the production until the end of the year. Saltpetre: foreign is disposed of freely at 23s.; English, steady at 27s. 6d. Alum: no change in prices, the demand being good, chiefly for the paper makers; prices are firmer, at £6 5s. for home, and £7 for export. Ammonia: sulphate is nearly all bought to December, and £16 10s. is asked for inferior lots. If nitrate soda maintains its price, no reduction in quotation for sulphate of ammonia will occur. Copperas: the market is unchanged. Green, 52s.; dry, 50s.; chloride of iron firmer, at 52s. Pyrites: a moderate business in Norwegian at 7½d. per unit. No change in Spanish. Calcined pyrites is offered at 44s. 6d., returning charges for copper. Lime: the transactions in phosphate have been moderate at previous prices. Bleaching powder in better demand at £8 2s. 6d. for 35. Disinfectants meet with a ready sale at £5 5s. per ton for farmers. Manganese: considerable contracts have been concluded for high percentages at 95s. to 97s. 6d.

METALS.—The past week has been an inactive one in metals, and prices generally remain about the same as quoted in our last report. Iron: Scotch pigs keep steady at 53s. 1d. to 53s. 3d. Cleveland, firm at 43s. for forge to 48s. 6d. for No. 1. Welsh bars, £6 5s. to £6 7s. 6d.; Staffordshire, £6 10s. to £7; gas tubes at 60 to 70 off list; boiler tubes, 40 to 45. Copper: very little business doing in copper, except for braziers' sheets, for which some good orders have been given out for India lately. Prices are for tough ingot, £72 to £73; and for Chili slab, £67 to £68. Tin is firm at present quotations. Straits, £129 to £131; English, £125 to £126. Lead: a moderate business has been done for export, English soft pig selling at £19 to £19 5s.; P. G. brand, £18 10s. Spelter is very quiet. English firm at £20 15s. to £21 5s.; Silesian, special brands, £20 5s. to £20 10s.; hard spelter, for export, £16 5s. to £16 10s.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—A. W. H.—H. B. S.—G. D.—F. R.—G. W. H.—C. H. B.—J. R.—E. K.—R. R.—S. M.—B. F. T.—R. B. J.—J. N.—B. J. and Co.—S. E. T.—R. G.—R. S.—W. T. G.—T. R.—G. W. H.—S. E.—T. C.—J. B.—R. T. and Co.—H. W.—H. S.—C. W. T.—R. and L.—W. B. M.—C. E.—R. F. E.—T. P.

Meeting for the Week.

MON.—Society of Engineers.—Mr. Perry F. Nursey on "English and Continental Intercommunication," at 7.30 p.m.

Naval, Military, and Gunnery Items.

THE "Leander," the second of the clipper tea ships, arrived off the Scilly Islands this day week.

WE regret to observe that the death is announced of Mr. Thomas Wingate, the oldest engineer and shipbuilder on the Clyde.

A NOTIFICATION has been received at the Portsmouth Dockyard that the usual annual examinations of the different trades for promotion is not to be held as usual this year, and that it will not take place unless further orders are issued. The examination has usually been held in the first week of December of each year.

THE tonnage for the port of Hull for the nine months of the present year is 1,055,677, being about 10,000 tons in excess of the corresponding period of last year, which was one of the most prosperous years the port ever had.

THE Board of Trade have awarded a telescope to Captain A. D. Larsen, of the Norwegian vessel "Bien," of Krageroe, in acknowledgment of his humanity and kindness to the shipwrecked master and crew of the "Prima Donna," of Hull, whom he received on board his vessel on the 7th September, 1869, in latitude 55·40 N. and longitude 1·18 E.

DURING the month of September twelve vessels were launched from Clyde shipbuilding yards. Four of the number were iron screw steamers, and the remaining eight iron ships. The total tonnage was over 13,000 tons, the two largest vessels being of 1,385 and 1,380 tons respectively. Five of the launches were at Glasgow, three at Port Glasgow, two at Dumbarton, and two at Greenock.

THE Colonial Office has issued the casualty roll of the Europeans killed and wounded by the rebel Maories between June 1, 1868, and August 1, 1869. It is to be understood, however, that it is the best account of the casualties that can be obtained, but it is feared that it is not quite complete or correct in all particulars. The total is a very serious one, viz., murdered, 47 and 18 children; killed in action, &c., 96; and wounded, 98.

THE Pacific Steam Navigation Company of Liverpool have just contracted with the shipbuilding and engineering firm of the late John Elder, of Govan and Glasgow, which continues its extensive operations, for an additional steamship of 3,088 tons and 550-horse power, for the Liverpool and Valparaiso mail service. The engines will be the 25th pair on the "compound" principle, of which the company have long had favourable experience.

ON the 3rd inst. the screw corvette "Elizabeth" set sail from Dantzic. She is to proceed to England, and afterwards to take up the Prussian scholars of the Egyptian expedition, and start for the East. The Crown Prince will sail on board her as far as Alexandria, and then make use of the "Grille." Two hundred men have been added to the crew, which now numbers 500, the nominal strength in time of war.

LAST Friday night's "Gazette" contains regulations with reference to the pensions payable by the Board of Trade to masters and seamen who contributed sixpence a month towards the support of Greenwich Hospital. To be qualified for pensions applicants must prove at least five years' service prior to January 1, 1835; they must not be under 55 years of age, and must have been disabled or incapacitated from age. The amount of each pension is limited to the sum of £3 8s. a year. The whole sum applicable to these pensions, and paid by the Admiralty to the Board of Trade, is £4,000 per annum.

IT is said that a corps of volunteers is to be formed at Rome consisting entirely of nobles. At present only 500 have enrolled themselves, and, as the corps is to be 800 strong, 300 more are required. The members are not limited to the Roman nobility, but may be of any nation. The command will be given to a Lieutenant-Colonel taken from the army. The uniform is described as handsome. The members of the corps will not receive any pay, and their duty will consist in guarding Rome. There does already exist a Palatine Guard, whose duties are the same, but this guard is composed of shopkeepers, though they, too, give their services gratuitously.

ONE of the smallest screw steamers that ever crossed the English Channel at this season of the year arrived in the Cork harbour on Wednesday week from Cowes. She is named the "Cuckoo," and manned by Captain Wakely, John Groves, engineer, and Frederick Vincent, seaman. She is an open screw steamboat, of about 2½ tons, has a temporary covering over the coal locker, and a small saloon, a stern capable of only admitting four persons to sit in, has no cooking accommodation, nor any berths. The crew were obliged to take such stock of prepared food as was necessary for the voyage, and they did not change clothes since they left Cowes on the 7th of September.

NUMEROUS inquiries have reached the "Army and Navy Gazette" asking why the New Zealand medal has not yet been issued. Six months ago the medals were finished casting, &c., by the Mint; the ribbon (a very appropriate one) decided on and approved by His Royal Highness the Commander-in-Chief, and, we believe, by her Majesty; the lists of the names of candidates sent into the Admiralty and Horse Guards, and yet no issue! Rumour says that the fact of the Commander-in-Chief having approved of the ribbon before it was approved by the Home Department in the War Office has offended a clerk in the department, and Bumbledom has determined that the ribbon shall be altered, and so has stopped the issue. Fortunately a sample of the approved ribbon is in the possession of an influential member of parliament, and should any alteration be attempted he is determined to sift the matter to the bottom.

Miscellanea.

THE Harvest Fête given on Monday last at the Crystal Palace with such success will be repeated, with display of fireworks, on Monday next, the great trophies and other decorations remaining until then.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending October 9, was 5,452. Total number since the opening of the Museum, free daily (May 12, 1858) 1,662,657.

A CORRESPONDENT writes us that Sir Titus Salt has recently had expansion valves fitted to the whole of his steam engines at Saltaire—six in number—the result being a saving of 50 tons of coal per week!

THE Government of India has made arrangements for having a cast taken of the principal remaining gateway of the Sauchi Tope, near Bhilsa, with a view of having produced several copies of this work, the date of which is supposed to be about 250 B.C. It is the most elaborate work of sculpture existing in India.

MR. WOODWARD, librarian in ordinary to the Queen at Windsor Castle, died on Tuesday night. Mr. Woodward was a man of considerable literary and artistic culture. He wrote a history of Wales, and a history of America, and a local history of Hampshire, was editor of the "Fine Arts Quarterly Review," and was lately engaged on a life of "Leonardo da Vinci."

THE number of visitors to the South Kensington Museum during the week ending October 9, 1869 was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 15,692; Meyrick and other galleries, 2,095; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 2,110; Meyrick and other galleries, 294; total, 20,191. Average of corresponding week in former years, 13,006. Total from opening of Museum, 8,868,402.

THE imports of iron minerals into France in the first seven months of this year have been officially returned at 336,392 tons, of which 130,499 tons came from Algeria. The Belgian iron trade continues active: great efforts are being made by the Belgian works to increase their means of production; the Thy-le-Chateau Company proposes, for instance, to double its annual make of rails. Under these circumstances it will be inferred that prices display considerable firmness in Belgium. The extraction and consumption of coal are increasing in Belgium.

THE "Saint Louis Republican" records the death of Archibald W. Oxendine, another "Last Man," who was born on Pedee River, South Carolina, August 29, 1759, and died at Benton's Creek, Phelps County, September 3, 1869. He served throughout the war of the Revolution as one of "Marion's men." For over 40 years he was a Baptist minister. He had been unable to walk for the last three years, but retained his sight, hearing, and intellect up to his last hour. He was attended in his last illness by his youngest daughter, over 70 years of age.

A CORRESPONDENT, writing from Auckland by the last mail, says:—"I fear we are being carried away by an extraordinary flow of commercial prosperity. Our Thames gold fields are literally flooding us with wealth. The returns are likely to be from 25,000oz. to 40,000oz. per month during the next six months, worth (say) fifty shillings per ounce. This amount will necessarily cause a great increase of trade and confer a benefit on a large portion of our population, while numbers are becoming suddenly rich. At present we do not see any great increase of public immorality, but I fear the tendency will be in that direction."

THE imports into the colony of Victoria in 1869, to August 7, amounted in value to £8,125,208, an increase of £947,632 over the amount for the corresponding period of 1868. But the "Melbourne Argus" reports that the markets are very much glutted with merchandise, and importers will have to submit to unsatisfactory prices for a little while yet, before the markets begin to recover. The exports have amounted in value to £7,276,918, showing a decrease of £1,413,636. Hopes were entertained of better prices for wool, and an increasing demand for preserved meats in the home market.

ACCORDING to the "Rangoon Gazette," a discovery has been made by a European gentleman resident in Maulmain, which may eventually become of great importance to the place. Near the Damathat caves he has found a certain description of clay, which when mixed with certain proportions of sand, water, and other substances, possesses all the properties of the best Portland cement. It can be produced in any quantity at about one-fourth of the cost of the latter article. We believe the chief engineer has given every encouragement and all the assistance that lay in his power to the discoverer. We trust the latter gentleman may make a rapid fortune out of the new cement.

THE reports received from the French metallurgical districts—the Haute Marne, the Moselle, the Meurthe, the Ardennes, the Nord, &c.—are of a satisfactory description, some difficulty being experienced in executing the numerous orders received. Iron is well maintained in price; rolled from coke-made pig is quoted at St. Dizier at £8 4s. per ton; mixed rolled iron (merchants' bars) at £8 12s. to £8 16s. per ton; and rolled iron from charcoal made pig at £9 4s. per ton. The foundries of the Haute Marne are well employed, the forges and foundries of the Moselle and the Meurthe also display considerable activity. The Moselle and the Meurthe works have even been obliged to transfer some orders to the rolling mills of the Ardennes.

MR. W. I. TRAFTON, of Manchester, U.S., who has already made one miniature steam engine of great delicacy and beauty, is about to construct another. He is to make every part of the engine, with the boiler, from a single silver half-dollar. The "Scientific American" states that when done it will be placed under a glass case ¾in. in diameter and 1¼in. in height. The boiler will hold about 8 drops of water but one-half that quantity will run it several minutes. It will have all the parts of an engine, and the boiler will have two minute gauges. Some of the smaller parts can only be made by the aid of a powerful magnifying glass.

THE "Lounger" of the "Illustrated Times" says:—By the way, touching waterproofs, I think I can give travellers a valuable hint or two. For many years I have worn indiarubber waterproofs, but I will buy no more, for I have learned that good Scottish tweed can be made completely impervious to rain, and moreover, I have learned how to make it so; and, for the benefit of my readers, I will here give the recipe:—In a bucket of soft water, put ½lb. of sugar of lead and ½lb. of powdered alum; stir this at intervals until it becomes clear; then pour it off into another bucket and put the garment therein, and let it be in for 24 hours, and then hang it up to dry without wringing it. Two of my party—a lady and gentleman—have worn garments thus treated in the wildest storm of wind and rain without getting wet. The rain hangs upon the cloth in globules. In short, they are really waterproof. The gentleman, a fortnight ago, walked nine miles in a storm of rain and wind such as you rarely see in the south; and when he slipped off his overcoat, his under clothes were as dry as when he put them on. This is, I think, a secret worth knowing; for cloth, if it can be made to keep out wet, is in every way better than what we know as waterproofs.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—824, 830, 848, 850, 877
BUILDINGS AND BUILDING MATERIALS—869, 879, 884
CHEMISTRY AND PHOTOGRAPHY—819, 858, 870, 881
CULTIVATION OF THE SOIL, including agricultural implements and machines—826, 859, 883
ELECTRICAL APPARATUS—888
FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—823, 846, 865, 871, 874, 894, 899
FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—847, 856
FURNITURE AND APPAREL, including household utensils time-keepers, jewellery, musical instruments, &c.—817, 843, 844, 851, 855, 866, 873, 876, 878, 880, 891, 898
GENERAL MACHINERY—822, 852, 857, 868, 900
LIGHTING, HEATING, AND VENTILATING—820, 827, 831, 832, 845, 849, 887
METALS, including apparatus for their manufacture—836
MISCELLANEOUS—841, 847, 858, 860, 862, 872, 875, 882, 886, 887, 890, 893
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—834, 837, 842, 863, 864, 885
SHIPS AND BOATS, including their fittings—828, 835, 840, 867, 889
STEAM ENGINES—818, 829, 854, 861
WARFARE—821, 825, 838, 839, 893, 896, 897

817 F. GILLHAM, Liverpool. *Hats.* Dated March 17, 1869.

This consists in making the bands of elastic ventilating soft material, preferably vulcanised indiarubber, or other elastic material capable of being moulded or otherwise formed. These bands it is proposed should run round the interior of the front of the hat and extend backwards on each side about one-third of or all round the circumference, and it is preferred that they should be from 1in. to 1½in. in width, and about ¼in. thickness.—Patent abandoned.

818 J. H. BENNETT, Leith. *Steam engines.* Dated March 17, 1869.

This relates, first, to an improved construction of surface condensers for steam engines; second, to certain peculiar constructions and arrangements of frictionless slide valves; and third, to certain peculiar constructions and arrangements of high pressure steam boilers or generators and their furnaces.—Patent completed.

819 C. F. CLAUS, Middlesborough-on-Tees. *Carbonate of potash.* Dated March 17, 1869.

This consists, first, in the manufacture of carbonate of potash by the action of carbonic acid derived from various sources, either pure or mixed with other gases, upon solutions of sulphide of potassium obtained either by the decomposition of solutions of sulphate of potash, by means of solutions of sulphide of barium, or by the reduction at a high temperature of sulphate of potash by means of carbonaceous materials (such as coal, coke, or charcoal or other analogous substances), and by dissolving the sulphide of potassium produced in water.—Patent completed.

821 J. RAMSBOTTOM, Crewe. *Ventilating tunnels.* Dated March 18, 1869.

This consists in extracting the vitiated air from the tunnel through one or more openings, at or near the middle of its length, by means of fans or pumps, or by the rarefaction of the air by heat in an upcast shaft as is practised in mines. The vitiated air so exhausted is replaced by fresh air from each end of the tunnel.—Patent completed.

821 T. MARTIN, Formby, Lancashire. *Supplying ammunition.* Dated March 18, 1869.

A light hand car or truck accompanies the troops into action, which may contain any amount of ball ammunition, say 1,000 rounds, which can be conveniently transported therein. By this means, greater confidence will be imparted to the men, and rapid and useless firing off of ammunition will be prevented.—Patent completed.

822 G. R. MATHER, Wellingborough. *Cutting wood.* Dated March 18, 1869.

This relates to the use of stone, artificial stone, or other gritty composition, adapted to cut into wood and give form thereto. For this purpose, the natural or artificial stone or composition is fitted to a spindle which is caused to revolve, and the form desired to be given is produced as a counterpart on the edge or other surface of the stone or composition. The wood to be cut, if of contiguous length as in the case of mouldings, is conducted by guides to the surface of the revolving stone or composition.—Patent completed.

823 J. C. RAMSDEN, Bradford. *Looms.* Dated March 18, 1869.

The inventor dispenses with the shuttles and feeds in the weft from each side by means of needles. The bobbins upon which the weft is wound can be of any suitable size, and fixed at any convenient part of the loom, care being taken to fix them in that position in which the yarn or weft will come off with the least friction or drag.—Patent completed.

824 E. BOOTH, W. P. GAULTON, and J. WALLS, Manchester. *Admitting air to steam boilers.* Dated March 18 1869.

This consists in applying an apparatus formed by an elastic diaphragm or by a pair of bellows or by an apparatus somewhat similar to a small gasometer, sealed with mercury or other fluid, to act as a pump to draw in or expel air through a suitable valve. This air is again driven out or drawn in again slowly through a small orifice regulated by a tap or valve. Such an apparatus as one of those above referred to may be mounted upon the furnace door and connected directly, or by levers, and rods or chains, with a "grid" or other valve in the fire-door, which valve is lifted to open the orifices for air when the furnace door is open or latched, the latch of the door forming a lever for the purpose. The act of opening the air valve draws in or expels the air (as the case may be) from the apparatus above referred to, and this causes the valve to be held open, while the slow admission of air to the apparatus allows the valve gradually to shut and cut off the supply of air.—Patent abandoned.

825 J. H. JOHNSON, Lincoln's Inn-fields. *Firearms and cartridges.* (A communication.) Dated March 18, 1869.

This consists, first, in making the bore of small arms (whether for military or sporting purposes) and ordnance oval, but without any twist, the object being that when using small shot, or when more than one ball is employed, to scatter the shot in the most serviceable direction. In military arms the major axis of the bore should be horizontal, so as to disperse the shot in a horizontal line, but in double-barrelled sporting guns one of the barrels is placed above the other, and the major axis of one bore coincides with the minor axis of the other.—Patent abandoned.

826 J. T. DARKE, Walton-on-Thames. *Manure from sewage.* Dated March 18, 1869.

This consists in receiving the sewage on a filtering fabric supported by a perforated surface, the fabric being adapted for arresting the more solid parts of sewage matter, and allowing the liquid sewage to pass away through the perforations below the fabric. The sewage matter arrested by the filtering fabric is treated with dry earth or other deodorising and disinfecting substance.—Patent abandoned.

827 A. DE PINDRAY, Paris. *Smoke-consuming apparatus.* Dated March 18, 1869.

This relates to improvements in the construction of the furnaces of steam boilers, at the same time ensuring an entire consumption of smoke. First, by an improved combination of the apparatus at present employed, which are modified to obtain the result desired. Second, by the particular arrangement of the furnace and boiler and the disposition of the same one with the other for utilising the whole of the available heat. Third, by the particular form and dimensions of the fire-grates, flues, and other parts, which vary with the horse power and form of the boilers and the fuel employed.—Patent completed.

828 W. R. LAKE, Southampton-buildings. *Anchors.* (A communication.) Dated March 18, 1869.

This consists in an anchor made with the palms of its flukes in the same plane, and with the arms of its flukes made integral with an open yoke, across which extends, from one side to the other, in the same plane with the palms and arms of the flukes, a pin shaft or pivot integral with the yoke, the shank being entered within the yoke, opening and grasping the cross shaft in the yoke in the manner of a machine bearing.—Patent completed.

829 A. and S. HAYCRAFT, Stroud, and S. HAYCRAFT, Birmingham. *Steam engines.* Dated March 18, 1869.

This consists in so constructing and arranging the parts of stationary, locomotive, and marine steam engines as to effect a more economical use of steam than in steam engines of the ordinary construction. This is effected by arranging the valves and gearing of the engine in such manner as to keep steam from the boiler continuously on one side of the piston, the motive steam from the boiler, or that steam by which motive power is produced, acting on the other side of the piston.—Patent abandoned.

830 J. PARTINGTON, jun., Oldham. *Smoke consumer.* Dated March 18, 1869.

The inventor makes or leaves apertures or openings at the lower part of the front of the bridge wall. From these openings holes or passages lead to the top of the bridge through the bridge wall, or passages may be formed leading directly from the front part of the wall below the firebars to the top of the bridge. Cold air enters the apertures or openings at the lower part of the bridge wall, and is caused to pass through the passages leading out at the top of the bridge by the draught of the chimney or other well-known means.—Patent abandoned.

831 W. T. SUGG, Vincent-street, Westminster. *Gas burners.* Dated March 18, 1869.

This consists in the delivery of the gas into the chamber containing the aperture or apertures at which ignition takes place at a low velocity and a temperature exceeding that of the surrounding atmosphere as little as possible, and in so arranging the sizes and shapes of the tubes or channels and orifices that the gas shall issue at the point of ignition at an inapplicable or the least possible pressure.—Patent completed.

832 A. B. WALKER, Liverpool. *Producing and applying heated air.* Dated March 18, 1869.

The inventor uses a stove of the following peculiar formation. He has a tube of copper or other suitable material, of a broad flat form (sectionally), coiled like a helical spring. This he encloses in a case of metal or firebrick, placed over a fire, the flame of which passes up through the spaces formed in the coil between the tubes. The air to be heated is driven by a fan or any other form of blowing machine, through the inside of the tube forming the coil in which he places tines or obstructions, so as to break up the current of air and bring each particle of it in contact with the heating surface of the tube, thereby ensuring a more perfect heating of the whole body of air than can be obtained by passing it through a plain tube. The inventor uses gas alone for heating the coil, and sometimes, by preference, when the air is not required to be highly heated, places the coil inside of a steam boiler.—Patent completed.

833 J. RITCHIE, Leicester-square, Westminster. *Flywheels.* Dated March 18, 1869.

The inventor makes flywheels or other similar constructions in the form of hollow circular cases of iron, earthenware, porcelain, or other materials, with an opening or openings provided with means of closing the same to admit of the insertion and the emptying of water or other fluid or weighting body to increase the power of rotary or other motion.—Patent abandoned.

834 J. COX, Gorgie Mills, Edinburgh. *Velocipedes.* Dated March 18, 1869.

The inventor proposes to attach levers by connecting rods to the cranks of the guide wheel, and fastens them to the shears, fork, or frame in which the wheel is fitted and revolves, so that all the propelling parts turn or revolve with the shears, and keep in proper position in relation to the wheel. According to the angle of inclination at which he places the driving levers, the motion of the feet of the rider is more or less perpendicular or horizontal.—Patent completed.

835 E. A. INGLEFIELD, Grove End-road, St. John's-wood. *Hydrostatic steering apparatus.* Dated March 19, 1869.

This consists in constructing and connecting a cylinder with the tiller in such a manner that for a single movement of the rudder several strokes of the piston of the cylinder are necessary, and thus the force resulting from the use of a moderately-sized cylinder during several strokes of its piston is accumulated so as to furnish the power required to move the rudder.—Patent completed.

836 J. THOMAS, Middlesborough-on-Tees, W. BACON, Newcastle-on-Tyne, and H. GROVES, Redcar. *Iron and steel.* Dated March 19, 1869

This consists in a new method or process for making refined iron, wrought iron, and also steel from melted metal run directly from the blast cupola or other furnace used for melting iron. The inventors refine the molten metal as it comes from the blast furnace, or the metal, if in pigs or casts crap, may be melted in a cupola, air furnace or any other furnace used for melting iron, and if the ground is practicable they prefer to build such furnace, which may be of any required capacity, at such a level that the metal may run direct from the blast or melting furnace into the air or refining furnace by gravitation, such air or refining furnace being contiguous or near to the blast or melting furnace. The refining furnace has a high crown, and on the top of the crown the inventors form a well, with one or more holes leading through the crown into the furnace. They heat the furnace up to the necessary heat for melting iron and fluxes, and they first melt the ores or oxides of iron with earths, alkalies, salts, or any other material used for cleansing or improving iron. When the fluxes are properly melted the inventors run or pour the molten metal into the well on the top of the crown, and let it run into the furnace through the holes.—Patent completed.

837 F. W. FOX, Bristol. *Railway engines and carriages.* Dated March 19, 1869.

The inventor connects the contiguous ends of the framework of the engines or carriages, or engine and carriages, combined by means of springs or elastic rings inserted in both or one of the outer frames at each side thereof. In the centre line of the engine and carriages, midway between the side connections, he passes a bolt or bolts through the two frames in such a manner that they can freely turn laterally upon such bolt or bolts, while the two frames, by this lateral connection, form practically one, admitting of no other relative motion beyond the lateral motion round the connecting bolt.—Patent completed.

838 A. ALBINI, Genoa. *Repeating firearms.* Dated March 19, 1869.

The inventor mounts the charge chamber on a tubular

axis fixed to an arm, which, when the cylinder is in position for firing, lies between the fore end of the cylinder and the back of the fore part of the frame. The lower end of the arm is jointed to the lower part of the frame at the side of the latter, so as to admit of the arm and cylinder being turned or swung out of the frame, in a vertical plane, at right angles to the axis of the barrel. In the tubular axis the inventor fits a rod, which carries the extractor and effects the locking and unlocking of the cylinder. This rod, which may be called the extractor rod, has a thumb plate or handle on its fore end, by means of which it can be slidden backwards and forwards within the tubular axis. A hole, of a diameter corresponding to that of the fore end of the extractor rod, is drilled in the fore part of the frame in a line with the axis of the cylinder, and communicates with a lateral slot cut in the frame, so as to allow the extractor rod to pass into and out of the hole, when the charge cylinder is turned on its hinge, that portion of the rod which comes opposite the slot when the rod is in its most forward position being cut away or reduced in diameter so as to allow the rod to pass through the slot.—Patent completed.

839 C. G. Bonehill, Birmingham. *Breech-loaders.* Dated March 19, 1869.

This relates to those kinds of breech-loading firearms in which the breech is opened for charging and closed for discharging by means of a block hinged to the side of the breech shoe. The invention consists in the arrangement or combination of parts for effecting the bolting down of the closing block by the fall of the hammer to discharge the gun. In the tail pin of the breech shoe of the gun is a sliding bolt pressed inwards or backwards by a coiled spring, so that its outer end lies flush with the said tail pin. The rear face of the closing block is furnished with a hole into which the said bolt can be shot. Projecting vertically from the bolt and working in a longitudinal slot in the tang of the tail pin is an arm, which arm carries at top a slide working upon the said tang. This slide covers the slot in which the vertical arm of the bolt works. On one side of the slide is an inclined projection. The hammer of the gun is provided with a shoulder, which, when the hammer falls to act upon the striker in the block, strikes against the projection described on the slide of the bolt. The bolt is thereby projected with the breech or closing block, and the latter bolted down firmly for discharge before the said hammer acts upon the striker.—Patent abandoned.

840 J. Jack, Liverpool. *Propelling vessels.* Dated March 19, 1869.

The inventor constructs that part of the ship immediately forward of the screw propeller of a form tapering towards the screw. By so doing a free entrance for water is provided, and to close in the tapered portion of the strip and the opening in which the propeller works the inventor employs a single or double slide or shutter operated from the deck. When the ship is under steam the slide or shutter is raised, and when under sail it is lowered.—Patent completed.

841 E. T. Hughes, Chancery-lane. *Scales.* (A communication.) Dated March 19, 1869.

This consists in combining parallel bars and vertical supporting rods for the table within a case the sides of which form the bearings of the parallel rods.—Patent abandoned.

842 S. Fox, Deepcar, near Sheffield. *Permanent way.* Dated March 19, 1869.

The inventor supports the ends of the rails where they are joined or connected to one another by a portion of rail placed beneath them, the two ends of such length of rail being hammered or flattened out so that they may rest upon the two sleepers between which the joint or connection of the rail occurs, and pass under the chairs which support the rail, and in order that the spikes which fasten the chairs to the sleepers may pass through the flattened out end portions of the rail.—Patent abandoned.

843 A. V. Newton, Chancery-lane. *Sewing machines.* (A communication.) Dated March 19, 1869.

The object is to provide an improved motive power for light running machines, and more particularly for sewing machines. The device is equally applicable to any of the known machines for sewing, giving the requisite motion and requiring only to be occasionally wound up, when it will furnish sufficient power to run the machine a certain length of time without further attention. The motive power mechanism consists of a series of gear wheels operated by means of springs, so arranged that the power exerted upon the machine to be driven will be uniform.—Patent completed.

844 W. R. Lake, Southampton-buildings. *Overshoes.* (A communication.) Dated March 19, 1869.

The construction of the improved shoe is peculiar so far as the upper is concerned. The sole and foxing are made in the manner commonly practised, and are secured to the cloth and vamp in the well understood way. The cloth which forms the upper is coated with india-rubber, which has been dissolved by any of the well known solvents. This thin solution is applied to the cloth by means of a knife in the manner in which rubber fabrics are usually coated by gum in solution.—Patent completed.

845 C. E. Brooman, Fleet-street. *Burning petroleum.* (A communication.) Dated March 19, 1869.

This consists in means for employing for heating purposes lighting apparatus, especially those fed by petroleum. The type apparatus consists of a long cylinder of iron or other material, having at its top a disc pierced with holes, in which the matters to be heated are placed. In the lower part of the cylinder the lamp is placed, and the products of combustion are carried off by a chimney of relatively small diameter, maintained by screws in the centre of the cylinder. Air is admitted by holes formed in the lower part of the apparatus. A spring coiled round a supporting rod tends to produce an improved movement of the support, and forces the case of the burner to press against the bottom of the chimney. A regulator and eyelet hole are provided. The above apparatus may be modified to serve for a great variety of purposes. More than one burner and chimney may be used when necessary.—Patent abandoned.

846 S. R. Wybrants, Dundee. *Textile fabrics.* Dated March 19, 1869.

This consists essentially in employing previously used materials, such as ropes of jute, hemp, flax, tow, cotton, wool, coir or manilla, or other material, for the manufacture of all kinds of bagging, sacking, coarse sheeting, and similar articles, for which rove yarns or heavy spun yarns have hitherto been or may be employed. The ropes may or may not be unstranded or broken up, and may be used as weft or warp without passing them over or through teasing or carding or roving machinery, but in some cases it may be advantageous to partly or wholly unstrand them for weaving, and the separate or combined strands may be reeled, warped, or formed into cops ready for weaving, and manufactured into cloth or other textile fabrics.—Patent completed.

847 J. Hamilton and R. Paterson, Glasgow. *Making aerated beverages.* Dated March 20, 1869.

The first part relates to apparatus for supplying carbonic acid gas to casks or other vessels containing beer or similar fermentable beverages, and, second, to collapsable vessels of a peculiar construction, for containing fermentable or aerated beverages.—Patent completed.

848 F. D. Nuttall, St. Helens, Lancaster. *Reverberatory furnaces.* Dated March 20, 1869.

This consists in constructing reverberatory furnaces with a combination of, first, a thin partition or wall formed at the back of the fuel chamber, so that there is left between the partition and the fire bridge an opening or passage, for the regulated admission of air upwards therethrough to commingle with the fuel gases and thereby promote combustion, and, second, an opening at the side or openings at both sides of the furnace, at or near the end or ends of the fire bridge, so that any deposit in or stoppage of the above-mentioned air passage may be easily reached and removed. The opening or openings is or are closed when the furnace is at work.—Patent completed.

849 J. D. Morrison, Grange-road, Edinburgh. *Heating and ventilating.* Dated March 20, 1869.

The grate, which is semi-circular in appearance between its pillars, and round from front to back, is composed of eleven principal parts, namely, a base, a channel chamber back, an outer semi-circular chamber, a chamber dome-top, an inner semi-circular chamber, a circular fire-grating, an ashpan, a fluted semi-circular fire-brick back, a semi-circular row of tube ribs placed vertically, and four quadrant doors and door guides.—Patent completed.

850 H. Whitehouse, Tipton, and W. Probert, Oldbury. *Tuyeres for blast furnaces.* Dated March 20, 1869.

The inventors take a piece of wrought iron or other tubing of a length about three times that of the tuyere to be made, and at or near the middle of this tube they bend it into nearly a complete circle, the side circle part being in a plane at right angles to the straight portions of the tube. The two unbent portions of the tube are parallel or nearly parallel. They place the bent tube described in a properly formed mould, and cast iron or other metal thereupon in the form of a conical or other shaped tuyere.—Patent completed.

851 F. Holmes, Hatcham-road, Surrey. *Blind pulleys.* Dated March 20, 1869.

To a piece of indiarubber the inventor secures a pulley by means of a collar or socket which clasps the same, and through which a pin or rivet is passed. This pulley has one of the bearings of its axis in an upright piece forming one piece with the collar, or being otherwise securely attached thereto, the other bearing of the pulley axis being on a piece which is free to move on the pulley axis, and has a catch which is fastened by means of the projecting end of the pin, which passes through the collar and the indiarubber as above stated.—Patent abandoned.

852 W. L. Wrey, United Service Institution, Whitehall. *Toothed gearing.* Dated March 20, 1869.

The inventor uses one toothed wheel of any ordinary or suitable form or construction, and to gear therewith he constructs another wheel which has two rings or circular frames, between which he arranges a number of rotating rollers or moving bars of any suitable form corresponding with the teeth of the wheel. As the teeth of the wheel take into the rollers or bars the same move on their axis, and thus, the action of the teeth being on a yielding and not on a rigid body, friction is reduced to a minimum.—Patent abandoned.

853 J. V. Robinson, Dublin. *Photo-negatives and raised surfaces.* Dated March 20, 1869.

This relates to the production of negatives for photographic printing, which is effected in the following manner:—Upon a plate of glass or other transparent material, the inventor deposits or affixes a layer or stratum of suitable metal (preferably of silver) or metallic alloy, or it may be a preparation of aniline or other suitable matter, upon which metallic or other surface a drawing may be made with pen or pencil. The lines of the drawing or design are then removed by means of a graver etching needle or other suitable instrument, or the drawing or design may be at once etched in without the aid of the first pen or pencil if desired. A plate is thus obtained from which the metal is removed in the parts representing lines in the drawing or subject, so as to admit light through the plate at those parts, and obstructing it wherever the metal deposit remains, thus producing what the inventor terms an etched negative.—Patent abandoned.

854 F. E. Duckham, Millwall. *Governors for marine engines.* Dated March 20, 1869.

One arrangement of this invention consists of a plunger or piston working in a cylinder, one end of which is open to the external water through an aperture in the side of the vessel. This cylinder is suitably disposed near the point of propulsion, so that when the screw or paddle near which it is placed is immersed, the piston will be also submerged. The piston rod is geared in any suitable manner with the steam through the valve, which is operated to admit the steam directly by the pressure of the external water on the piston or plunger, so that on the governor emerging from the water (which, consequently, ceases to exert any pressure on the piston) the steam will be cut off, a counterbalance being employed for the purpose if required.—Patent abandoned.

855 J. Kay, Glasgow. *Wind instrument.* Dated March 20, 1869.

This consists in forming the outer part of the flanch or that part which is applied to the lips of a curved form, the convexity of the curve being outwards. Curves of various forms, or a combination of curves, may be used in the same mouthpiece.—Patent completed.

856 H. E. Newton, Chancery-lane. *Measuring liquids.* (A communication.) Dated March 20, 1869.

An oscillating water-way is employed, arranged centrally between a double-chambered measuring vessel and the discharge orifice of a pipe, through which the liquid flows into the meter, and in combination therewith certain mechanism controlled by the alternate rise and descent of floats, applied within the measuring chambers to cause the water-way to oscillate, and turn the inflowing stream from one measuring chamber into another. Both measuring chambers are provided with outlets and valves, and these latter are connected to suitable apparatus in such a manner as to alternately open and shut their outlets, so that during the supply of liquid to one measuring chamber the liquid in the opposite chamber will be allowed to escape from it.—Patent completed.

857 H. E. Newton, Chancery-lane. *Motive power engine* (A communication.) Dated March 20, 1869.

This consists in the employment of a steam engine and an atmospheric engine combined, and relates to a new manner of utilising the heat force created in a steam boiler. The steam engine consists of a cylinder piston, piston rod, steam inlet pipe with valve, and steam and steam exhaust pipe.—Patent completed.

858 W. H. Phillips, Nunhead. *Water-fire machinery.* Dated March 22, 1869.

This consists of a chamber or reservoir for containing a supply of water or other liquid which is introduced through suitable passages. The chamber or reservoir is provided with means or apparatus, by means of which the space above the water in the chamber is charged with air or gas at a sufficient pressure to discharge the water from the chamber through a suitable outlet when a tap or valve is open.—Patent completed.

859 W. R. Lake, Southampton-buildings. *Hay-tedding machinery.* (A communication.) Dated March 22, 1869.

This consists primarily in such an organisation of the mechanism of rotary tedders as shall impart or cause to be imparted to each set of forks or teeth (arranged in an open rotary frame) a motion in excess of their relative motion, which acceleration of movement being given to them as they come into contact with the hay adds to the effectiveness of the forks or teeth in tossing or operating it.—Patent completed.

860 J. Booth, Birmingham. *Book indexes.* Dated March 22, 1869.

Instead of making the index of a series of leaves situated at the front of the ledger, each leaf being provided with one or more letters of the alphabet as usual, the inventor makes the index in the form of a long flap of calico or other flexible material attached or hinged to the inner side of the end board of the cover of the ledger and near the outer edge thereof. The flexible flap is covered on its upper side with paper ruled into a series of vertical columns, each column being provided with one, two, or more letters of the alphabet. The index flap is nearly of the width of the ledger with which it is used, but its length is varied according to the size of the ledger and the arrangement of the name columns.—Patent abandoned.

861 J. Loader, Upper Clifton-street, Worship-square. *Injectors.* Dated March 22, 1869.

The inventor employs a strong vessel in which a steam chamber pipe or pipes are coiled or otherwise arranged, one end of which is connected with the dome or steam space of the boiler, whilst the other is provided with a suitable valve. This vessel is also provided with suitable connections and valves, one of which leads into such vessel from the hot well or other supply, whilst the other leads from such vessel into the boiler.—Patent abandoned.

862 G. Lauder and G. Cope, Liverpool. *Tobacco twister.* Dated March 22, 1869.

To a pair of adjustable grooved pulleys revolving in the same plane, and so formed that there is left between them a circular opening or passage, the inventor imparts a double motion, viz., one on their own axis and another round the axis of a revolving disc on which they are carried. The first of these motions serves to shape the tobacco and propel it through between them, and the second to give the desired twist. The tobacco is fed by hand to the grooved pulleys to form a twisted core only, or it may be fed with the covering leaves laid on.—Patent abandoned.

863 T. Carrodus, Keighley. *Self-coupler for railway engines.* Dated March 22, 1869.

This consists of a self-acting tumbler or drop catch, or latch applied to each end of such carriages, and of a catch bar or latch plate also applied to each end of the carriages side by side with the catch or latch, and so placed that the catch or latch on one carriage will take into the catch bar or latch plate on another carriage, when two carriages are brought together, thus effecting a double coupling or connecting of two carriages.—Patent abandoned.

864 W. G. Crossley, Cambridge. *Wheels.* Dated March 22, 1869.

This consists in forming the nave of two plates or discs and a collar or ferrule, to which the central axle is secured by rivets or otherwise. The spokes are formed of separate pieces of hoop iron or steel, the inner ends of each of the spokes are looped by turning or folding the ends of the metal strips over and riveting them together, or a loop of metal is attached to the ends of the strips by rivets or otherwise.—Patent completed.

865 W. Crossley and J. W. Swithenbank, Bradford. *Shuttles.* Dated March 22, 1869.

This consists in constructing the spring in a single lap and inserting it in a vertical position in relation to the shuttle, so as to act on the end of the pike, by which the inventors avoid cutting any recess on the under side, or the use of the pins to secure it, whereby shuttles are much strengthened, and any oil used to lubricate the pike where the spring acts on it is prevented from dropping on the warp when the shuttle is in use.—Patent abandoned.

866 E. G. Reuss, Sheffield. *Table cutlery.* Dated March 22, 1869.

This consists in driving the tang of the knife or other instrument through the haft or handle, and riveting it at the other end, but several alterations are rendered necessary by the difference in the material of which the handles are constructed.—Patent abandoned.

867 H. Vansittart, Richmond. *Screw propellers.* Dated March 22, 1869.

This consists in adapting to the face or forward edge of any ordinary screw propeller a metal plate or plates of suitable form, and bent to the required curve according to the lines of the vessel and the proposed speed. This curved or waved line piece is placed straight or diagonally across the diameter of the leading side of the blade.—Patent abandoned.

868 J. Combe and J. Barbour, Belfast. *Rotary motion.* Dated March 22, 1869.

The inventors adapt to the machine to be driven what is known as White's improvement on Hooke's gearing. When the pressure endwise on the shaft caused by the angular setting of the teeth would be an objection, half the length of each tooth may be angled in one direction and the other half in the opposite, so that the pressures in the opposite directions will neutralise each other. Or, instead of the teeth being made angled to their axes, they may be divided into two or more sets, planes, or steps, with a lead, that is, the teeth of one plane or step being in line with the spaces between the teeth of the adjacent planes or steps, as in Hooke's gearing.—Patent completed.

869 M. Tildesley, Willenhall. *Door bolts.* Dated March 22, 1869.

This consists in performing both operations of bending or turning up and finishing by means of suitable dies in a stamp or under a steam hammer. These dies may both be formed upon one stamp or hammer, or separate stamps or hammers may be employed for each die, or the dies may be employed in a hydraulic or other powerful press. —Patent abandoned.

870 E. Stacey, Princes-street, Cavendish-square, and J. Thomson, Arthur-street, Peckham. *Purifying gas.* Dated March 22, 1869.

The inventors allow the tar and ammoniacal liquor to pass with the gas through the condenser, which he constructs with a series of horizontal pipes through which the gas passes above the tar and ammoniacal liquor, the temperature of the pipes being gradually diminished from the entrance to the exit end of the condenser. The gas, as it passes through the pipe, is gradually cooled, and the napthaline is absorbed therefrom by the tar instead of condensing in the main and service pipes.—Patent abandoned.

871 M. Sigler, Paterson, New Jersey. *Stretching warps.* Dated March 22, 1869.

This consists in the use of a series of rollers, fitted in a swinging frame, applied to the loom so as to receive and hang in the warp with such a degree of weight as may be best adapted to the fabric to be woven, the swinging frame being provided with an adjustment, by which the weight upon the warp may be increased or diminished at the pleasure of the attendant.—Patent completed.

872 J. J. Hicks, Hatton Garden. *Glass stoppers.* Dated March 22, 1869.

The inventor forms a stopper of glass, earthenware, vulcanite, or other suitable material in any desired colour by blowing, moulding, or other well-known means, and he forms from the lower end of such stopper to a certain distance up the side thereof, any desired number of grooves or cuts. The neck of the bottle is lined with cork, as is now well understood.—Patent abandoned.

873 J. E. Emerson, Trenton, New Jersey. *Rocking chairs.* Dated March 22, 1869.

This consists chiefly in the application to the chair, between the seat and the supporting stand or legs, of a spring, which allows the seat and upper portion of the chair to rock or oscillate freely upon an axis or centre below the seat, but which, by its resistance to expansion and contraction, confirms the motion of the chair within proper limits in either direction.—Patent completed.

874 G. T. Bousfield, Brixton. *Felting cloths.* (A communication.) Dated March 22, 1869.

This consists in improvements in jiggering machines for continuously hardening and felting felt cloths. The invention consists, first, in the arrangement and combination of an intermittently moving horizontal felting cylinder, with an intermittently moving conductor or hardening cloth and a horizontal concave jiggering apparatus. Second, in improvements in jiggering machines, in which the material is fed upon a carrying cloth between a flat-surfaced jigger and a platten.—Patent completed.

875 A. Clark, Rathbone-place. *Mixing paints.* (A communication.) Dated March 22, 1869.

This consists, first, in combining with a pan, tub, or other suitable holding vessel, revolving horizontally on its support, a rubbing or mixing apparatus, which turns about its support within or over the pan, tub, or other holder, so that the united movements of the pan or holder and of the rubber or mixers will form or resemble a series of circular lines, that cut or cross each other after the manner of lathe work or engine turning, as it is termed. —Patent completed.

876 J. Nicol, Stirling. *Envelopes.* Dated March 23, 1869.

This consists in cutting the closing flap with a lateral security extension, which, when the flap is closed down, can be turned over upon the address side of the envelope, at the corner usually occupied by the postage stamp.—Patent abandoned.

877 R. Gregson, Wigan. *Furnace firebars.* Dated March 23, 1869.

This consists in making endless travelling firebars with their upper surface alternately plain, and with a curved notch. The inventor is thus enabled to bring the lower edge of the suspended bridge in such a furnace nearer to the surface of the firebars, and at the same time allow the clinkers to pass under the bridge in the notches or hollow parts of the surface of the firebars, and thus prevent the accumulation of clinkers in the front of the bridge.—Patent abandoned.

878 G. Blanche, Paris. *Pocket guard.* Dated March 23, 1869.

The inventor employs a ring or other analogous device with an opening cut therein, or a piece of wire or metal curved so that its two ends nearly meet, leaving a similar space or opening to allow a portion of the clothing, whether the interior of the pocket, the lining thereof, or any other part of the apparel, to be inserted within such opening, and by means of a screw or screws upon the ends, or acting upon them. He closes this aperture upon the folds of the dress portion of the pocket or other part of the apparel within the opening or vacant space between the ends of the curved wire or piece of metal.—Patent abandoned.

879 C. Longfield, Birmingham. *Cramps.* Dated March 23, 1869.

The cramp is constructed in the form or shape represented on the drawings annexed to the published specification, and is made of iron or other suitable material of sufficient strength.—Patent completed.

880 J. Macintosh, North Barrack, Regent's Park. *Boots and shoes.* Dated March 23, 1869.

The inventor makes a vertical cut down each side of the boot or shoe to the depth of about 5in., and introduces four or five fillets transversely across the opening between the leather and the lining.—Patent completed.

881 L. A. Israel, Crescent, Minories. *Sulphuric acid.* Dated March 23, 1869.

This consists in manufacturing sulphuric acid in a chamber by means of a rotary or disturbing motion in combination with water, and by such means absorbing the gases generated; also in concentrating sulphuric acid and acids generally by the means and application of superheated steam.—Patent completed.

882 C. de Bergue, Strand. *Punching holes.* Dated March 23, 1869.

This consists in a mode or modes of making holes in metal by punching, by so mechanically feeding, grinding, or controlling the work, or presenting it to the action of the punch or punches as to obtain a regular or other accurate pitch or distance between the holes when punched, and at the same time to ensure a proper determined distance of the holes from the edge or edges of the work.—Patent abandoned.

883 J. Fryer, Redcar. *Rotary cultivator.* Dated March 23, 1869.

This consists in constructing cultivators having a series of diggers or blades arranged on a shaft or axle in such manner that, by means of suitable pins projecting from the wheels carrying the machine, such wheels, one or both of them, may by their onward motion be made to drive the shaft or axle holding such diggers or blades at a velocity quicker than the revolution of the carrying wheels when in movement.—Patent abandoned.

884 J. H. Johnson, Lincoln's Inn-fields. *Artificial stone blocks.* (A communication.) Dated March 23, 1869.

This relates to improvements in the artificial stone blocks known as "Beton agglomire," and consists in facing those parts of such blocks as are most liable to become worn or injured when in use with cast iron or steel projecting plates, whereby the durability of such blocks is greatly increased.—Patent completed.

885 F. Rudrum, Norwich. *Velocipedes.* Dated March 23 1869.

The velocipede is provided with a (compound or double) hind wheel, the parts of which can, when desired, be caused to separate and slide apart on the axle so as to form two wheels; the inventor arranges forked levers and gearing between the seat and this compound double wheel. The parts of this wheel are drawn together by a rack or other suitable arrangement when required, and can be held together until it is desired to separate them. This shifting gearing is worked by the handle of the guiding wheel.—Patent abandoned.

886 J. Horsley, Cheltenham. *Protecting nitro-glycerine.* Dated March 23, 1869.

For the purpose of protecting nitro-glycerine the inventor uses freshly powdered common alum (aluminous sulphate of potash or ammonia) or Epsom salts (sulphate or magnesia) containing the full complement of water of crystallisation, that is, undried or unexsiccated. Either of these earthy salts will answer, but preference is given to the alum, which is reduced to an extremely fine powder, and after passing it through a brass wire sieve of from 90 to 100 or 120 holes per linear inch (the finer the better), the inventor takes (say) 16oz. of the powder, and incorporates therewith in an open dish 4 fluid ounces (equal to 5½oz. or nearly 6oz. by weight) of nitro-glycerine, stirring the ingredients well first with a bone or wooden spatula till the oil or nitro-glycerine is absorbed, and finishing the operation with the hand or other suitable means so as to get it thoroughly blended.—Patent completed.

887 F. de Bowens, Philadelphia. *Match splints.* Dated March 23, 1869.

This consists in cutting match sticks and other similar short sticks from blocks of wood secured to a large rotating wheel. Also in the shape of the cutting knives and the arrangement of the cuts, the operation of the mechanism for giving motion to the knives, and the mode of depositing the sticks in the dipping frames as they fall from the knives.—Patent completed.

888 M. F. Maury, Gloucester-place, Dorset-square. *Heating by electricity.* Dated March 24, 1869.

This consists of a chain or coil composed or made up of alternate obstructions and free conductors, arranged in any compact form and properly insulated, and in applying it the inventor proposes to use any kind of electricity which might be best adapted for the particular application of it.—Patent abandoned.

889 J. B. Fell, Spark-bridge, Lancashire. *Locomotives.* Dated March 24, 1869.

This consists of an arrangement or arrangements for putting pressure on the gripping wheels of centre-rail locomotives. The right and left-handed screw shaft passing through the compressing beams is arranged so that by its means and that of the volute springs interposed between the beams and the cradles, the pressure is put on the horizontal wheels. A worm wheel is used for turning the shaft, which is worked by a worm and shaft from the foot plate of the engine. Blocks are attached by pins or trunnions to the compression beams, the object of which is to allow those beams slightly to swivel and take an oblique position, and thus to follow any similar movement in the cradles when the engine is passing round sharp curves. In this manner, the additional strains to which the compression beams and screw shaft might be subjected from the above cause may be avoided.—Patent completed.

890 R. W. Page, South Molton-street, W. *Garden re engines.* Dated March 24, 1869.

The engine consists of a water cylinder surrounded by or in communication with an air chamber supported by a foot and base plate resting on the ground, water being admitted at the top of the cylinder and discharged therefrom at the bottom.—Patent completed.

891 W. Harrison, King Edward-street, E.C. *Head sunshade.* (A communication.) Dated March 24, 1869.

The improved shade is composed of a round or oval piece of textile or other suitable material, in the centre of which is formed a circular or oval opening of sufficient size to give passage to the body of the hat. The edge of this opening is surrounded by an elastic band or binding by the tension of which the shade is maintained in position on the hat, and from this band radiates a series of stretchers composed of whalebone, cane, steel, or other suitable flexible material.—Patent abandoned.

892 C. M'Dermott, Edge Hill, Liverpool. *Eyelets and paper fasteners.* Dated March 24, 1869.

This consists of three parts, which are denominated, first, the base; second, the prong; third, the plunger. The base is the foot or that part upon which the press is built. The prong is a round piece of steel riveted to the base and projecting upwards. The plunger is a piece of rounded metal about 6in. in length and ⅜in. in diameter, having a flattened head piece suitable to the application of pressure by the palm of the hand.—Patent abandoned.

893 F. J. Manceaux, Paris. *Firearms.* Dated March 24, 1869.

This relates to a previous patent granted to the same inventor dated March 30, 1867 (No. 962.) The present invention consists in fitting the barrels between plates which stretch across from one side to the other, and connected to side plates or straps by means of screws or otherwise. The side plates are carried on trunnions and are held in place by screw nuts. The trunnions enable the apparatus to be mounted upon a carriage so that it can be used in field operations. The rear ends of the side plates are of greater thickness, the thicker parts being slotted on the under side for the plates of the breech-closer to work in as hereafter described. These plates are centred upon pins, one of the ends of each of which has screw nuts on it. The pins are prevented working loose by means of tappets.—Patent completed.

894 V. Chemery, Sedan, France. *Damping and pressing cloth.* Dated March 24, 1869.

The apparatus is composed of two pipes or tubes, one placed within the other, a space being formed between them. The inner one is perforated with holes, preferably at the lower part, and is furnished with washers or distancing plates upon which the outer tube rests. The steam which passes through the perforations is distributed over the entire inner surface of the other tube.—Patent abandoned.

895 The abstract of this specification will appear in a future number.

896 W. E. Newton, Chancery-lane. *Working heavy guns* (A communication.) Dated March 24, 1869.

This consists in using an air cylinder in connection with the levers for upholding the gun, so that air, when in its natural density, may be compressed in the cylinder by the force of the recoil of the gun acting on a plunger or piston which moves in the cylinder, and by retaining this air while thus compressed the power developed by the recoil is stored up, and may be released at the will of the operator.—Patent completed.

897 A. Clayton, Southampton. *Firearms.* Dated March 24, 1869.

This consists, first, in an arrangement of the parts whereby the ordinary lock mechanism is dispensed with. The barrel of the gun is connected with the body by means of lumps, in which an axis or screw parallel to the axis of the barrel is supported and works, the opening of the breech being effected by turning aside the body from the barrel upon the said axis or screw. The nipple is fixed to receive the percussion cap on the side of the barrel, and a long spring, carrying at its free end the hammer, is fixed at its other end to the side of the barrel, the hammer on the free end of the spring pressing on the nipple. A curved lever is jointed to the side of the body, the lower end of the said lever constituting the trigger.—Patent abandoned.

898 T. Shakespear and G. Illston, Birmingham. *Sewing machines.* Dated March 24, 1869.

At or near the end of the principal shaft of the sewing machine the inventors fix a wheel, which receives a rotary motion from the said shaft. A vibrating arm or lever, working in a plane parallel to that in which the said wheel works, is geared to the said wheel by means of a connecting rod connected to the face of the wheel by a crank pin. The connecting rod and arm give motion to a rocking shaft working in the upright or frame supporting the feed plate of the machine. The other end of the rocking shaft carries another arm or lever, the upper end of which is geared to the shuttle carrier by means of a connecting rod jointed to the end of the said lever and to the said shuttle carrier. When the machine is worked, the wheel on the principal shaft communicates a reciprocating motion to the first-named vibrating arm or lever, which motion is transmitted by the rocking shaft to the other arm or lever, and through it and the connecting rod to the shuttle carrier.—Patent completed.

899 C. B. Parkinson, W. H. Heald, and A. and J. Metcalf, Preston. *Spinning mules.* Dated March 24, 1869.

The machine consists of the ordinary carriage chain and rope barrel. The chain, which in some instances instead of hooking on to the nut worked by the screw in the quadrant radius arm is passed over a pulley, down over another pulley (which in some instances is not required), over an eccentric, and the end secured on the eccentric. On the side of this eccentric is a pulley, on which is secured the end of the chain, which comes round and under to stud on to the side and near the bottom of the radius rail. On the upper part of this radius rail is fixed a lever, to the end of which is worked one end of a connecting rod, the other end of which is connected to the carriage.—Patent completed.

900 F. Baker, Kennington. *Locking signal levers.* Dated March 24, 1869.

The shafts or pivots on which the various hooks or catches, stops, and actuating cranks work are arranged in suitable diagonal frames or supports, placed at the same or nearly the same angle or inclination as the levers when pulled over.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated October 5, 1869.

2880 C. Montagu, Cannon-street, City. An improvement in umbrellas, parasols, and sunshades.

2881 T. Atkinson, Hull. Improvements in machinery or apparatus for expressing oil, and for the manufacture of cake from the residue thereof.

2882 W. Horsfall, New York, U.S. Improvements in machinery for forging bolts, screws, and spikes.

2883 J. N. Batey, Landport, Hants. Improvements in hammers for sewing machines.

2884 J. Winter, Wardour-street, Soho, Middlesex. Improved apparatus for filling glass bottles and jars with soups, jellies, fruits, and other edibles, for the purpose of preserving them with the said apparatus, being also applicable for filling bottles with sauces, wines, spirits, beer, liqueurs, and other still and effervescing beverages; also machinery in combination with the above apparatus for corking or stoppering such said bottles and jars.

2885 F. Hazeldine, Lant-street, Borough, Surrey. An improved corkscrew adapted for gaseous and aerated liquids.

2886 W. Morris, Triangle, Halifax, and J. Teal, Sowerby, Halifax. Improvements in machinery to be employed for combing wool.

2887 L. Byrne, Birmingham. A new or improved construction of pump for domestic, horticultural, and other useful purposes.

2888 H. Howard-Keeling, King and Queen Ironworks, Rotherhithe, Surrey. Improvements in manufacturing bars or links of wrought iron or other metal used in the construction of suspension or girder bridges, and for other purposes.

2889 T. W. Bunning, Newcastle-upon-Tyne, and W. Cochrane, Oakfield House, Coxlodge, Northumberland. Improvements in apparatus used in getting coal, stone, and other minerals.

2890 J Kircher, Cannstadt, Wurtemberg, and E. Ebner, Stuttgard, Wurtemberg. An improved black printing ink capable of being removed from paper.

2891 J. Kircher, Cannstadt, Wurtemberg, and E. Ebner, Stuttgard, Wurtemberg. An improved mode of removing print from paper.

2892 E. Smethurst, Stockport, Cheshire. Improvements in funnels or funnel measures for the measuring and pouring of liquids into vessels.

2893 T. Adams, Laurel-grove, Penge, Surrey. Improvements in the slide valves and pistons of steam and other engines.

2894 J. Clayton, Preston, Lancashire. Improvements in the construction of boilers for generating steam.

2895 W. Richardson, Oldham. Improvements in machinery for burring or cleaning wool, cotton, and other fibrous materials.

2896 C. E. Spooner, Bron-y-Garth, Port Madoc, Carnarvonshire. Improved machinery for bending rails or bars for railways or other purposes.

Dated October 6, 1869.

2897 S. Farron, Ashton-under-Lyne. Improvements in the construction of cocks or taps.

2898 E. Wigzell and J. Pollit, Sowerby Bridge, near Halifax. Improvements in metallic pistons for steam engines, and in the manufacture thereof.

2899 W. A. Whitty, Strand. An improved advertising medium.

2900 J. W. Powell, East lane, Bermondsey, Surrey. An improved valve cock.

2901 B. Hunt, Serle-street, Lincoln's Inn. Improvements in the decoration or ornamentation of metals.

2902 H. and A. Holmes, Derby. Improvements in axletrees for carriages and other vehicles.

2903 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the permanent way of railways.

2904 E. Russ and H. and E. Hammond, Winchester, Hants. Improvements in breech-loading firearms.

2905 T. F. Newell, Cloak-lane, City. Improvements in rag engines for the preparation of paper pulp.

2906 E. A. Pontifex, Shoe-lane, City. Improvements in refrigerators for cooling worts and other liquids.

2907 E. Tyer, Old Jewry Chambers, City. Improvements in electro-magnetic telegraphic apparatus for train signalling on railways, part of which apparatus may be employed for other useful purposes.

2908 W. H. Horsley, Waltham-street, Hull. Improvements in washing machines.

2909 E. B. de Leon, Boulevart Bonne Nouvelle, Paris. Printing without heat upon wood used for cases, bars, or heads of casks and packages of all kinds, any mark, countermark, inscription or drawing in relief, in sunken or in surface impression, in one or several varied colours as well as in gold and silver, for trade purposes generally, and particularly for the wine and spirit trade, in lieu and place of the marking obtained by hot brand and open vignettes.

2910 W. E. Newton, Chancery-lane. Improvements in the permanent way of railways and tramways.

2911 J. F. M. Pollock, Leopold-street, New Leeds, Leeds. Improvements in machinery for making bricks and other similar articles.

Dated October 7, 1869.

2912 J. M'Kenzie, Glasgow. An improved method of jointing, fastening, and securing rails in railway chairs.

2913 A. Coleman, St. Mary-at-Hill, Middlesex, and W. Coleman, Whitefield, Heaton Norris, Lancashire. Improvements in latches or locks applicable especially to railway carriage doors.

2914 J. C. Ramsden, Bradford, Yorkshire. Improvements in looms for weaving.

2915 H. Schildberg, Westminster Chambers, Victoria-street, Middlesex. Improved signalling apparatus for use in private or public buildings.

2916 W. E. Newton, Chancery-lane. An improved form of wheel for propelling ships, and applicable also to pumps for raising or forcing water.

2917 W. P. Gregg, Boston, Massachusetts, U.S.A. Invention having reference to parlour or roller skates.

Dated October 8, 1869.

2918 R. Chapman, Shrewsbury, Salop. Improvements in the construction and mode of fastening railway fish-plates and chairs.

2919 D. Parrish, Threadneedle-street, City. Improvements in axle boxes.

2920 J. Hilton, Albert-road Ironworks, Farnworth, Lancashire. Improvements in casting socket and flanged pipes.

2921 J. Duckworth, T. Hindle, and G. B. Jerram, Liverpool. Improvements in the construction of concrete and cement buildings, structures, and articles, and in apparatus to be employed therein.

2922 G. W. Hawksley and M. Wild, Brightside Boiler Works, Sheffield. Improvements in the construction of steam boilers.

2923 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in pedals and damping apparatus for pianofortes and other similar instruments.

2924 T. Rice, Bath-street, City-road, Middlesex. Improvements in fixing door knobs or handles on to the spindles of door locks.

2925 A. Etienne, Charlotte-street, Fitzroy-square, Middlesex. Improvements in the construction of carriages, vehicles, and velocipedes.

2926 O. C. Evans, Upper Grange-road, Bermondsey, Surrey. Improvements in wheels for vehicles and other purposes.

2927 N. Wilson, High Holborn, and W. Campion, Nottingham. Improvements in sewing machines.

2928 H. Wainwright, Rue Gaillon, Paris. Improved apparatus for distilling and producing fresh potable water.

2929 J. Fearson, Birmingham. Improvements in water tuyeres for forges and furnaces, and in apparatus connected therewith.

2930 J. Wallace, College-square, East Belfast. The distilling of alcoholic liquors.

2931 W. J. Jones, King-street, Cheapside, City. Improvements in the construction of hot water boilers.

Dated October 9, 1869.

2932 C. E. Brooman, Fleet-street, City, patent agent. Improvements in liquid meters or apparatus for measuring the flow of liquids. (A communication.)

2933 J. Chandler, Cottage-grove, Mile End-road, Middlesex. Improvements in apparatus for drawing and preventing waste of water from pipes, mains, cisterns, or other sources, for domestic or other purposes, also for waterclosets, &c.

2934 J. More, Lee, Kent. Improvements in the preparation of oils for painting or other purposes.

2935 R. L. Hickes, Liverpool-street, Old Broad-street, Middlesex. Improvements in the modes or methods of applying electricity to obtain motive power, and for other useful purposes.

2936 W. Kelsey, Cannon-street, City. Improvements in driving drums or pulleys and railway wheels.

2937 D. Sowden, R. C. Stephenson, and J. Myers, Bradford, Yorkshire. Improvements in looms for weaving.

2938 B. Baugh and B. Walters, Birmingham. Improvements in ornamenting bricks, building blocks, and roofing and other tiles.

2939 J. H. Johnson, Lincoln's Inn-fields. Improvements in nail-making machines.

2940 H. Reid, Herne Bay, Kent. Improvements in the treatment and preparation of clays for the manufacture of Portland and other cements.

2941 W. N. Hartley, Litchfield, Staffordshire. Improvements in whitening or bleaching yarns, fabrics, and fibrous substances.

2942 A. H. Brandon, Rue Gaillon, Paris. Improved means of locomotion or summer skate.

2943 E. H. C. Monckton, Oriental Bank Corporation, Threadneedle-street, City. Improvements in railways, in motive and locomotive power.

2944 E. H. C. Monckton, Oriental Bank Corporation, Threadneedle-street, City. Improvements in guns, cartridges, and projectiles.

2945 A. M. Clark, Chancery-lane. Improvements in high and low water level indicators for steam boilers.

2946 W. C. May, Sanders'-terrace, Chobham-road, Stratford, Essex. Improved non-oleaginous printing inks and non-oleaginous printing varnishes.

2947 C. Wyndham, Southover, near Lewes, Sussex. Improvements in wheeled vehicles commonly known as velocipedes.

2948 J. H. W. Biggs, Manchester. Improvements in machinery for joining warp ends.

2949 A. Welch, Southall, Middlesex. Improvements in cattle trucks.

Dated October 11, 1869.

2950 A. C. Kirk, Glasgow. Improvements in treating mineral oils.

2951 G. A. Middlemiss, Sunderland, Durham. An improvement in withdrawing water or other fluids in as pure a condition as possible from wells, cisterns, and other places where the water or other fluid is mixed with foreign matter; also to prevent the choking up of the pumps and other instruments usually used for drawing off water and other fluids.

2952 J. Huggett, Terminus-road, Eastbourne, Sussex, and J. A. Huggett, Union-grove, Clapham, Surrey. Improvements in the manufacture of nails, and in apparatus employed in such manufacture.

2953 E. A. Cowper, Great George-street, Westminster. Improvements in treating cast iron for the production of wrought iron and steel therefrom, and in apparatus employed for that purpose.

2954 A. V. Newton, Chancery-lane. An improved mode of, and apparatus for, manufacturing paper hangings.

2955 T. Greenwood, Leeds, and J. Keats, Leek, Staffordshire. Improvements in the manufacture of boots and shoes, and in machinery to be used therein.

2956 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the construction of land cultivators.

2957 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the permanent way of railways.

LIST OF SEALED PATENTS.

Sealed October 9, 1869.

1132 R. E. and C. Marshall
1133 W. Gillespie
1137 F. Erskine
1141 E. Dowling
1145 W. H. and T. Hacking and J. Chambers
1152 J. H. Johnson
1163 E. Cooper
1169 J. H. Johnson
1170 W. J. Cowlman and A. Doe
1171 A. K. Rider
1172 F. Mulliner
1177 S. Harrison
1190 T. Page
1212 G. Green
1224 M. Henry
1232 J. H. A. Bleckmann
1275 O. Engholm
1281 I. Farrell and W. Turner
1338 R. Ward
1339 E. Tutte
1361 P. Southern
1363 E. and E. Thomas and J. Morris
1373 A. V. Newton
1374 W. E. Newton
1486 J. H. Johnson
1490 I. M. Milbank
1534 R. E. Keen
1566 J. P. Nolan
1683 H. Holdrege
1735 G. E. King
1749 J. and S. W. Varley
1824 D. Fitzgerald
1825 P. Jensen
1865 J. H. Johnson
1892 R. Olpherts
1930 R. Olpherts
2001 W. Frazer
2087 W. R. Lake
2090 W. R. Lake
2102 W. R. Lake
2118 J. A. Horlick
2119 J. A. Horlick
2358 W. Manwaring
2409 J. H. Johnson
2438 T. Ward and W. S. Black
2449 J. Lawson and E. G. Fitton
2477 W. Campion
2501 J. Baur
2528 W. R. Lake

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," October 12, 1869.

1636 T. Bradford
1645 G. J. Pedley and H. Grabowski
1676 R. Mathers
1679 D. Evans
1690 J. Warhurst
1693 C. F. Waldo
1696 R. B. Cooley
1698 J. Urbain
1699 A. Watt and T. Knowles
1700 G. V. Turnbull, C. Salvesen, and R. Irvine
1705 F. R. A. Glover
1706 H. Larkin and W. White
1716 J. Stewart and T. Charlton
1718 J. and R. Tatham
1722 J. C. Norman
1733 R. B. Plum and R. George
1736 J. Blomfield
1737 T. Wilkins and W. Fisk
1744 F. H. Holmes
1747 H. Kinsey
1750 W. B. Leachman
1753 G. A. Frebault
1758 F. Heckner
1774 W. E. Gedge
1782 A. St. C. Radisson
1806 J. Hill
1813 C. Mather
1814 W. R. Lake
1823 W. R. Lake
2011 A. Angell
2089 W. R. Lake
2144 W. Hosack
2145 W. Hosack
2375 J. Stanier, S. Dawson, and E. Davies
2450 T. J. Leigh
2472 J. Watson
2523 C. Mackay and T. K. Wheeler
2534 H. P. Stephenson, E. G. Bartholomew, and R. King
2551 J. Ritchie
2651 D. J. Williams
2699 C. Mohr and S. E. Smith
2724 J. G. Willans
2728 S. A. Varley
2738 C. E. Schoeller

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2566 J. C. Chapman
2571 G. Gordon
2591 W. E. Newton
2601 M. Mirfield and J. Scott
2607 T. Outram
2608 W. Dudgeon
2609 C. J. Hill
2613 G. Pitt
2630 A. V. Newton
2645 E. Beanes
2653 E. M. Boxer
2654 W. Rossetter
2720 J. G. Tongue
3389 J. Rodgers

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2710 H. D. P. Cunningham
2762 F. G. Grice
2735 J. Lowe and J. Harris
2818 J. Tangye

LIST OF SPECIFICATIONS PUBLISHED

For the week ending October 9, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
501	1 0	540	0 10	586	0 6	632	0 4	648	0 4	664	0 4
518	1 0	543	0 6	594	1 4	636	0 4	653	0 4	665	0 4
521	0 10	545	0 6	602	0 8	637	0 4	655	0 4	685	0 4
522	0 10	547	1 6	621	0 4	638	0 4	661	0 4	699	0 4
530	0 10	558	1 10	624	0 4	639	0 6	662	0 4	730	0 8
532	0 8	567	0 10	627	0 4	642	0 4	663	0 4	944	0 8

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1645	2629	2724	2747	2762	2786	2802	2824
1718	2638	2727	2748	2764	2788	2804	2826
2442	2677	2729	2750	2766	2790	2808	2828
2480	2695	2731	2752	2770	2792	2812	2830
2531	2709	2740	2754	2774	2794	2816	2832
2534	2716	2741	2756	2776	2796	2818	2834
2546	2719	2742	2758	2780	2798	2820	2859
2621	2720	2746	2760	2782	2800		

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, OCTOBER 22, 1869.

THE GOLD AND SILVER COINS OF ENGLAND.

AS there still appears to be much misconception existing in respect to the coinage question, and comparatively few persons are acquainted with the precise system upon which our metallic currency is based, we purpose furnishing a few facts which may help to elucidate the subject. From the tenor of many of the letters which have recently appeared in the journals of the day in reference to the gold coinage it might be and indeed has been inferred that the Mint is in the habit of receiving gold from all and sundry who choose to take it there, and of giving in exchange for it sovereigns, weight for weight, and free of all cost to the importers. This arrangement is really in accordance with the coinage laws of the United Kingdom, but in practice it is seldom or never carried out. Nearly forty years have elapsed since the Mint has dealt in this way with private importers of bullion, and the last of these were the Messrs. Rothschild. Successful golddiggers and others on their arrival in this country laden with nuggets and auriferous dust find their way to bullion dealers, who purchase the precious material at an estimated price, refine it, and sell it to the Bank of England. The market price of standard gold is £3 17s. 9d. per oz., and what is termed the Mint price £3 17s. 10½d. per oz. The Bank therefore makes an apparent profit of 1½d. per oz. upon all the gold which it sends to the Mint for conversion into coin. It further enjoys the privilege of sending into that place as much as it pleases and whenever it likes.

The Mint is thus, so far as gold is concerned, a manufacturing branch of the Bank of England, and its presses are active or idle as the latter may desire. The Bank pays nothing whatever to the Mint for the use of its machinery or otherwise, and the expense of maintaining it is borne wholly by the State. The Bank thus represents all the sellers of gold, and enjoys the advantages which the law theoretically grants to them.

It is not necessary to explain the precise method pursued by the Bank and the Mint in the transfer of the metal and coin from one to the other, but the transactions are always on a large scale. It is seldom indeed that the Mint is required to coin less than a million of sovereigns off hand, and generally five or six millions are wanted.* The form in which the material is sent into the Mint, almost invariably, is that of ingots. These weigh each 200oz., and are 8in. long, 3in. broad, and 1in. thick, the value of such a wedge being nearly £800. One hundred of these are technically termed "an importation." After being duly assayed and reported upon as to fineness, the ingots are cast into bars for coinage. These latter are rolled, cut, annealed, blanched, and otherwise dealt with until they are converted into sovereigns or half sovereigns, as may be desired by the Bank.

We now arrive at a stage in the history of the sovereign which is highly interesting. The law demands that, theoretically at least, the weight of each coin shall be precisely 123·2744 grains. Practically this is an impossibility. The most perfect machinery in the world cannot be made to accomplish the desideratum unless at a cost so great as to be entirely inadmissible. Pieces of gold rolled and cut with mathematical precision, and so that no micrometer gauge, however delicate, would detect differences of size, will yet be found to differ in weight when placed in the fine balances of the Mint. The truth is, that uniform density or homogeneity in the metal cannot be attained to, and without uniformity the weight of individual coins must vary. The law recognises the fact, and propounds a remedy for the evil. The remedy is a legal allowance above and below the true standard. This amounts to 12 grains on each pound weight (troy) of sovereigns or half sovereigns coined, whether over or under the standard. The Mint endeavours to balance the difference on either side, and, on large quantities, to give standard results. Thus, a thousand sovereigns weighed collectively would be found to be of the true standard weight which the law demands, although not more than one hundred tested individually would be found to weigh precisely 123·2744 grains. The remedy legally allowed on each sovereign is ·256 grains, say a quarter of a grain, or one halfpenny worth of standard gold. The legal maximum weight, therefore, at which a sovereign may pass from the Mint for circulation is 123·531 grains, and the legal minimum weight 123·017 grains. For the half sovereign the legal maximum weight is 61·765 grains, the legal minimum weight 61·508 grains, and the remedy ·128 grains. Out of these limits it is not possible for any gold coin to escape, being returned to the Mint crucibles, and it is not too much to say that since automatic weighing was introduced in 1851 into the Mint, not a single "too heavy" or "too light" sovereign or half sovereign has left the Mint gates. Before following a batch of carefully sized sovereigns out of the Mint, let us examine what Mr. Lowe's improved (?) system would do with the coinage within its walls. That gentleman proposes to reduce the theoretical weight of each sovereign by 1 grain and therefore to make it 122·2744 grains, or twopence less in actual value than at present. He cannot interfere with the "remedy." That is already low enough for all practical purposes, and high enough for the public security.

The allowance for fallibility of workmanship, as it is termed in legal parlance, of 12 grains on the 1lb. troy will still, therefore, remain intact; but since 40lbs. weight of gold by the Lowe proposition will be cut into 1,884, instead of 1,869 sovereigns, as at present, the 12 grains of allowance must be equally distributed over the larger number of pieces. Individually, therefore, the remedy will be slightly less, though collectively the same. Thus the practical difficulty and cost of coining will be increased, for every diminution of the remedy, however trifling, ensures an increase of the percentage of rejected coins to be returned to the furnace. Of the diminished value of the coins when issued, and the inconveniences which would arise from that circumstance, it is not necessary again to speak, except to say that every coin would be actually twopence less in value than those now issued from the Mint, and that it would be taken for what it is worth and no more. In order to the complete understanding of Mint operations, so far as the weights of gold coins are concerned, we shall here furnish a table, which from foregoing explanations will be readily comprehended:—

MINT WEIGHTS OF GOLD COINS.

Denomination of Coin.	Standard weight.	Legal remedy.	Legal maximum weight.	Legal minimum weight.	Weight at which coins cease to be a legal tender.
	gr. prts.	gr. prts.	gr. prts.	gr. prts.	gr. prts.
Sovereign...	123·274	0·256	123·531	123·0·7	122·500
½-Sovereign	61·637	0·128	61·765	61·508	61·125

Under the Chancellor of the Exchequer's proposed arrangement, these figures would be reduced in the proportion of one grain in the sovereign and one half grain in the half sovereign, and both coins would therefore be issued from the Mint at a weight sensibly below that at which they now cease to be a legal tender. In addition to this most serious consideration, there must be taken into account the fact that the process of deterioration commences with the gold currency as soon as it passes from the Bank of England. When a sovereign emerges from that palace and mixes freely with the people, degeneration surely follows the act. Abrasion and attrition commence their baleful work at once. If the sovereign does not lose in authority, it quickly loses in weight. The eye of the law is upon the traveller, and bankers' balances reveal the growing weakness of his constitution. At a certain stage of declension, the axe falls, his circulation ceases, and the victim is relegated to the crucible! The fell moment legally arrives when the weight of the piece is less by ·774 or (say) three-quarters of a grain than the theoretical standard. Such a coin would, at this point, be worth a halfpenny more than the Lowe sovereign when newly minted, and twopence more than a worn-out specimen of that coin. In short, the latter would begin life as mere tokens of value, and end it as they began. To all intents and purposes the gold coinage would thus be placed on a footing of equality with the silver coinage, of which we are desirous also of saying a few words. As at present organised, the Mint purchases silver for itself in the market, though generally at the instigation of the Bank. The market price of standard silver* varies from 5s. 0½d. to 5s. 2d. per ounce. The law says that 1lb. troy shall be coined into 66 shillings, and other denominations in proportion. The Mint thus makes a large profit or seignorage on the coinage of silver moneys. Thus, whilst, as at this moment, £1,000 in gold, whether in the form of coin or bars, is worth intrinsically £1,000, £1,000 in silver coins newly struck is only worth £925 in silver bars.

This large seignorage pays all the Mint expense of coining silver, and enables it to undertake the obligation of giving the Bank new silver coins for worn and light ones. (It would be well if the Mint performed this last operation more completely, for the silver coinage generally is in a very bad state.) By reducing the weight of the sovereign, the relative value of the shilling and other silver coins will be lessened too, and this is another argument against alteration. Upon this branch of the coinage question it is probable that, at some future time, a few reflections may be submitted, but, in this instance, out of consideration to space and other circumstances, we shall simply furnish a tabular view of the

MINT WEIGHTS OF BRITISH SILVER COINS.

Denomination of Coin.	Standard weight.	Legal remedy.	Legal maximum weight.	Legal minimum weight.	When not a legal Tender.
	gr. prts.	gr. prts.	gr. prts.	gr. prts.	
Florin	174·548	0·727	175·272	173·818	If clipped or defaced wilfully, or the Mint mark invisible.
Shilling ...	87·272	0·363	87·636	86·909	
Sixpence ...	43·636	0·18	43·818	43·454	
Threepence	21·818	0·090	21·909	21·727	

From the tabular statement, crowns, half-crowns, and fourpences are omitted because they are never coined now, and are, in fact, dying out.

THE WOOLWICH MUZZLE-LOADING GUN.

THE most recent novelty at Woolwich in the way of gun construction is the substitution of a wrought-iron breech coil and trunnion coil for the single massive forging hitherto used in the heavy guns of the Fraser construction up to 11in. calibre. The first piece of ordnance made upon this double coil system is a 12-inch Woolwich muzzle-loading rifled gun. The piece was tried this day week at Shoeburyness, upon which occasion

* The productive power of the Mint is equal to the creation of one million of coins of any denomination per week

* Standard silver is composed of 222dwts. fine silver and 18dwts. copper = 240dwts.

twenty rounds of 600lb. shot were fired from it with 67lb. charges of large grain rifle powder. This is the first instalment of a series of 200 rounds for testing its accuracy, range, and endurance. The gun is 14ft. 2in. in length; it weighs 25 tons, and is vented with hardened copper. It was mounted on a wrought-iron carriage and dwarf platform, running with flat-soled trucks with only a front flange upon C-racers, and was traversed with facility by Cunningham's chain gear worked by four men. It was also fitted with Colonel Clerk's hydraulic buffer, which acted admirably in checking the recoil. The buffer is 8in. in diameter, and about 6ft. in length; the diameter of the piston rod being 2 in. The quantity of water in it was 12 gallons. The shot were of cast-iron solid, of the same dimensions and weight as the service Palliser shot for this weapon. The first five rounds fired were at two degrees elevation, the times of flight of projectiles being respectively in second 3, 3·1, 3, 3, 3; the recoils 6ft., 6ft. ¼in., 6ft., 5ft. 11in., 5ft. 10¼in. The second five rounds were at four degrees; flights, 5·1, 5·3, 5·2, 5·1, 5·2 seconds; recoils, 5ft. 9in., 5ft. 9in., 5ft. 9in., 5ft. 9in., 5ft. 8¾in. The third five rounds were at six degrees; flights, 7·4, 7·6, 7·8, 7·6, 7·9 seconds; recoils, 5ft. 7in., 5ft. 8in., 5ft. 8in., 5ft. 8in., 5ft. 8in. The fourth five rounds were at eight degrees; times of flight respectively 10, 10, 10, 10·1, 10 seconds; recoils, 5ft. 7in., 5ft. 7in., 5ft. 8in., 5ft. 6in., 5ft. 7in. The ranges were at two degrees about 1,100 yards, at four degrees 1,830, at six degrees 2,650, and at eight degrees 3,450 yards. The line of fire was very good, the extreme deviations from the pegs being at the six degrees practice from 4yds. left to 4yds. right, at the eight degrees practice from 1yd. left to 4yds. right. The experiments were conducted by Captain Alderson, R.A., assistant superintendent, under the direction of Colonel Elwyn, R.A., the commandant.

THE BRITISH INDIAN SUBMARINE CABLE.

WE have to record the successful completion and storage on board the "Great Eastern" of the cable for the above line which is to be laid between Bombay and Suez. According to present arrangements the "Great Eastern" will leave Sheerness to-morrow (Saturday) with this work, which there is every reason to hope will be successfully laid. Having so recently given the particulars of the British Indian submarine cable,* it will be unnecessary here to repeat ourselves. We will merely mention that the work to be carried out consists of two cables—one of 1,550 knots, from Suez to Aden, and the other of 2,050 knots, from Aden to Bombay. This gives a total length of 3,600 nautical miles, and constitutes the longest submarine cable ever manufactured. To celebrate the successful manufacture of this cable, and to wish the important enterprise, and those who will have the practical carrying out of the work, good speed, the chairman, directors, and friends of the Telegraph Construction and Maintenance Company dined at the Albion Tavern on Wednesday evening. The chair was occupied by Sir Daniel Gooch, Bart., and among those present were—Lord Houghton, Lord W. Hay, the Right Hon. W. Massey, Captain S. Osborn, C.B., Mr. J. Pender, Sir J. Anderson, Sir C. Bright, Sir J. Whitworth, Hon. A. Cochrane, Lord S. Cecil, Mr. R. W. Crawford, M.P., Mr. G. Elliot, M.P., Admiral Hall, Mr. E. J. Reed, CB, Dr. W. H. Russell, Captain Halpin, Mr Willoughby Smith, Mr. W. T. Henley, Mr. Shuter, Mr. G. Sayward, Mr. J. Chatterton, Mr. H. Clifford, &c. After the usual loyal and patriotic toasts, Lord William Hay proposed "The Prosperity of our Indian Empire and of our Eastern Colonies," coupled with the names of Mr. Massey and Mr. Verdon, and, in a brief speech, referred to the immense importance of direct telegraphic communication with India. Mr. Massey said that he looked forward with confidence to the completion of the cable between Egypt and India, and he was pleased to be able to announce that on that day arrangements had been completed for the extension of the cable to the principal Chinese ports, by means of Ceylon and Singapore, and thence also to Australia. Mr. Verdon, in the name of the Australian colonies, also acknowledged the toast, and especially referred to the great want of telegraphic communication with Europe that is now felt by all the people of Australasia. "The British Indian Submarine Telegraph Company" was proposed by the Chairman, who said he hoped the cable between Bombay and Suez would be laid not later than the month of February next, while it was expected that the cable between Falmouth and Malta would be laid in the following June, thus completing our telegraphic communication with India. Mr. Pender, with whose name the toast was associated, briefly acknowledged it, and proposed the toast of "Prosperity to the Telegraph Construction and Maintenance Company," connected with the name of Sir D. Gooch, the chairman. The compliment was suitably replied to, and some other toasts of a personal and friendly character, including those of Captain S. Osborn, the managing director, and Captain Halpin, of the "Great Eastern," brought the proceedings of a very pleasant evening to a close. We trust the day is not far off when by means of the line between Bombay and Suez, and of another line between Falmouth and Malta, our telegraphic connections with India will be rapid and complete. The accomplishment of such a scheme cannot but be highly advantageous to the commerce and industry both of England and India.

The further extensions eastward of the cable referred to above is naturally consequent upon the establishment of direct telegraphic communication with India by the formation of the Falmouth, Gibraltar, and Malta, Anglo-Mediterranean, and British Indian Companies, whose cables are expected to be open for traffic next May. For this purpose a company has been formed, with a proposed capital of £460,000, in 46,000 shares of £10 each. By this company a cable will be laid from Galle to Singapore, touching at Penang and Malacca, as a first instalment towards connecting Australia and China with the Indian and European systems. Negociations are in progress, to the knowledge of the directors, with the Dutch and Australian authorities for the necessary concessions to enable telegraphic extensions to be carried out from Singapore to those countries, and soundings are about to be taken for a cable route from Singapore to Hong Kong. From the extreme point of the Dutch possessions to the Australian continent the distance is only 1,130 miles; and a cable 1,780 miles in length will connect Singapore with Hong Kong *viâ* Cochin China. The directors intend, after the completion of their cable, or earlier if so advised, to adopt such measures as may ensure the carrying out of the above extensions. When such a system is completed there can be little doubt that the messages passing over the Singapore and Ceylon cable will exceed the present estimate of the British Indian Company—namely, 300 per diem. In the meantime, looking to the importance of Singapore, and the fact that messages will reach it at once by steamers from China, the Philippines, Cochin China, and Java, it is considered a moderate estimate that 75 messages will pass each way daily. The total length of the present Singapore cable will be 1,756 miles, and the type is similar to those manufactured by the Telegraph Construction and Maintenance Company for other deep sea lines, with such improvements as recent experience has suggested.

A contract entered into with the Telegraph Construction and Maintenance Company provides for the manufacture and laying of this company's cable in the year 1870, at a cost of £440,000, of which the contractors will take £130,000 in fully paid shares. £50,000 of these fully paid shares are to be reserved until this company's engineers have certified that the whole line has been successfully laid, and has continued for thirty consecutive days equal to the standard of insulation prescribed by the specification. A tariff has been arranged with the Falmouth, Gibraltar, and Malta, the Anglo-Mediterranean, and the British Indian Telegraph Companies, by which the charge for a message of twenty words from England to Singapore will be £4 4s., of which this company will receive £1 7s. The tariff for local messages between the termini of this company's cable is intended to be £1 10s. Calculating the daily number of messages at 150, of the average length of thirty words, at a tariff of 27s. per twenty words, and allowing 330 working days, the gross annual revenue would be £100,237. Deducting from this £16,000 for working expenses and £10,000 for a reserve, a balance is left of £74,237, yielding upwards of 16 per cent. per annum on the capital; and it may be fairly assumed that this income will be doubled as soon as the projected extensions are carried out. In these days of successful telegraphic enterprise, we can have no doubt that the public will come forward to the support of the undertaking, and that it will prove a practical success.

MANUFACTURE OF CAPS AND CARTRIDGES.

No. XI.

THE operation of filling the cases of the sporting cartridges is performed in a manner similar to that already described for those intended for less peaceful purposes, and it is not necessary therefore to recapitulate our previous description. An almost identical process introduces the charge of shot, and a wad being placed on top, the end of the case is solidly closed up, and the manufacture complete. It is rather curious that the finished cartridges do not constitute, as might be expected, the chief trade in the article. It is the empty cases that furnish the principal contingent, which are despatched to the gunsmiths and ammunition sellers, independently of large numbers which are supplied direct to sportsmen who prefer filling their own cartridges. They probably imagine that they have some secret respecting the relative proportions of powder and lead which ensures more accurate shooting.

With a few unimportant modifications the manufacture of the central-fire cartridges is conducted on the same principles as those already alluded to. The cartridge cases intended for carbines and pistols, including revolvers, are composed wholly of brass instead of pasteboard, or paper and tinsel, but the succeeding operations do not vary from those undertaken in the other examples. Besides those we have mentioned, a large number of other types of cases are constructed at the establishment of M. Gevelot, but as they are not exported in any considerable quantities, it is unnecessary to refer to them in detail. The only one deserving mention is the example in which the brass end or socket is surrounded by a metallic ring or collar. This description has been extensively used for guns and revolvers. The object aimed at is to obtain a large rim or edge. If this be gained at the expense of the brass socket, the latter will be very considerably reduced in thickness and weakened, and, moreover, the rims so obtained will

* See the MECHANICS' MAGAZINE for October 1, p. 238.

be uneven in their own thickness and diameter. Instead of this method, another is adopted, which fulfils the required conditions most successfully. A disc is cut out of a piece of iron and pierced with a hole corresponding in diameter to that of the exterior of the socket of the cartridge case. It is then slipped over the socket from the front end, and is prevented from sliding off by a slight swelling of the back extremity of the socket. The case is then subjected to a strong pressure in a suitable mould, and the disc tightly fixed in its place between a couple of rims raised on the socket upon each side of it. For especial purposes the cartridge cases for guns are manufactured all of copper, and, in order to increase the range of some of the sporting cartridges, the charge is enclosed in an extremely fine iron wire net. The theory is that for a certain distance the charge would act like a ball, and when the net broke and the charge spread its destructive effect would be greatly increased. At present, no experiments have been undertaken to practically substantiate this expectation.

Having brought to a termination the description of the articles manufactured by M. Gevelot, a few words may be now said regarding the premises themselves, in so far as they are connected with the welfare and comfort of those inhabiting them either temporarily or permanently. The enterprising proprietor speedily discovered that in order to retain good and reliable workmen upon the books of the establishment, it became absolutely indispensable to provide them with habitations in the immediate vicinity. Accordingly, he laid out a street alongside the principal workshops, and on the side opposite to them he built a terrace or row of houses three stories in height, counting the ground floor as one. At a short distance from this row of buildings, and connected with it by a timber gallery, are three pavilions, whose pointed tops break the monotonous appearance of the hard straight sky-line presented by the row of houses. The different flats and apartments are reached by staircases and external corridors or galleries, very similar in construction to those belonging to some of our "industrial dwellings." From these buildings a fine view of the scenic expanse is obtained, embracing the hills of Meudon and Bellevue, the river Seine as it encircles with its waters the Isles of Billancourt, and the sharp, clearly-defined contours of the arches of the viaduct of the Western Railway. According to the taste and habits of the tenants so does the internal appearance of the habitations vary. The arrangements for comfort, and even comparative luxury in some instances, are very complete, while in others there is a great deal to be desired on the same score. As a rule, the old hands are all pretty well "set up" in furniture and effects, and it is easy to perceive that they intend to be permanent tenants. Small gardens are attached to most of the dwellings, which are carefully attended to and maintained in a blooming condition. The disposition of the apartments is identical in every instance. A kitchen, sitting room, and bed room comprise the suite. These rooms are not let to the workmen gratuitously, but a rent of eight shillings is deducted at each pay day, which occurs every month. As frequently more than one member of a family is employed on the premises, this deduction is scarcely felt, and obviates much of the discomfort and misery that is so often attendant upon rent-time owing to the improvidence of the working classes. This small town occupies an area of about an acre and a half, and contains seventy-five tenements. Its erection, including the value of the land, cost £8,850. With women and children, the total working staff of M. Gevelot averages over 2,000 persons. Among these must be included a large number of fitters, mechanical engineers, turners, and others, whose duty is to repair and keep in order all the various machinery and apparatus, and, when required, to construct new ones for especial purposes.

Before drawing to a close our articles on the "Manufacture of Caps and Cartridges," it is to be regretted that there is a dark side to the picture. But so it is. The system of surveillance—it might almost be termed espionage—that the "paternal government" is so fond of indulging in, is not neglected in this instance. In the first place, it is included in the category of unhealthy establishments, and in consequence subjected to the rigorous regulations provided for their especial behoof. The manufacturers of fulminating powder can only obtain provisional permission to carry on their business. This permission can be revoked at any time by the authorities who grant it, so that the proprietors of an establishment of this nature are placed in a very trying and unfair situation. After erecting the works and starting the business, it all depends upon the caprice of the Administration whether it may remain a permanent concern or be closed almost before it has got into working order. Under such circumstances it is a marvel that any one would embark in an enterprise of the kind. Moreover, when the articles such as caps and cartridges are manufactured, they cannot be exported without express permission of the Minister of War, while foreign firms may import as many as they please by paying the import duty of ten per cent. *ad valorem.* This arrangement altogether prevents the French manufacturers from taking foreign contracts, since they cannot be sure whether they would be allowed to carry them out. They are thus placed at a great disadvantage in comparison with our English firms. Another evil, which arises from the small difference that exists in many instances between sporting cartridges and those intended for war, is that the exportation of the latter is strictly prohibited, and it is easy to perceive that, by a slight stretch of arbitrary power, the former might be brought under a warlike designation. Although the premises at Moulineaux are not on a scale of such colossal magnitude as those at Essen (a full description of which appeared in our columns of 1866), yet if the proprietor of the former was as untrammelled in his actions as M. Krupp, he would not hesitate to add considerably to the size of his present manufactory. Instead of turning out half a million cartridges per diem, the yield might easily be raised to one or two millions. Past events have proved, both in the old world and the new, that the fate of an army, of a fleet, and of an empire, may at any moment depend upon the efficient or inefficient construction of arms and ammunition.

SIR JOHN FRANKLIN.

SOME important and interesting facts bearing upon the unfortunate Franklin expedition have been made known by Captain C. F. Hall, the eminent Arctic explorer, who recently returned to New Bedford from a five years' search for the remains of Sir John Franklin's companions. Captain Hall has unmistakable evidence of the fate of Sir John and his party. Although the evidences found are conclusive as to the fate of the party, Captain Hall is confident that if a large and well-organised expedition should spend one summer on King William's Land, where records, "beyond doubt," are buried, the complete history of the fate of Franklin's last expedition would be found. These manuscripts are supposed to be buried in a vault a little inland or eastward of Cape Victory, the Captain at one time being within 75 miles of there; but a stampede of the natives accompanying him as an escort forced him to retrace his steps. From the imperfect description given by the Esquimaux of the condition of Crozier's party of 105 men, the Captain is satisfied that they were suffering from the scurvy, as nothing but sickness would have kept so experienced an Arctic traveller as Crozier from the game which was in abundance within 75 miles of where he and his party perished. The relics brought back number about 150, and were as many as could be conveniently carried, although there were hundreds of them in the possession of the natives. Those brought back were obtained from the natives through the (with them) all powerful agency of presents—a needle being considered a fair equivalent for a silver fork or spoon. Captain Hall writes :—"I could have gathered great quantities—a very great variety—of relics of Sir John Franklin's expedition, for they are now possessed by natives all over the Arctic regions that I visited or heard of—from Pond's Bay to Mackenzie River. As it was, I had to be satisfied with taking upon our sledges about 125lb. total weight of relics from natives about King William's Land. Some of these I will enumerate :—A portion of one side (several planks and ribs fast together) of a boat, clinker built and copper fastened. This part of a boat is of the one found near the boat found by M'Clintock's party. A small oak sledge runner, reduced from the sledge on which the boat rested. Part of the mast of the 'North-West Passage' ship. Chronometer box, with its number, name of maker, and the Queen's broad arrow engraved upon it. Two long heavy sheets of copper, 3in. and 4in. wide, with counter sunk holes for screw nails. On these sheets, as well as on most everything else that came from the 'North-West Passage' ship, are numerous stamps of the Queen's broad arrow. Mahogany writing-desk, elaborately finished and bound in brass. Many pieces of silver plate—forks and spoons—bearing crests and initials of the owners. Parts of watches. Knives, and very many other things." Wherever Captain Hall found that Sir John Franklin's companions had died, he erected monuments, then fired salutes and waved the Star-spangled Banner over them in memory and respect of the great and true discoverers of the North-West Passage.

PHOTOGRAPHY.

MR. BLANCHARD ON THE WET PROCESS—ALKALINE WET PLATES—EFFECTS OF AGE ON COLLODION—PHOTOGRAPHIC COMETS.

MR. VALENTINE BLANCHARD, one of the best workers of instantaneous processes in London, has just published, in the "Journal of the Photographic Society," some experiments on plates sensitised in an alkaline nitrate of silver bath. To get clean pictures, free from fog, a trace of free acid in the bath is almost always necessary, though, with some samples of collodion, the bath may be in a perfectly neutral state. An alkaline bath in the wet process is, under ordinary conditions, perfectly useless. Mr. Blanchard points out that, when a collodion is used containing an ammoniacal salt in excess of the other bromo-iodising compounds, clean pictures could be obtained. In his experiments, cadmium and ammoniacal salts were used in the collodion; the first plate fogged, but every successive plate gave better pictures, till, after a few trials, clean pictures were the result, produced apparently by the formation of nitrate of ammonia in the bath.

Mr. Sutton's pamphlet on alkaline wet plates having been unanimously condemned by all reviewers because it withheld the formula of the necessary collodion, kept on sale by Mr. Sutton's agents, Mr. Sutton at last has made known full particulars as to its composition, as follows:—

Ether, S. G., ·725 . .	4 fluid drachms
Alcohol, S. G., ·810 .	4 „ „
Pyroxyline . . .	5 grains
Bromide of cadmium .	5 „
Bromide of ammonium	5 „

He says that no matter what pyroxyline be used, he knows of none that will make a collodion capable at first of giving a film free from wrinkles and listers. The collodion must be kept for a

time—say a few months—before it ceases to give a skinny film, and forms one having the soapy, powdery consistency so necessary in dry plates. Collodion made with pure materials and cadmium salts should keep for years, and, for a considerable time, should improve in working qualities. He says that good old collodion never exceeds a pale yellow tint, and that, with a pure nitrate bath, it will yield negatives which require no intensification.

As yet only one comparative trial seems to have been made of the relative rapidity of Mr. Sutton's new process and the old ones. Major Russell narrates in the "Illustrated Photographer" how he coated one half of a plate with tannin and the other half with the alkaline gelatine organifier. On developing the picture, he could not see any decided difference between the two halves.

Comets, with tails attached, sometimes are troublesome by making their appearance upon the picture during the developing process. They also manage, as a rule, to come out just in the right place to spoil the picture—across the nose or mouth of the sitter for instance. They are far more common with iodised than with bromo-iodised collodion; hence a remedy often applied was to add more bromide. Naturally enough, these facts suggested that the fault lies in the collodion when comets appear, but it is not so. They are caused by imperfectly cleaned glass plates, and are very often seen when depositing metallic silver by the chemical method upon sheet glass to form mirrors, though, in such processes, no collodion at all is employed. The fact is that iodised collodion is more sensitive to disturbing influences than bromo-iodised collodion, so that the comets appear in the one case more frequently than in the other.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

THE OCCLUSION OF HYDROGEN BY NICKEL—A NEW HYDROMETER—COPPERSMITHS AND CHOLERA—THE COLOURS MOST READILY DISTINGUISHED—THE DYNAMOMETER AND WASTE HEAT.

THE small cubes of nickel, such as we find in commerce, have been found by M. Raoult to be in an eminent degree porous, and to have, like palladium, the power of absorbing hydrogen. One cube of metal will occlude 165 times its volume of gas. We are not yet informed whether any increase of bulk is occasioned by the entry of the gas or what alteration in density takes place. The author would seem to regard this as a case of simple absorption, such as happens with charcoal; for it appears that, once hammered, the metal loses its porosity and power of absorption.

A new kind of hydrometer has been invented by M. Baudin, which we have no doubt will give very accurate results with strong spirits. In this instrument the strength of the spirit is measured by its expansibility. A thousand measures of absolute alcohol at 50degs. become a thousand and seventy-nine at 170degs., or a little below its boiling point. With mixtures of alcohol and water the rate of expansion is not uniform, but no doubt M. Baudin's tables have been constructed upon special experiments.

A fortnight ago we published a paper by Dr. Burg, of Paris, showing the immunity from cholera which coppersmiths and others working with alloys of copper enjoy. We have now a statement by Dr. Clapton, of St. Thomas's Hospital, that the same fact is observable in London. He has found by inquiries at various works that copper workmen have been free from cholera and diarrhœa, although their neighbourhoods suffered severely during the great epidemics. This is a remarkable fact, deserving the serious attention of medical authorities. Dr. Clapton's observations have extended beyond those of Dr. Burg. He has been able to prove that by handling copper some absorption of the metal into the system does certainly take place. Copper-workers get green stains on the gums immediately above the teeth, just as painters and lead-workers get a dark, almost black line. They have a bluish-green perspiration, and, if afflicted with ulcers, the exuding matter is of a greenish colour. But their occupation, unlike that of painters and water-gilders and others, seems to bring them no specific disease.

Experiments made to ascertain what colours are most quickly and easily perceived by the eye seem to show that bright yellow is the colour most easily distinguished, and violet and red are the least readily recognised. After yellow, blue is most quickly seen. These experiments may be of some value in improving our system of railway signalling. The colours most readily distinguishable at the greatest distance are obviously the best to employ for signals. Now, according to these experiments, red comes last or last but one, and green stands but just before it. Bright yellow and blue, the colours most easily recognised, would, therefore, seem to be preferable for signal lights.

In connection with this we may mention an interesting fact, but one of no practical importance further than showing that the perceptions of the lowest animals seem to accord with our own. When a basin of water containing some of those active little animals water-fleas is surrounded with blackened paper the animals sink into inactivity, but when a strong beam of light is sent through a hole in the paper, they spring at once into activity and collect in the illuminated part of the water. Further than this, if a spectrum be projected through a slit in the paper, the greater number of animals collect in that part of the water illuminated by the orange yellow rays, and the fewest in the line of the violet, which would seem to indicate that they too most readily perceive yellow light.

Dr. Mayer, the celebrated physicist, has now perfected an instrument he calls a dynamometer, which, adapted to engines of 20-horse power and upwards, reads simultaneously measurements of force in the form of heat as well as of pressure. We have no account as yet of the instrument, which is obviously of more scientific than practical value. The same philosopher, dealing with the question of the conservation of force, has come to the conclusion that the large amount of force which is lost in the form of heat in all mechanical operations can never be utilised. Heat, he tells us, is the cheapest possible form of force, mechanical is far dearer, and electricity the dearest force of all. Hence it would never pay to transform waste heat into any other form of force.

ENGLISH AND CONTINENTAL INTER-COMMUNICATION.

By Mr. Perry F. Nursey.

AT a meeting of the Society of Engineers, held on Monday evening, the 18th of October, the President, Mr. F. W. Bryant, in the chair, the following paper was read:—

One of the most prominent and important questions of the present day, and one to which a very wide-spread attention is being given, is that of providing a more easy and rapid system of intercommunication between England and France than we at present possess. Nothing is more obvious than the necessity which exists for improvement in this direction. The steam packet service between England and France—which is in fact a service between Great Britain on the one hand and Europe and the East generally on the other—is about the worst we have. It is an undoubted fact that the great majority of passengers crossing the Channel suffer—short as is the sea passage—extreme discomfort from sea-sickness and want of shelter during bad weather. Not unfrequently the traveller from India or from America finds the British Channel the most unpleasant part of his journey, and he sometimes looks forward with more anxiety to the state of the Channel than to the heat of the Red Sea or the passage of the Atlantic. In the case of America, he will often select a French or an English vessel, according to the country which he desires to reach, in order to avoid the Channel crossing, rather than from any other consideration. There are now, exclusive of the routes by Ostend and Antwerp, 310,000 passengers per annum to be provided for, of whom 142,000 travel by Calais, as the mail route. Those numbers are undoubtedly capable of great augmentation on greater facilities and increased comfort being afforded. But the existing steam vessels, restricted as to their dimensions for want of better pier and harbour accommodation, are disproportionate to the service. Larger vessels, with less movement in rough weather, more shelter, and better accommodation generally, would do much to mitigate the discomforts of the sea passage. Pending the successful issue of other more extensive and more permanent projects it would be well if these improvements were effected. But larger vessels cannot be employed for a fixed service until better provision is made for embarking and disembarking passengers, especially on the French coast. The Society of Arts, ever on the alert to improve the social position of mankind, has offered its gold medal for the best design for a steamer which shall afford the most convenient shelter and accommodation to passengers on the deck of the vessel crossing between France and England. The attendant circumstances of the case, however, oblige the society to specify that the steamer is not to exceed in tonnage and draught the best vessels now in use between Folkestone and Boulogne. There have also been other schemes propounded at various times for vessels of special build suited to the present harbour accommodation. Into these propositions, however, it is not our present purpose to enter. The growing necessity for a radical improvement teaches us that they can only be regarded as temporary expedients which must give way in course of time to more permanent works. We will therefore proceed to the consideration of the more important and extensive projects which have been placed before the public during the last few years. These consist of tunnels driven beneath the bed of the sea; submerged roadways and tubes; large ferryboats carrying the trains on board, bridges across the Channel, and embankments.

If we glance at the history of the question we shall find it to extend further back into the past than is generally supposed. Something like a score of projects for effecting direct communication between the two countries have been proposed from first to last. Up to the close of the year 1866 three French projectors had proposed tunnelling under the Channel; five English and two French inventors had proposed submerged tubes; one Frenchman proposed an arched roadway or tunnel, and an Englishman a bridge. Since that time there have been some seven or eight proposals for effecting that object; to these attention will presently be specially directed. The idea of tunnelling is much the oldest; a French engineer, M. Mathieu, nearly seventy years since, considered the scheme practicable. He worked out the details of his plan and laid them before Napoleon, then First Consul. In 1856, M. Thomé de Gamond proposed a tunnel scheme which received more than ordinary notice. The plan was to form in the Channel thirteen islands by carrying materials out to sea, to sink shafts through them into the earth below the bed of the Channel, and then tunnel from one to the other. A commission of engineers was appointed and they carefully examined M. de Gamond's data and conclusions, and particularly his geological investigations, which were the first steps taken to demonstrate practically the nature of the strata beneath the Channel. These investigations supported the theory that the Straits of Dover were not opened by a sudden disruption of the earth at that point, but had been produced naturally and slowly by the gradual washing away of the upper chalk; that the geological formations beneath the Straits remained in the original order of their deposit, and were identical with the formations of the two shores, being, in fact, the continuation of those formations. Acknowledging the scientific accuracy of M. de Gamond's conclusions, the commission recommended an appropriation of £20,000 to make preliminary examinations. The plan, however, was finally rejected on account of its interference with the navigation of the Straits. The submerged tube projectors of that time, with one or two exceptions, appear to have given the subject less study than the advocates of the tunnel. It was a work very easily effected: you only have to construct your tube in sections; float them over the proposed line of route; sink them and connect their ends; pump the water out, and the thing is done. Hear how one of these facile gentlemen describes his project:—

"My plan is simply to construct wrought-iron tunnels in separate divisions; to sink them on the bed of the water, and then to connect them. It will be admitted that to construct such a tunnel would be an easier matter than to build iron vessels, as it would be the same shape the whole length. Then to sink it on the bed of the water would be the work of a few hours for each division of 400ft. in length." A momentary fit of

reflection, however, seizes him when he has sunk his lengths of tube, for he says:—"Perhaps the part of the work which will appear the most complicated will be to connect the divisions under water." But, quickly recovering himself, he adds:—"The operation will be attended with no extraordinary difficulty to those who can remain during half an hour in deep water." Turning to the shore ends he observes:—"As regards that part of the tunnel which would be near the shore, it would be sunk under ground, and covered with stones fastened together, so as to render them immovable. . . . . Then the railway will be formed in forming the tube; there will be no hills to cut through, valleys to fill up, nor arches to build; in short, the sum total of the work is comprised in the tunnel itself." Warming with his subject he grows bolder and says:—"Supposing the divisions to be 1,000ft. in length; in that case, only 104 divisions would be required to join the rails of the South-Eastern Railway with those of the Calais and Paris. Now, supposing each of these divisions would cost £40,000, the cost of the whole would be £4,160,000; and if we allow for the expense of throwing them in deep water, of connecting them, of building stations, &c., on a magnificent scale, it will, I believe, be found that the sum of £8,000,000 sterling would be quite sufficient to complete the submarine railway." Really the manner in which this gentleman speaks of throwing into deep water iron tubes a thousand feet in length, and capable of containing a railway, is most refreshing, and must have been very encouraging to the sea-sick continental traveller.

Turning to another project we find it to consist in crossing the English Channel by means of a tube made of strong plate iron or cast iron, lined and prepared for that purpose, and which, placed at the bottom of the sea, should contain the two lines for the trains which would run within it. The slope given to the submarine railway would admit of a motion sufficiently powerful to enable the carriages to cross the Channel without a steam engine. The greatest depth of the sea at the middle of the Channel will admit of the construction of inclined planes, by means of which the train would be enabled to reach a point where a stationary engine, or atmospheric pressure, might be employed in propelling the train to the level of the land railways of France and England.

Another visionary does not place his tube on the bottom, but proposes to situate it at a uniform depth from the surface, by means of ties below (and buoys above, if necessary), at suitable intervals. He says:—"The continuation of the tunnel into the shore on either coast I should dispense with; and, in order that it should have a partial freedom of motion, it should terminate with solid ends before reaching the shores. To these points, chain piers should extend; or, if strict economy were aimed at in this item, the communication might be by small steamers." As the tunnel or tube in question contains only a single line, the projector proposes pushing one way, and pulling the other; or, he says, electricity should, if at all practicable, be the motive power. After proposing, as the principle of construction, something analogous to the cooper's craft, he continues:—"When the tube was completed from end to end, favourable weather would be waited for, and the work of lowering would then be accomplished, nearly as follows:—The airtight interior of each pontoon would be connected by an ample length of flexible pipe to an air pump of adequate power, on board a vessel anchored at a distance corresponding to that intended for the mooring weights. The two lines of vessels should be manned by steady men, each crew under a trustworthy leader. Athwart the vessels would be laid, from the shore, the wires of an electric telegraph, communicating with an apparatus on board of each; so that, at a preconcerted signal, the abstraction of the air from the pontoons should be commenced simultaneously at a given time, and carried on at a given rate. By this means, the pontoons, gradually deprived of their buoyancy, would yield to the pressure of their burden—the buoyancy acquired by which as it entered its future element would be overcome by the weights with which, throughout its length, it was loaded, and which would speedily sink it to its prescribed depth. It would be when the tube reached the water that the mooring weights, having been preparatorily slung under the vessels above mentioned, would, at another signal by the electric telegraph, be simultaneously let drop into the sea, and drag down their charge along with them."

We will only briefly notice two more of these easy-going gentlemen, whose ideas slip out so glibly that practical men fail to grasp them, and these are the proposer of the arched roadway or tunnel on the bottom, and the proposer of the bridge. The former, with 40 subaqueous boats, of which he was the inventor, 1,500 sailors and navvies, 4,340,000 cubic yards of material, and £10,000,000, undertook to construct a tunnel, by means of which the Straits could be crossed in 33 minutes. The mammoth bridge projector would make in the Channel 190 pedestals, 300ft. square at the bottom, consisting of rocks bolted and lashed together, gradually rising at an angle of 75deg., till they formed each an insular plain, 150ft. square, 40ft. above the level of the sea. On these he would build towers 100ft. diameter, 260ft. high; crowning the whole with a tubular bridge 50ft. deep and 30ft. wide.

CHALMERS.

We will now turn to the more practical projects which have since been advanced, noting them somewhat in the order of their appearance before the public. First, then, comes the proposition for a Channel railway, by the late Mr. James Chalmers, whose name is connected with some very valuable improvements in the construction of armour-plated ships and forts, but which his premature death prevented him perfectly developing. Mr. Chalmers' plan was to have a tube of boiler-plate iron, lined with brickwork, laid on the bed of the sea, and having ventilating towers at intervals. Through this tube the railway was to be carried. His project provided for an unbroken double line, connecting the railways of England and France by easy gradients, capable of carrying all ordinary trains at the usual speeds on the best roads, and of insuring perfect safety and comfort. It was to offer no obstruction to the navigation of the Channel, and Mr. Chalmers estimated that the work could be completed in three years for £12,000,000. The principal features of the work, as proposed in 1866, were two strong iron tubes, cased with timber and lined with brick, each containing a single line of railway, and reaching from shore to shore on the bottom of the Channel. The displacement and weight of these tubes was designed to be so nearly balanced that both in submerging and when in position they would not be subjected to any appreciable lateral strain. There would be a slight excess of displacement, which would be effectually overcome by the materials with which the tubes were to be covered. Mr. Chalmers held that as the current alternated up and down Channel with the rise and fall of the tide, the embankment would silt up eventually, and become a solid, impermeable mass, having the appearance of a ridge reaching from shore to shore, about 150ft. wide at the base, 40ft. high, and from 40ft. to 120ft. below the level of low water. Mr. Chalmers proposed to have three ventilators, one in mid-channel, and one about a mile from either shore. Thus the main portion of the work would be 18 miles in length; and this divided by the deep-sea ventilator, would give two sections of 9 miles each. Consequently, a train could never be more than 4½ miles from an opening. From those and other points, the air was to be withdrawn through pipes by machinery situated in the central ventilator, or on the shore embankments, which would cause currents of fresh air to rush to those parts most distant from the ventilators.

The tubes were to be circular in form, and made of boiler plate, double-riveted and caulked. The circular form was to be preserved, and the tubes were to be strengthened by iron girder frames surrounding them. To the outer flanges of these frames the timber casing would be attached by bolts; and the spaces between the timber casing and the tube proper filled with concrete. Finally, the interior would be lined with the most durable description of brickwork.

The timber casing, properly caulked, says Mr. Chalmers, would be equal in strength and watertightness to the plating of a frigate; the tube itself would be as tight and stronger than a steam boiler or iron ship; and the concrete packing between the planking and the tube would also be impermeable to water. Thus, not only is a double or treble precaution taken against leakage, but the iron would be protected, both without and within, from any injurious effects that might result from contact with sea water; though, at the depth at which these tubes would be placed, such contact, even if possible, under the circumstances, would not be so injurious as if they were nearer the surface. Maury, in his "Physical Geography of the Ocean," states as follows:—"Count Marsigli divides sea water into surface and deep-sea water; because, when he makes salt from surface water (not more than 6in. below the upper strata), this salt will give a red colour to blue paper; whereas the salt from deep-sea water will not alter the colours at all. The blue paper can only change its colour by the action of an acid. The reason why this acid (iodine?) is found in surface and not in deep-sea water is that it is derived from the air." Hence, argues Mr. Chalmers, the bottoms of iron ships—when the interior skin of the iron is kept clean and well-painted—appear to suffer little or nothing from the action of the water on the exterior. But, even if the iron of the tube were to suffer by oxidation in forty or fifty years (a circumstance which, from its position, Mr. Chalmers considers is far from probable) the embankment, by this time silted up into a solid mass, the timber casing, the concrete and interior lining, would of themselves ensure the permanency of the Channel railway.

The ventilator in mid-channel was to be a circular mass of iron and stone, 100ft. in diameter, and 210ft. in height, 168ft. of which would be below the water-line. When finished it was to weigh about 100,000 tons, and displace 50,000 tons of water. It was to be surrounded by, and imbedded in, the embankment that covered the tubes, which at that point was to be raised to a height of about 80ft. The other ventilators were to be ordinary air-shafts near the end of the shore embankments, which would be run out, breakwater fashion, about a mile from either shore to a depth sufficient for navigation over the tubes. The tubes were to be made in lengths of 300ft. or 400ft., were to be fitted with temporary bulkheads lowered into position, and united by a somewhat delicate submarine operation.

HAWKSHAW.

Mr. Hawkshaw's attention has been directed to the subject of a tunnel for connecting the railway systems of England and France, and he has made a practical geological examination of the Channel and the two coasts, the results of which are of great value in connection with the question. As Mr. Hawkshaw's scheme appears to have absorbed those of M. de Gamond and Mr. Low, an English mining engineer, it will be as well to trace the history of the combination concurrently with the development of the scheme. The project has been worked out under the auspices of a committee by Messrs. John Hawkshaw, James Brunlees, and William Low, English engineers, in conjunction with MM. Paulin Talabot, Michel Chevalier, and Thomé de Gamond. These gentlemen have reported to the committee of promoters of the undertaking, and that document supplies the following facts and valuable information, from which we gather the history of the scheme.

Following the order of the report, we will first take Mr. Low's proposition. That gentleman has for several years past conceived the idea of connecting the railway systems of France and England by tunnelling, and as a practical mining engineer he has devoted his attention in the first place to securing the efficient ventilation of the work both during construction and after completion. In most of the tunnel schemes it is proposed to effect ventilation by means of towers in the sea, more or less numerous, and differing in magnitude and cost. Mr. Low proposes to dispense entirely with shafts in the sea, and to commence the work by sinking pits on each shore, driving thence, in the first place, two small parallel driftways or galleries from each country, connected at intervals by transverse driftways. By this means the air could be made to circulate as in ordinary coal mines, and the ventilation be kept perfect at the face of the workings. Another advantage attending this mode of proceeding is that these headings could be driven from shore to shore at the minimum of cost, and the practicability of executing the proposed tunnels demonstrated without extravagant outlay. The driftways were to be turned into two tunnels suitable for the ordinary locomotive traffic of the railways to be connected by this work. Having settled the principle of the construction of his tunnels, Mr. Low investigated the geological nature of the shores of the Straits. From personal examination of the most careful character, he verified the data of Mr. Phillips and of other eminent geologists who have made the geology of the shores of the Straits, and the subject of the continuity of the strata under the sea, their special study. He also examined the borings for the artesian well at Calais, the artesian well at Harwich, and several other wells of less magnitude, by all which the regularity of the strata was proved. He found everywhere that the deductions of the geologists were sound; and at the line which he ultimately fixed on for his proposed tunnels, viz., about half a mile west of the high light of the South Foreland, and at four miles west of Calais, the tunnels could be made almost entirely through the lower or grey

chalk, which, owing to its comparative freedom from water, and the general absence of cracks and fissures in it, offered the most desirable stratum for working in. Mr. Low laid his plans before the Emperor of the French in April, 1867, and his Majesty desired Mr. Low to proceed to organize the means of carrying out his project, and to come to his Majesty again when he was prepared to lay definite proposals before him.

In an international work of this nature, it was desirable to obtain the co-operation of a French engineer, and Mr. Low therefore put himself in communication with M. de Gamond, who placed his geological studies and sections at Mr. Low's disposal. Mr. Low then laid the results of his and M. de Gamond's labours before Mr. Brunlees, who, after a careful examination of the project, consented to co-operate with Mr. Low and M. Thomé de Gamond for the prosecution of the proposed work. In accordance with the desire of his Majesty, a committee of French and English gentlemen was formed in furtherance of the project.

For some years past Mr. Hawkshaw's attention had been directed to this subject, and ultimately he was led to test the question, and to ascertain by elaborate investigations whether a submarine tunnel to unite the railways of Great Britain with those of France and the continent of Europe was practicable. With this object he caused to be made a careful examination of the geology of the Channel and of the French and English coasts, and had a chart prepared, based on that examination, and on such further information as he could procure. From a careful consideration of these geological investigations, Mr. Hawkshaw arrived at the conclusion that it was desirable that the tunnel should pass as far as possible through the lower chalk, for it appeared to him that if an attempt were made to carry it through the strata lying under the chalk, it would have to penetrate material of variable nature, some of which would be soft, and through which it would be undesirable to construct a submarine tunnel. It also seemed to him desirable to depress the tunnel as much as possible below the upper or white chalk, and to carry it as far as practicable through the lower or grey chalk, which is less permeable to water than the upper or white chalk. But when he had proceeded thus far, Mr. Hawkshaw felt that more accurate information than could be arrived at by geological inquiries only, however carefully conducted, was necessary. He had ascertained that at Calais an artesian well had been sunk to a depth of about 1,000ft., and from the records of this work he obtained the particulars of the strata at that point. This well, which failed to procure water, was some distance from the spot on the French coast where, from the geological inquiries, it seemed desirable that the submarine tunnel should be placed. He therefore decided to make borings on each coast, at the ends of the line which approximately seemed the best position for the tunnel, and also to examine the bottom of the Channel for some distance on each side of that line. Accordingly, at the beginning of the year 1866 a boring was commenced at St. Margaret's Bay, near the South Foreland; and in March, 1866, another boring was commenced on the French coast, at a point about three miles westward of Calais; and simultaneously with these borings an examination was carried on of that portion of the bottom of the Channel lying between the chalk cliffs on each shore.

The boring on the English coast was satisfactorily completed in 1867. It was carried through the chalk and into the green sand, which was reached at a depth of 540ft. below high water. The boring on the French coast was continued from the surface to a point about 520ft. below high water. It passed through the upper chalk into the lower or grey chalk. This was completed at the end of 1867. It was Mr. Hawkshaw's intention to have carried this boring also entirely through the chalk, but in attempting to substitute larger boring tubes, the hole was accidentally filled up with sand and shingle from the top. The results, however, arrived at from this boring seem sufficient, and accorded very nearly with the records of the Calais well, and with the geological survey previously made; so as not only to confirm their accuracy, but to lead to the deduction that at the site of this boring the chalk would extend to, and the green sand be reached at, a depth of about 750ft. below high water.

For the examination of the bottom of the Channel a steamer was engaged and suitable apparatus provided, by means of which the bottom could be pierced for a short distance and specimens could be raised from the bed of the Channel. On shore suitable points can be selected for examining the strata; whilst at sea many of the examinations made from soundings fall on superficial deposit. A survey of the Channel, therefore, cannot be so complete as a survey of the coasts. Nevertheless, the result of the examination seems to indicate that across the Channel the position of the chalk is nearly identical with that deduced from the previous geological inquiries.

The principal practical and useful results that the borings have determined are, that on the proposed line of the tunnel the depth of the chalk on the English coast is 470ft. below high water, consisting of 175ft. of upper or white chalk and 295ft. of lower or grey chalk; and that on the French coast the depth of the chalk is 750ft. below high water, consisting of 270ft. of upper or white chalk and 480ft. of lower or grey chalk; and that the position of the chalk on the bed of the Channel, ascertained from the examination, nearly corresponds with that which the geological inquiry elicited. It also appears probable that there is no great fault or serious interruption in the continuity or regularity of the strata between the two shores on the proposed line of tunnel. The results of these investigations were submitted to M. Michel Chevalier and M. Paulin Talabot, and they were put in possession of all the information that had been obtained.

Such, then, is the history of the separate investigations which have been made into this important and interesting subject, and the general nature and result of those investigations. We will now proceed to the conclusions at which the members of the Committee of Engineers arrived after consulting together and comparing the several data.

They submit that it is evident that at some sufficient depth below the bottom of the Channel a tunnel could be constructed, so that, as regards superincumbent pressure only, it would be analogous to constructing a tunnel of similar length through a mountain so high as to prohibit intermediate shafts; it is further evident that any possible irruption of sea-water may be avoided by going deep enough below the bottom of the Channel. On the other hand, they observe that there is a limit to the depth at which the tunnel can be carried, from the necessity of approaching it from the shore and obtaining gradients for those approaches suitable for railway traffic. If the tunnel were carried through the upper or white chalk, or chalk with flints, apart from a possible irruption or percolation of water from the sea, fresh water might be encountered to the usual extent that it is met with in that formation. But the tunnel can be depressed so as to pass mainly through the lower or grey chalk, which is less permeable, and where the quantity of fresh water would be comparatively unimportant, provided no great fault or dislocation of the strata exists—and the investigations lead to the conclusion that no such great fault does exist. It is probable that at the depth below the bed of the Channel at which it would alone be prudent to carry the tunnel, any fissures that may occur in the chalk have been filled up, and that from this circumstance and from the nature of the lower chalk no more water will be met with than can be overcome by pumping.

With regard to the execution of the work itself, the Committee of Engineers consider it proper to drive preliminary driftways or headings under the Channel, the ventilation of which would be accomplished by some of the usual modes adopted in the best coal mines. All other questions in relation to the construction of the permanent tunnels would be decided from the experience gained in making the driftways, and it might even be deemed advisable to commence the formation of the permanent tunnels before the completion of the driftways, if circumstances indicated the desirability of that course. They propose that the tunnel should be of the ordinary form, sufficiently large for two lines of railway, and to admit of being worked by locomotive engines, and artificial ventilation could be applied. The desirability of adopting other modes of traction is left for future consideration.

Finally, the following general conclusions are submitted:—

1. That there is a reasonable prospect that the work can be accomplished, but that it would be improper to deny that it is attended with a certain amount of risk.

2. That this risk is limited to one contingency—viz., the possibility of sea water finding its way by some unforeseen fissure into the workings in quantity too great to be overcome. Apart from this risk, tunnelling in chalk is easy and rapid, and the execution of a tunnel of the length of the one under consideration is only a question of time and expense.

3. There seems to be no reason to assume that the tunnel would cost more than ten millions sterling, or that it could not be completed in nine or ten years.

4. The question of risk would be fully solved by sinking land shafts on each coast, and driving the preliminary driftways. This portion of the work being safely accomplished, the remainder would be of an ordinary character.

5. The possible loss would be measured by the cost of this preliminary work, which is estimated at one million and a half, and which could not exceed two millions, or (say) one-fifth of the whole cost of the tunnel.

6. That this risk should be undertaken by the Governments of France and England, if, after consideration, they deem the importance of the work and the probability of its completion sufficient to justify them in doing so.

Austin.

Towards the close of last year Mr. W. Austin proposed a submarine three-way tunnel under the Channel. His plan is to cross at a line of route extending from the landing piers at Folkestone to the landing piers of Cape Grisnez, but the tunnel will range below the sea bed, at a safe depth for practical permanent masonry arches, which will be constructed of imperishable materials, on an improved principle of vertebraical bond. The tunnel is intended to pass underneath the submerged island, called the Varne, laying near the mid-channel, and on which island Mr. Austin proposes to erect a central ventilating shaft or tower, which would be available as a permanent central lighthouse and naval signal shaft; also to afford a refuge or retreat for crews of ships wrecked in the Channel. As a fence or guard to this central tower or shaft, it is proposed to have two ranges of timber floating breakwaters, so as to act as floating retreats for ships, and protectors to the tower shaft from hurricanes or gales. Two other masonry shafts will be permanently constructed for ventilation and pumping purposes at each shore. Seven or eight temporary shafts will also be constructed in iron, and sunk and bored down to the tunnel arching, so as to give ventilation to workers in construction of the tunnels, and also to remove a portion of the excavated *debris*. These temporary shafts would be protected by moored floating booms or fences during the construction of the tunnel, and, on completion of the tunnel, the temporary shafts and booms would all be removed, having done their work. The gradients of inclines of the proposed tunnels are so arranged that the steepest gradients of the two shore inclines, or connections with the main land railways, in England and France, do not exceed 1 in 100, so that locomotives of moderate powers would accomplish the required work easily. Occasional openings are to be constructed in the masonry range of tunnel wall sides, so as to allow for a traverse of engines and carriages from one range of tunnel to another, in the event of any accident or emergency, when traverse frames would quickly shift the disabled carriages out of the way of an obstructed traffic.

Arrangements of a distinct and peculiar character were to be made for the proper ventilation of the tunnels, by air and water streams; also for the lighting the tunnels throughout, by perfected modes of gas burning, in specially constructed lamps, &c. Every facility will be provided for laying down a perfect system of telegraph conducting wires, which will be easily accessible for adjustment and repair; and the present great risks and accidents, now so often occurring, of tearing up telegraph cables by ship's anchors will then be avoided. Subways are to be constructed throughout the tunnel ranges, which will exhaust any accumulation of steam and waste waters, or temporary leakages, and which water will be passed through wellpits, and then ejected by pumps, connected with the great central shaft and two shore shafts. The advantages of three tunnel ranges will be to keep special, ordinary, and goods traffic trains separate and distinct, and thus obviate present causes of frequent accidents by clashing trains conveying passengers and goods on the same ranges.

Fowler.

Mr. John Fowler has for several years past directed his attention to the best mode of improving continental communication, and he prefers a system of ferrying the trains over in steam vessels rather than either a bridge or a tunnel. He has for the last two years associated with him Mr. Abernethy, and Mr. Wilson as acting engineer. After a careful examination of the harbours of Calais and Boulogne and the coast between them,

and after considering the general question, these gentlemen came to the conclusion that the following were essential requirements:—

1. Well-sheltered harbours with deep water on both coasts capable of affording ingress and egress at all times, irrespective of weather and tide.

2. A class of vessels, in the nature of ferry-steamers, of greater size and power, making rapid passages, and comparatively unaffected by wind and sea.

3. Safe and speedy means for the interchange of passenger traffic between the railways and such ferry-steamers, so as practically to form a continuous communication.

Conceiving that the harbour and pier at Dover afforded very inadequate terminal accommodation, and insufficient protection, particularly from easterly and south-easterly gales, they propose the construction of a new harbour westward of the existing pier, with a graving dock, a covered berth for the steamers, and hydraulic apparatus for transferring the trains from the quay to the steamers and *vice versa*. They consider that Calais, which was exposed to all winds from west to east, and was choked up with sand, offers no facility for a harbour for such steamers; and that the harbour of Boulogne, though more readily capable of partial improvement, partakes of the same natural defect of sand accumulation. They have, therefore, selected a point of the coast south of Cape Grisnez and north of Ambleteuse, near the village of Audresselles, where the deepest water was to be found near the coast, and sheltered from the northward and eastward by Cape Grisnez. They consider that, by constructing a harbour at this point, they will secure the shortest available sea passage, with clear navigation across the Channel from Dover, and with the advantage of the first-class light on Cape Grisnez as a guide on the darkest nights. They propose to connect this harbour by a railway four miles long with the Chemin de Fer du Nord, and to add a short branch for communication with Calais and the north.

The steam vessels the projectors of this scheme propose to employ between these harbours are to be 450ft. long, with 57ft. of beam, and 80ft. across the paddle-boxes, propelled by disconnected engines of 1,500-horse power, performing the voyage in one hour, and with comparatively little pitching or rolling in any state of the weather. They further propose to form covered stations for the interchange of passenger and goods traffic between the steamers and the shore, the transfer of the passenger carriages to be effected by hydraulic apparatus, irrespective of tide, in a few minutes. The steamers are to be luxuriously fitted up with first and second-class refreshment saloons, and with ladies' and private cabins; and, in addition to the saving of time in the sea passage, and on either coast, the passengers are to have the advantage of being able to secure and retain the seats in their railway carriages throughout the journey between London and Paris and other centres. At the same time the various saloons and cabins and the decks of the steamers will be at their service. The projectors believe that the extra comfort to the passengers afforded by such accommodation, and by the regularity of the service, is far more important than the saving of time that would be effected. They reject as insufficient and unsuited to the requirements of the present day, all partial improvements of Boulogne Harbour and the service between that harbour and Dover or Folkestone; and they estimate that these works, and the railway steam-ferry steamers, may be completed within three years, at an expenditure of £2,000,000.

REMINGTON.

In 1865 Mr. George Remington published a plan for the construction of a tunnel railway from Dungeness to Cape Grisnez. Before advancing his scheme Mr. Remington ascertained as far as possible the nature of the geological strata forming the bed of the Channel. He found that the coast in the neighbourhood of Dover and Folkestone consisted of chalk, which extends under the Channel to the Calais shore. As Mr. Remington concluded that this formation, which is in itself so very porous and contains so many fissures, could not be suited for tunnelling under a great head of water, he visited Dungeness, and examined the whole line of shore from Hastings to Dover, and satisfied himself that the Wealden formation, consisting of very strong clay, beds of freestone, and freshwater limestone, extended from Dungeness across the Channel to Cape Grisnez. Having concluded that that was the proper course for the construction of the tunnel, he at once proceeded to prepare plans and sections, and laid them before the Board of Trade, the Minister of Works, Paris, and others. This proposition has again been brought before the public within the last few months.

The line is intended to commence at the town of Lydd, where it will join the branch railway from the South-Eastern at Appledore. It will descend from Lydd at an inclination of 1 in 70, the distance of $3\frac{1}{2}$ miles to the point of Dungeness, where the level of the rails will be 240ft. below the level of low-water spring tides. The rails would then rise from Dungeness shaft at the rate of 1 in 3,795 for about 7 miles, and then fall at the rate of 1 in 1,200 for about 8 miles, to the centre shaft on the "Ridge;" from thence fall at the rate of 1 in 3,265 for 11 miles to Cape Grisnez, and then rise at the rate of 1 in 70 and 1 in 81 to join the French railways.

The height of the tunnel will be 30ft. from the soffit of the arch to the centre of the invert, and there will be a clear headway of 20ft. for the trains; the space between the rails and the invert will be occupied by a sewer, running along the centre line of the tunnel, and on each side of it two air tunnels, for the purpose of providing ventilation. The width of the tunnel will be 25ft., it will be constructed of brickwork and masonry, surrounded with concrete, and also a mass of concrete will be placed upon the invert surrounding the air and drainage tunnels, and forming a bedding for the sleepers of the railway.

There will be three main shafts of large dimensions. The centre shaft on the "Ridge" will be protected by a breakwater, formed of rubble and faced with ashlar. The other shafts are to be effected by means of wrought-iron tubular piles from 8ft. to 10ft. in diameter, the inside strengthened with plates on the cellular principle. These piles will be provided with valves to regulate the ingress and egress of water during the time of sinking into position, and when sunk they will be supported by proper guy chains and tackle from anchor moorings placed in various directions around the piles, every pile forming a shaft of sufficient length to reach the entire depth of water and through the bed of the Channel down to the level of the tunnel. It is intended to weight the lower end of the piles, and to sink them into position on the principle of the angler's float. The water will then be pumped out by steam power, and the soil be brought up from the interior and cast over on the outside, forming a cone round the pile. Mr. Remington estimates the cost of these works at £6,998,200.

MARSDEN.

Mr. Charles Marsden's scheme, which was brought before public notice in April last, consists of a tubular tunnel, made of boiler plate, and having a double skin, on the well-known principle used in shipbuilding, the annular space being filled in with artificial stone. Mr. Marsden proposes to carry pipes for ventilating the tunnel, as well as pipes for water, sewage, and telegraph wires, at the top of the tunnel. At the bottom runs the line of road, on which the railway is laid. The ventilating pipes are formed with longitudinal slots. Air is to be forced from the shore end into these tubes, which will pass through the slots into the tunnel, and ventilate it. Mr. Marsden has a special plan for jointing the several lengths of the tube. It consists in fitting one end of the tube with a series of stepped or curved plates, which are secured in place by screws or rivets. The adjoining end of the next pipe is fitted with a bulge or socket. Another series of plates is employed, one end of which is forced under the open end of the stepped plates. They are prevented from falling out by being guided into position by a number of rings, fitted on the end of the pipe. Another ring is employed on the outside, to hold the plates. A portion of this ring is looped or pocketed, to enable the plates to be placed in position. When passed through this looped portion they are made to slide round in succession, so as to meet each other, until the whole diameter of the pipe end is covered. They are then firmly secured in place by keys being driven in between them and the ring. The loop is then filled in with a wedge-piece, and thus the whole joint is made sound, flexible, and tight. The joint being flexible admits of its adapting itself to the general contour of the bed of the Channel, and following any undulation caused by a settlement of the soil.

It is proposed to lay this tunnel in the following manner:—A cutting is first to be made on land about two or three miles in length, gradually descending to a point where the water is about ten fathoms deep. A sea wall is to be built about 50ft. from the water's edge. A portion of a cylinder is to be built in the wall and made water-tight, and the sea is then to be allowed to flow up to the wall, so that the next cylinder can be floated and placed in a proper line. The same with the next, and so on, lowering them from a raft, which they will form. Mr. Marsden proposes that divers should cut through moderately high projections in the Channel bed, and also the levels, making a trough, into which would be lowered clay, the divers puddling the same, and thus forming a bed for tubes to rest upon. The cylinders can be made on the coast, and, when finished, have their ends stopped and be towed to the spot required, half filled with the artificial stone composition. Four or six of the tubes can be used to form a raft or stage to carry the machinery for lowering and fixing the tube in place, and afterwards can be used on the land end to finish the connection on shore. By this means Mr. Marsden estimates a working tunnel could be completed in about four years, without the danger of its being flooded. The heading at each end is to be made in three or more parts, and well secured with india-rubber, or other packing, and screw bolts. The heading, after two or three cylinders are fixed together from the outside, is to be removed from the inside, making an entrance from the shore end into the next tube, and so on throughout. The double cylinder is braced to keep the inner from the outer. The space between the two, which is 5ft. or 6ft., is to be filled with tarred granite and asphalte, which will form a perfect wall. As Mr. Marsden considers it impossible to have a ventilating shaft in the Channel, he proposes to have machinery on each shore to abstract the vapours from, and also to force air into, the tunnel. Mr. Marsden's estimate for a tunnel between England and France on his principle is £12,260,000.

MACHINERY FOR SHAKING STRAW.

MR. JOHN WILSON, of Poppleton, York, has patented some improvements in machinery for shaking straw. His invention consists of novel arrangements for agitating the sifter or riddle and giving it a reciprocating or rocking motion necessary for the falling of the grain on to the delivering board. The shaker consists of a series of leather bands (with spaces between each) and cross bands attached to bars at each end of the machine, and extending from the feeding hopper and drum to the delivering board. It is actuated by two hangers or rods suspended vertically within each side of the machine by means of pivots. These hangers are attached to iron shoes, which contain grooves in which a shaft works provided with an eccentric at each end. The shoes being attached to the delivering board, the revolution of the eccentrics gives an oscillating motion to the shoes, hangers, and board, and also to the leather shaker, alternately slackening and tightening each end, the shaker being supported midway from the board by uprights, leaving two divisions of the shaker in a slack position while the machine is at rest.

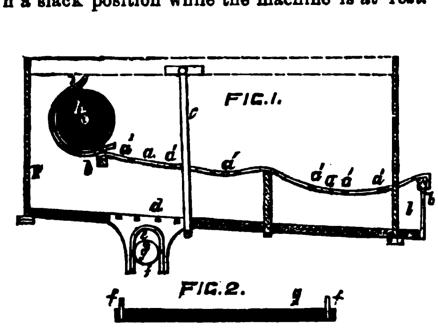
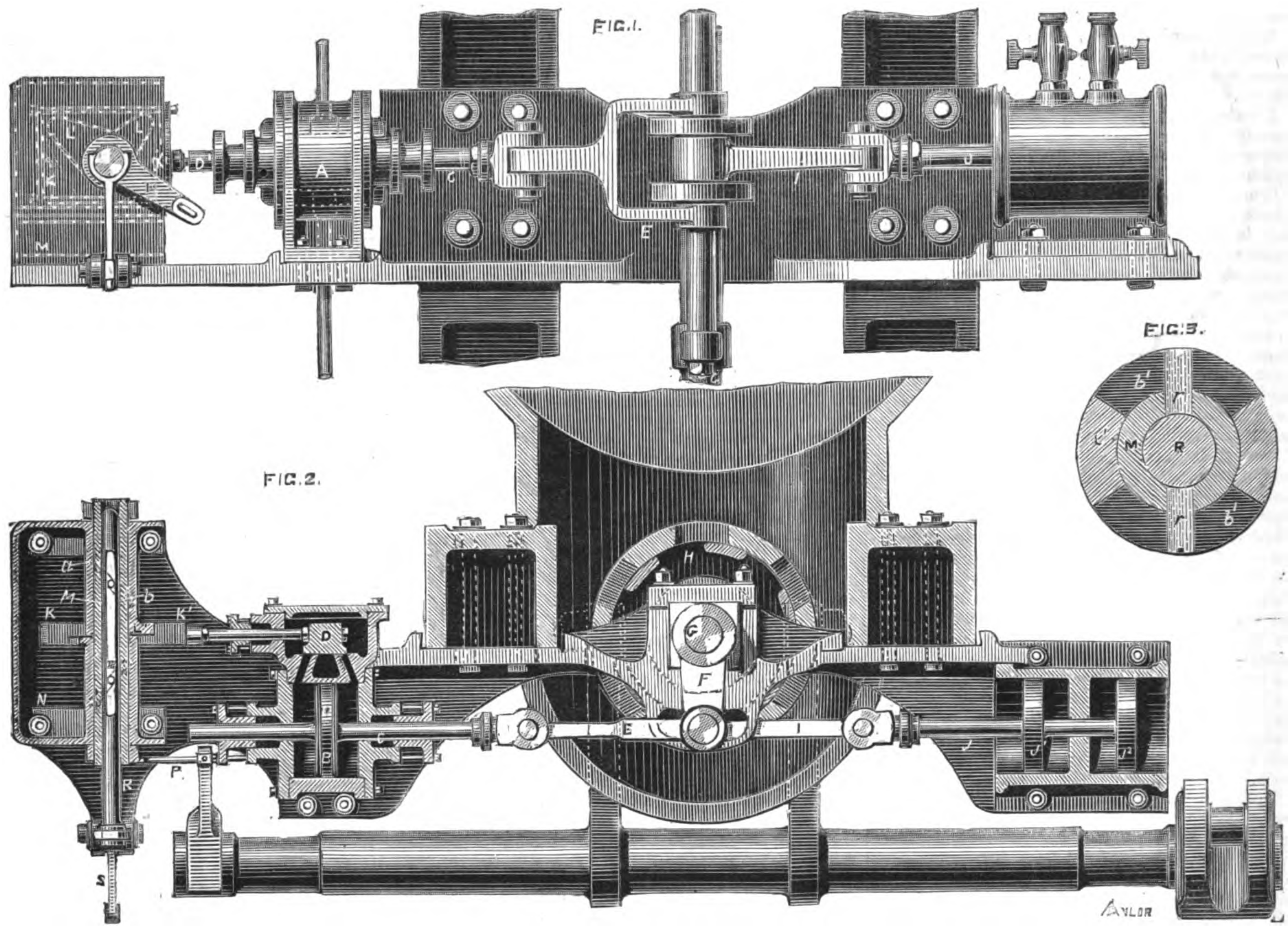


Fig. 1 in the annexed cut shows an internal side view of the shaker, and fig. 2 a longitudinal view of the spindle and eccentric bosses, which actuate the shaker *a a*, fig. 1, which is formed of a series of leather bands placed side by side, having cross bands at $a^1\ a^1$. The ends of the shaker are attached to bars *b b*. *c* is one of the hangers, of which there are two, one on each side of the machine or interior of the thrasher. Each of them is fastened to shoes, one of which is shown at *d*, in which a socket *e* is formed to receive the eccentric boss *f* on the spindle or working shaft *g*, fig. 2. The revolution of the spindle causes an oscillating or rocking motion of the shaker at the centre, alternately tightening and slackening each side or semi-surface, and thereby effectually shaking the straw. *h* is the drum, and *i* the hopper, into which the straw is fed; *k k* are the wooden hangers, and *l* part of the framework.

IMPROVED METHOD OF WORKING CUT-OFF VALVES.

BY MESSRS. JOHN WOOD AND CO.



WORKING CUT-OFF VALVES.

MESSRS. JOHN WOOD and Co., of Sowerby Bridge, Yorkshire, have patented some improvements in cut-off valves. The improvements consist in the application of a separate small steam cylinder and piston with ordinary slide valve. The piston rod is connected with another rod in communication with and giving motion to the spindle of the cut-off valve. The accompanying engraving shows at fig. 1 an elevation, and at fig. 2 a plan of these improved arrangements; fig. 3 being an enlarged section on the line *a b*, fig. 2. A is the small steam cylinder with its piston B and rod C, and D is an ordinary slide valve. The piston-rod C is connected with a rod E attached to a lever arm F fixed on the spindle G of an ordinary piston valve H, and to this arm F is another rod I, connected to a piston-rod J, on which are two pistons J^1 and J^2 in a double cylinder open at the ends, forming air cushions. The spindle D^1 of the slide valve D is connected to a rectangular frame, on the two opposite sides of which are formed shoulders K and K^1. Within this frame are two cams L and L^1, mounted upon a hollow spindle M, supported in bearings of a frame N. On one end of the hollow spindle M is fixed a lever arm P, which may be connected by a rod to a lever on the ordinary rocking shaft (by which the slide motion of piston valve is obtained), or this rod may be connected to an eccentric on the flywheel shaft or other convenient part of the engine. R is the slideable rod fitting within the hollow spindle so as to be capable of sliding or being moved endwise by the action of the governors upon the bell-crank lever S. On this rod are two pins *r*, which pass through slot holes *m* in the hollow spindle, which slot holes are parallel with the axis thereof, and these pins also enter slot holes *l* and l^1 in the bosses of the cams L and L^1, which slot holes are oblique to the axis thereof.

It will be readily seen that any variation of the speed of the engine will be communicated to the slide-rod K, which will act upon the cams L, turning them right or left upon the hollow spindle, so that the rocking motion given thereto by the lever arm P may cause them to actuate the slide valve D accordingly, thus admitting steam to either one or the other side of the piston B, which being moved will operate the lever F, and consequently the piston valve H, causing the steam to be cut off sooner or later, as required. To prevent concussion of the piston B against the ends of the steam cylinder the cylinder and pistons J and J^1, which form air cushions, are provided, the air being admitted through taps T, which may be regulated to admit more or less, as required. This apparatus may be worked by either steam, air, water, gas, or vacuum, and it is equally applicable to slide valves and to all classes of engines wherein cut-off valves are used.

IMPROVED BICYCLE VELOCIPEDE.

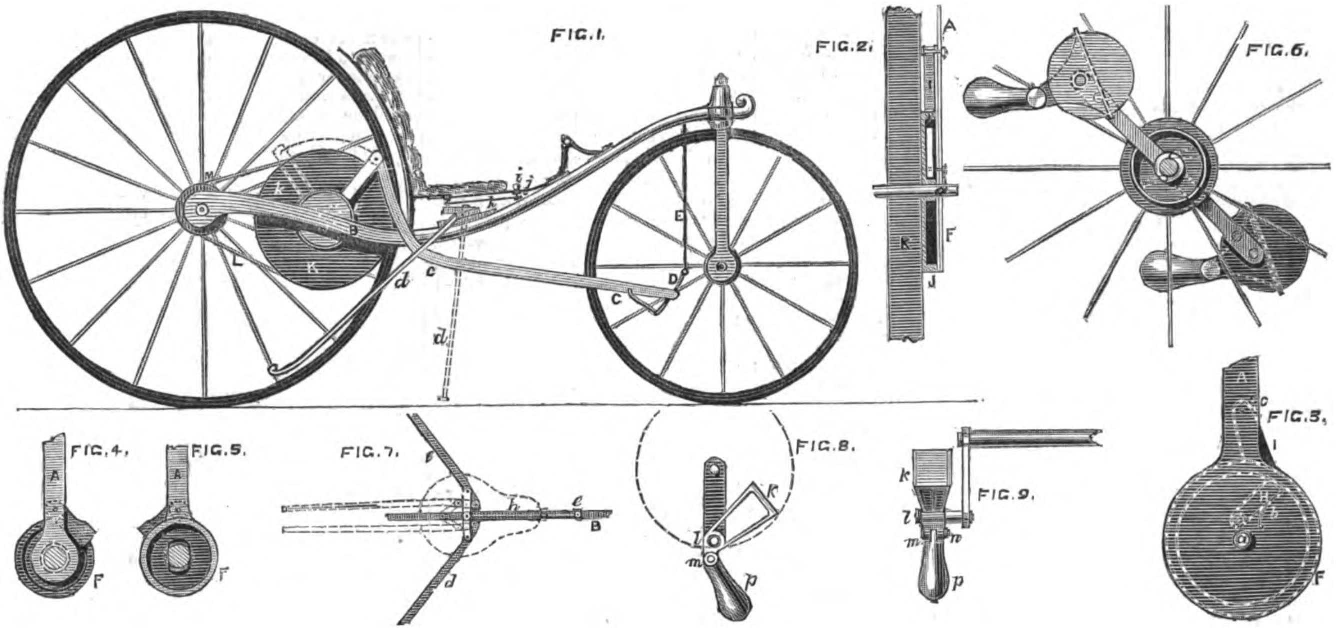
THE employment of lever power to the driving wheel of velocipedes forms the subject of a patent which has been secured by Mr. W. W. Hooper, of Bow, and Mr. J. D. Hooper, of Millwall, through the agency of Messrs. Robertson, Brooman, and Co., of 166, Fleet-street. The inventors connect a lever with the axle of the driving wheel, or to a wheel so placed that it may be connected with the driving wheel to multiply its revolutions. The lever is made to act on the wheel with which it is connected by means of a pawl furnished with lugs or claws, which impinge against or grip a flange on the wheel axle in one course of their stroke, and are released on their return stroke. Springs are employed in connection with the levers and pawls, to ensure their proper working. Fig. 1 of the accompanying engraving is an elevation of a bicycle velocipede. A is a lever, of which there are two, one on each side of the beam B; these are connected to the treadles C C, which are depressed alternately by the feet of the operator. The ends of the treadles C are connected to stirrup or foot-plates D by pins; the upper ends of the foot-plates and the forward ends of the treadles are held by a rod or wire E fastened to the beam B. The lever A is attached to a ring or disc F working on a stud *a* fixed to the beam; the disc F carries two pawls or claws H I, as shown more clearly in the detached sectional and face views in figs. 2 and 3. These pawls are brought into action on the forward movement of the levers A by jambing the ring of the wheel or disc K, which is mounted loosely on the same stud. The outer edge of this wheel K is grooved for the band or chain L to run in, and by which the rotary motion of the disc K is communicated to the driving wheel M. There are springs *b c* on the pawls to keep them always bearing against the faces of the ring J.

In some cases, the inventors employ a single pawl of the form shown in fig. 4. This pawl has two lugs on it, so that as the lever A is moved in one direction, the lugs grip the ring F, propel the vehicle, and in the reverse movement the lugs slide over the ring without gripping it. Fig. 5 is a similar view to fig. 4, but in this action the lever has a slight rising and falling movement imparted to it, so as to lift the pawl and cause the lugs to grip the ring more firmly. Fig. 6 is a view of the central portion of a wheel with the pawls and foot-plates fitted to act upon a ring on the nave itself. The invention consists, in the second place, in supporting and preserving the equilibrium of the vehicle by means of movable arms or struts attached in such a way that they may be readily extended to either side. This is effected by jointing to the beam B two legs or rods *d e*, as shown in fig. 1 and in plan in fig. 7; these legs are likewise jointed to links *f g*, by which the necessary motion is imparted to them by means of a rod or bar *h* moved by the operator when he wishes to get on or off the vehicle. The handle or knob *i*, by which the bar is moved, is fitted in a slotted guide *j* to ensure the legs working in the proper manner. When the knob is moved towards the front of the vehicle, the legs are caused to spread outwards and occupy the positions indicated in full lines in fig. 6, and when the knob is drawn back, as in fig. 1, the legs fold in towards the wheels as shown.

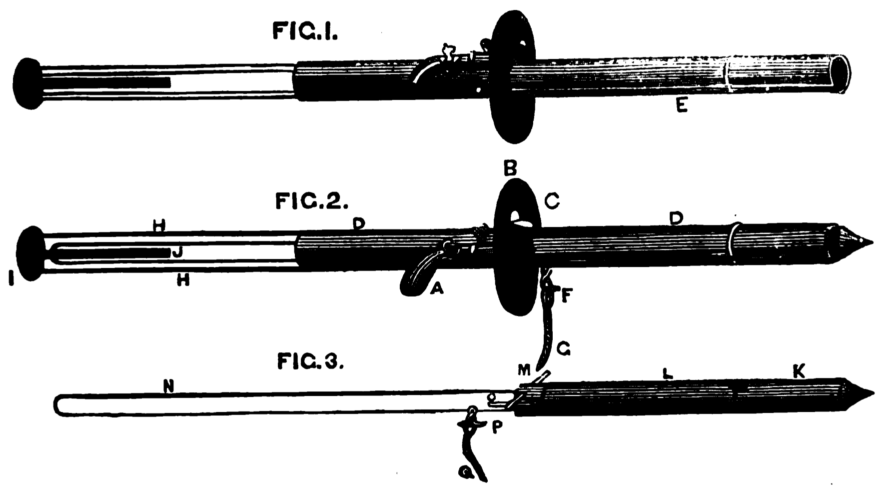
This invention further consists in providing the cranked portion of the driving wheel or wheels of ordinary velocipedes with foot-plates at a distance above them, whereby wheels of larger diameter than usual can be employed. Fig. 8 is a side view of a foot-plate *k*; it is attached at its lower part to the crank pin *l*, as shown in fig. 9. Below the crank pin and connected to the plate are two cheeks *m n*, through which a bolt passes, and which supports a balance weight *p*; a nut on the end of the bolt can be screwed up or loosened in order to adjust the weight *p* at any inclination to the foot-plate.

IMPROVED BICYCLE VELOCIPEDE.

BY MR. W. W. HOOPER AND MR. J. D. HOOPER.



THE ROCKET HARPOON GUN.



THE ROCKET HARPOON GUN.

THE gun represented in the annexed engraving has been employed for some years in the whale fishery round Iceland with great success—forty-six whales having been captured by two small steamers, cruising off the coast of Iceland, in the course of two months during the summer of 1866, and forty, during a like period. in 1867. These whales belonged to a class known as the "Sulphur bottom," and are admittedly the most difficult to capture, and such as ordinary whalemen think it useless to attempt to take. The inventor of this gun was for many years one of the most successful and experienced whaling captains sailing from America; and the present efficiency of the weapon has been attained only after many years of labour and experiment, and after having been practically tested in connection with several whaling expeditions from New Bedford, U.S. It possesses many advantages over the old method of whaling; and this one especially, that the rocket harpoon, with line attached, being fired from a gun poised on the shoulder, kills the whale almost instantaneously—the rocket, by means of a ten-second fuse, firing a shell which explodes on penetration.

In our engraving, fig. 1 represents the gun; fig. 2, the gun and rocket harpoon; and fig. 3, the rocket harpoon. In fig. 2, A is the pistol, which ignites the rocket; B is the protecting disc, through the opening in which, C, the marksman takes aim. This jointed cover or flap C is folded down during the time of taking aim, but on firing, the action of the back fire of the rocket immediately closes it, thus protecting the eyes of the marksman; D, the metal tube of the gun, through which, as in fig. 1, marked E, will be seen a slot or opening underneath, for the linked hook F, attached to harpoon, to escape with the rope G; H, the four parallel rods, of about 10in. in length; I is the disc against which the back fire of the rocket acts, escaping through between the bars; J are rods attached to disc to keep the harpoon in position. In fig. 3, K is the shell, on the rear end of which is screwed L, the rocket; M, the barbs on harpoon N; two are open showing how they act when the strain is on, the others are closed as in O, their position on penetration; P, the link on harpoon, with rope attached, Q. Weight of gun and harpoon, 30lbs.; charge in shell, 1lb.; charge in rocket, 2lbs.

In the use of bombs and other explosive projectiles, as heretofore used, the great objection has been the laceration of flesh, and the consequent weakening of the hold of the barbs of the harpoon on the whale; but in the use of this weapon no such objection can be made, from the fact that the rocket carries the harpoon with sufficient force right into the body of the whale, where the shell explodes, causing death. The laceration of flesh is only in the immediate neighbourhood of the bomb, and some distance apart is the barbed part of the harpoon. As soon as a strain is brought to bear on the harpoon, the barbs open and retain a secure hold by getting imbedded in the tough integuments of the hide, together with the blubber, through which the weapon has penetrated. In every case the barbs would break before allowing the harpoon to "draw out."

In the class of whaling in which this gun has been used, the whales had to be hauled up from the bottom, sinking when dead; and, although the rope was adapted to bear a strain of three and a half tons, there was never occasion to attribute the loss of a whale to the "drawing out" of the harpoon—either rope or barbs being sure to give way before such a thing could happen. The bomb is not explosive on contact, the rocket, by means of a ten-second fuse, igniting it. The composition employed in the manufacture of the rocket is of a peculi kind, and has been exactly graduated, after man experiments, to the distance which it is required carry, say from seventy to ninety feet. The agen for this gun is Mr. W. O. A. Lowe, of 9, North John-street, Liverpool.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

ON Saturday, the 16th inst., the members an friends of this institution, to the extent of ove 150 in number, paid a visit of inspection to the Abbey Mills Pumping Station of the great Main Drainage Works, West Ham. The day was not all that could have been desired for such a purpose, for at the time arranged for the arrival of the party rain fell freely and the wind swept over Plaistow Marshes in fitful gusts. Foremen Engineers, however, are, as a rule, not easily diverted from the realisation of a fixed purpose, and on this occasion, they were not deterred from it by adverse meteorological influences.

At the entrance gate of the high and middle level sewers, which cross the Stratford-road immediately beyond Stratford Bridge, the Associated Foremen, headed by their president, Mr. J. Newton, and accompanied by Mr. Richard Moreland, Mr. W. Todd, and several other engineering employers, were met at half-past three by Mr. G. Usher, resident superintendent engineer of the Abbey Mills Station. Passing along the grass-covered embankment through which the sewage tunnels at this point are laid, an excellent view was obtained of the magnificent engine-house and its appurtenances, which are on the south-west side of the embankment. The two chimney shafts, each 209ft. in height and standing isolated on either side the building, appeared like sentinels constantly on

guard. These stately columns are externally octagonal in form, and are capped by ornamental iron roofs, pierced for the egress of smoke. The engine and boiler houses form one building, the style of architecture being mixed. The decorations, which are very elaborate, consist of coloured bricks, encaustic tiles, and stone dressings, floriated carving being introduced at the caps of piers, columns, and pilasters. A cupola or dome of a highly ornamental character surmounts the engine house, its topmost point being 110ft. above the floor line. It must be admitted that the effect of the whole of the exterior of the building is imposing in the extreme, and one only regrets that the locality in which it is placed is comparatively an unfrequented one. The structure is apparently "born to blush unseen," whatever may be said of its "wasting its 'sweetness' on the desert air." On entering the building, on Saturday, a number of drawings on a large scale, and illustrative of the arrangements of the station, were found on the walls of what now seems a vestibule, but which is designed for a workshop, and these were clearly explained by Mr. Usher. Right and left of the vestibule and reached by descending staircases of iron are the stoking floors, in front of the boilers, of which there are in all sixteen, in two series of eight each. The disposition of the boiler houses is in all respects admirable, and tramways for the conveyance of coal, by trucks, from the vaults to the furnaces make the fitments complete. On ascending, the party was at once introduced into the engine house, where the scene was striking in the extreme. The height of the building, the rich elaboration of all its details, its cruciform shape, and the colossal and gorgeously fitted up engines within it, tended to convey the idea that it was a temple consecrated to the genius of science rather than an ordinary place of shelter for steam engines.

It is impossible, without occupying too much space, to describe minutely the grandeur of the interior of the building, and no other word than "grandeur" will convey an impression of its beauty. The engines are eight in number, and are each of 142 horse power. They are disposed in pairs, and in such a manner that the eight steam cylinders stand round the centre of the edifice under the dome, from which the engines themselves are lighted. By this plan the visitor has an opportunity of surveying the mechanical excellence and peculiarities of the giant motors, which are the work of Messrs. Rothwell and Co., of Bolton, Lancashire. On the occasion of the Foremen's visit the whole of the engines were put to work simultaneously, by direction of Mr. Bazalgette, who was unfortunately prevented by illness from attending in person, and the effect was one which will not be easily forgotten. Subsequently, the visitors ranged over the establishment and left no accessible portion unexplored. For Mr. Usher it is but justice to say they found a most intelligent and valuable guide, ready at all times to answer questions, and untiring in his efforts to satisfy inquirers. Under these circumstances, as may be imagined, the inspection was of a kind most instructive and gratifying to the inspectors. Two hours were spent in unravelling the mysteries of the Abbey Mills Station, the gigantic pumps of which place lift the sewage of districts covering an area of 25 miles a height of 36ft., and whence it flows to the outfall at Barking.

At the termination of the visit some seventy of the visitors adjourned to the Royal Hotel in the Bow Road, where a collation was provided for them. Mr. J. Newton presided at the festive board, and was supported by Messrs. Moreland, W. Todd, J. Timme, J. Campbell, W. Newton (of the Metropolitan Board of Works), G. Usher, Captain Rintoul, and others. The Chairman, in proposing as a toast the "Metropolitan Board of Works," took an opportunity of expressing the gratitude of the Association for the kindness shown to it on this occasion, and spoke eulogistically of Messrs. Bazalgette and Cooper. Mr. W. Newton responded in an eloquent manner, and justified the large expenditure of money by the Board of Works in erecting the Abbey Mills Station. "The Engineering Staff of the Board of Works" was next given from the chair, and to this Mr. Usher replied. For "The London Employers of Engineering Labour" Mr. Moreland admirably responded, and for "The Association of Foremen Engineers" its President answered. The whole of the proceedings were of an interesting and pleasant character, and certainly this, the first excursion of the Association, was in all ways a marked success. No doubt it is the happy prelude to many other excursions of a similar nature.

Accounts are given of the healing properties of a new oil, which is made from the yolks of eggs, and is said to be much employed by the German colonists of South Russia as a means of curing cuts, bruises, scratches, &c. The eggs are boiled hard, the yolks removed and crushed, and then placed over a fire and stirred carefully till the whole substance is on the point of catching fire, when the oil separates and may be poured off. Hen-eggs are considered the best, and nearly two tea-spoonfuls of oil may be gained from a single yolk.

MANCHESTER STEAM USERS' ASSOCIATION.

The last ordinary monthly meeting of the executive committee of this Association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, September 28, 1869, Mr. Hugh Mason, of Ashton-under-Lyne, vice-president, in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, which on that occasion was for two months, and is given in abstract as follows:—During the past two months, 455 visits of inspection have been made, and 995 boilers examined, 643 externally, 5 internally, 20 in the flues, and 327 entirely, while, in addition, 8 new boilers have been tested by hydraulic pressure. In these boilers 147 defects have been discovered, 22 of them being dangerous. Furnaces out of shape, 5; fractures, 28; blistered plates, 12—1 dangerous; internal corrosion, 13—4 dangerous; external ditto, 23—8 dangerous; internal grooving, 8; external ditto, 2; feed apparatus out of order, 2—dangerous; water gauges ditto, 13; blow-out apparatus ditto, 1; safety valves ditto, 8—6 dangerous; pressure gauges ditto, 8; boilers without glass water gauges, 8; without feed back pressure valves, 15; cases of deficiency of water, 1—dangerous.

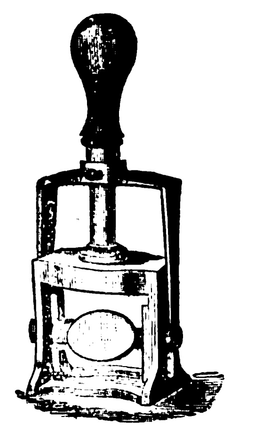
On the present occasion I have to report the occurrence of 6 explosions, by which 6 persons were killed and 4 others injured. Not one of the boilers in question was under the charge of this Association. The scene of the catastrophe has been visited by the officers of this Association in five of these cases, and particulars of the exploded boilers carefully taken, while information with regard to the other explosion has been obtained by an engineer residing on the spot. All the explosions referred to resulted, as usual, from the simplest causes, four of them being due to bad boiler making, and the fifth to defective condition and bad boiler making combined, while all of them would have been prevented by competent inspection. In addition to the above, an explosion, by which one man was killed, occurred on July 19 last, but of which information was not received until after the last monthly return was made up.

A fatal case of scalding may also be referred to, which occurred in a somewhat remarkable manner. The driver of a colliery locomotive engine was letting a train, consisting of some ten or twelve coal waggons, down an incline, the train being in front of the engine. These waggons had to pass under a roadway bridge, which, though affording sufficient headway for them, did not do so for the engine, so that the driver should have pulled up before arriving at this bridge. The brakes, however, were overcome by the steepness of the incline, and, notwithstanding that the driver reversed his engine, the train ran on, passing under the bridge, and dragging the engine after it. A collision consequently occurred, when the dome was swept off from the top of the boiler, and blown by the rush of steam and hot water to a considerable height, while, at the same time, the driver was so seriously scalded that he died a day or two afterwards. Literally speaking, this was a steam boiler explosion, as the boiler was rent, and steam and water rushed out with considerable violence and force. Since, however, the explosion was not due to any defect in the boiler, but arose from extraneous circumstances, it has not been thought desirable to insert it in the ordinary list of boiler explosions. The following is a statement of explosions from July 24, 1869, to September 24, 1869, inclusive:—August 11, multitubular marine (internally fired), 3 killed; August 16, single-flued or Cornish (internally fired); September 1, vertical (internally fired), 1 injured; September 3, two-flued or Lancashire (internally fired), 1 killed and 1 injured; September 8, single-flued or Cornish (internally fired), 1 killed and 1 injured; September 16, breeches (internally fired), 1 killed and 1 injured; total, 6 killed and 4 injured.

An announcement made by Messrs. Horne, as agents of the directors of the Services Maritimes des Messageries Imperiales, seems to discountenance the doubts recently expressed as to the Suez Canal being immediately ready for general traffic. They notify that the steamship "Godavery" will be despatched from Marseilles on November 10 to Port Said, where she is expected to arrive on the eve of the inauguration of the canal. After the opening ceremony she will pass through the canal and continue her voyage direct to Calcutta. The "Godavery's" extreme length is 93 metres. Her tonnage (English) is 1,380 gross and 965 registered, and her draught with full cargo is 5 metres 41 centimetres.

THE TELEGRAPH ENDORSING STAMP.

The annexed cut illustrates a very simple but valuable machine for endorsing documents, such as bills of exchange, bank cheques, &c., &c. It is so arranged that the dates can be removed, thereby making it invaluable for all purposes of endorsement. It operates with perfect cleanliness, and is stated to be capable of producing 5,000 impressions per hour without applying fresh ink or the use of separate ink pads. The advantages which this machine possesses over others are varied and essential. First, the spring is enclosed in a cylinder in the handle and cannot by any possibility become loose or disarranged. Second, the piston, instead of being a solid body, is a hollow tube so connected with the pad as to act as a reservoir for the purpose



f supplying the ink to the pads, thus obviating the n clean necessity of constantly supplying ink, as the e servoir contains sufficient for fourteen days' consumption. Third, it possesses a thumb-screw which acts as a lock instead of the cumbrous lever of other machines, as the lever from its protrusion is always in the way and therefore objectionable. This invaluable machine is manufactured by Mr. H. B Sale, of 65, Constitution-hill, Birmingham.

ON THE MONCRIEFF SYSTEM OF WORKING ARTILLERY AS APPLIED TO COAST DEFENCE.

By Captain Moncrieff.

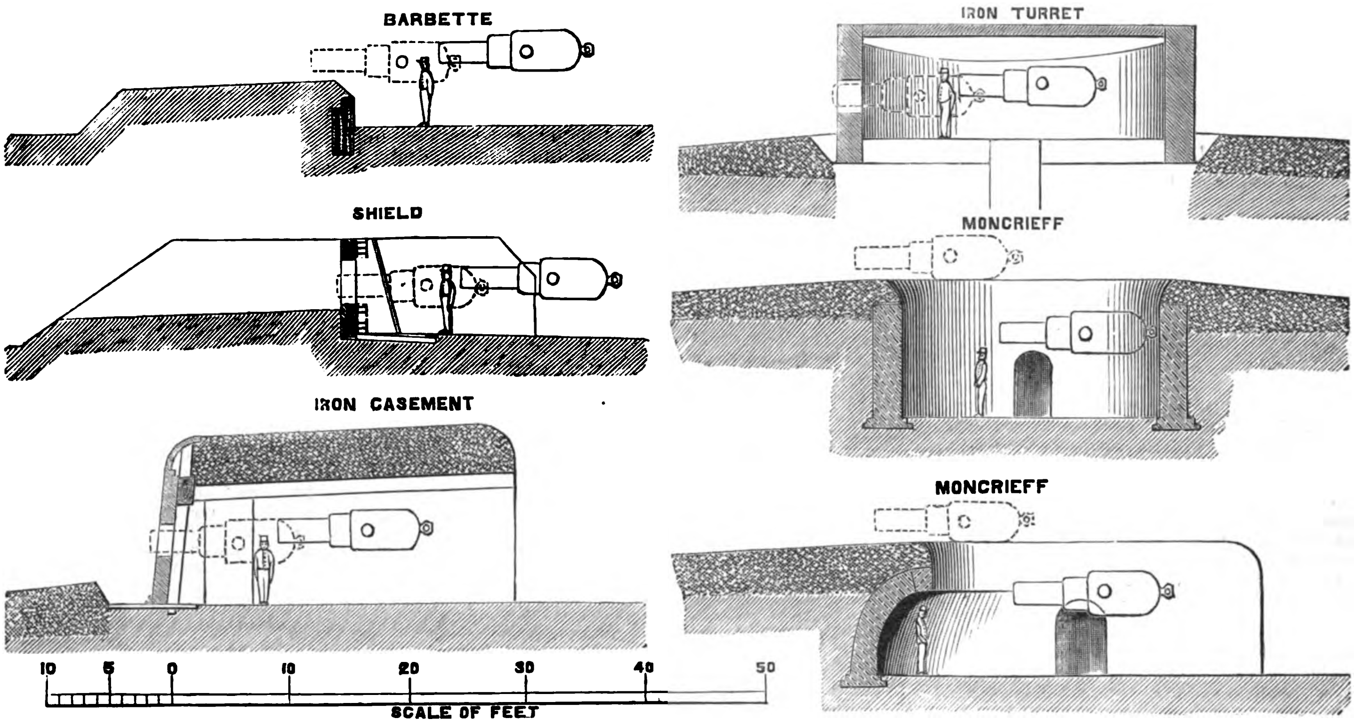
(Concluded from page 279.)

The second part of the system, viz., the profile of the batteries, is of the highest importance, because unless it is attended to great advantages are lost. This, unfortunately, makes the system extremely difficult of adaptation to existing works. In order to get the full advantage of it no exterior slope of parapet should be exposed to the view of the enemy. This prevents him from being able to tell whether the fire be correct or wasted, and affords no means to him of correcting error. The battery in fact is masked; so that at some distance, or in dull weather, a moving ship would have considerable difficulty in laying her guns on one battery, and still more difficulty if there were several batteries judiciously placed for the purpose of deceiving the eye. It can easily be understood that the slightest error in elevation would either carry the shot harmlessly over the battery or else cause it to ricochet off the glacis or superior slope. In fact, when the gun is down the enemy has nothing to aim at but an undefined horizontal line. In connection with this I should mention a very interesting fact, brought out by General Simmons at the last discussion of the Royal Engineers on a paper of mine. He stated that on analyzing the range reports of the Armstrong and Whitworth competitive trials, which were very carefully conducted, he found that the mean horizontal and vertical errors were very different. The horizontal error increased almost directly as the range, that is to say, at 400 yards it was four times as great as at 100 yards, but that the vertical error went on in a rapidly increasing progression, showing that it would be much more difficult to hit a low object than a high one of the same area. This law has an important bearing on the subject, and should not be lost sight of in designing defensive works of any kind. It will be observed that the interior slope of the parapet gives the most complete protection to the men, especially when the dome-form is adopted.

Up to the present time the new system has only been considered as an improvement, and its value has only been estimated as an adaptation to existing forts, and there are no proposals for applying it *per se*. I am extremely anxious to impress on you and on my countrymen that its full value cannot be seen in this manner, and that it suffers injustice by being thus treated. I trust its proper use will be fully discovered before the inevitable lesson is dictated by war, and that it may be applied in

ON THE MONCRIEFF SYSTEM OF WORKING ARTILLERY AS APPLIED TO COAST DEFENCE.

EXAMPLES OF FIVE METHODS OF MOUNTING HEAVY COAST ARTILLERY.



works expressly designed for it, and not merely adapted to its use.

The third part of this system consists in its application to given positions, the disposition of the batteries, and methods of working them in concert with or in support of each other. If I might be excused for using the paradox, the system for coast defence consists in the absence of any defined system; that is to say, instead of making large regular forts, and forcing surrounding circumstances into harmony with them, every accident of the ground in this case would be seized, where available, and small batteries, consisting of a few guns, or even one powerful gun, laid down so as not to take away the natural aspect of the position. These batteries would be well retired from the channel, and placed so as to support each other in case of attack, and should, when circumstances permit, afford flank defence to each other, in conjunction with obstacles of any character that could be conveniently employed, and with strongholds for infantry and light artillery, commanding, if possible, the sea-batteries, so as to make them untenable by an enemy, and so placed as to be in the best position for a reserve, ready to support any point attacked; the whole connected with good and sheltered roads. In stopping the passage of a navigable river or channel, for instance, the guns, instead of being massed, would be scattered round the points where marine obstructions were placed. These guns would be disposed in such a manner as to retain as much as possible for the defence the advantages of a free lateral range, converging fire, and different amounts of command. In other words, the method consists in placing in position the heaviest and most powerful artillery to the greatest advantage, making that the first consideration, and afterwards protecting the batteries, by separate and distinct arrangements easily devised by officers on the spot, against assault by any force that ships might land for that purpose.

When an object is to be attained I prefer to grapple with the most difficult and important part of it first,—do that well,—and meet the other requirements afterwards, with as little loss of efficiency as possible. The first object of coast defence is to meet and defeat the attack of powerful ships; the next is to protect the shore batteries against landing parties. It must not, however, be forgotten that there are positions of such importance that they might be attacked by an army on land. Such positions must either be defended by another army placed in a favourable position by such arrangements as those above referred to, or else by regular and complete earthworks thrown up in time of danger, which would enable a still smaller garrison to resist anything but regular approaches. There are, however, few coast positions of such importance as to draw the attack of a whole army; and such positions, as a rule, are now provided with regular works of a very high order; whereas there are many positions exposed to a heavy naval attack, such as our large mercantile ports, &c. They are almost invariably centres of population, who require only fieldworks and good small arms (which are now more powerful than ever) to repel the most determined attacks of any numbers that war ships could land.

I believe many of the present coast works are defensible only against a *coup de main*. Wherever land attack is of more importance than naval, the character and efficiency of sea batteries must give precedence to those considerations which provide against assault. On the best provisions for meeting this I do not pretend to give an opinion. In such cases, the possibility of attack by both direct and vertical fire must be kept in view. Where my system is employed for arming such works, one or two precautions would increase the power of resistance. 1st. The large guns for operating against ships, with traverses and parados to each, should be kept as far apart as space will admit. 2nd. Ample and thoroughly complete bomb-proof cover for the whole garrison should, if possible, be supplied in the middle of the work, with arrangements for interior defence (not barracks, but places for emergency), thoroughly secure from vertical fire—good and healthy barracks for the men being made independent of the works, and by preference kept out of the way. 3rd. Howitzers and light artillery ought to be kept in reserve, in bomb proofs constructed for the purpose, and (with the new system this can easily be done) also with the means of changing these to any required face.

The dispositions of defensive batteries such as those I have very imperfectly attempted to describe would not be complete without good arrangements for internal communications, not only by roads but by telegraph, with a clearly laid down and simple method of working them; that is, not liable easily to go wrong, nor to lead to mistakes, and which would not require very high skill. Such arrangements would increase the power of the defence, and indeed would be necessary with the detached system. I have accordingly given them some attention, and designed a general plan of laying off the ranges and working the telegraphs, which will make it possible to supply simultaneous information. The system I refer to (which has been submitted to the Director-General of Ordnance) would apply to any position, but its particular application would vary in each case. It is extremely simple. One part of it depends on electrical instruments which I have invented for the purpose, and which, without calculations or experience, give the range and positions of an indicated ship at every gun in the position. Another part of it enables the officer directing the defence to deliver in one instant, by the touch of his finger, a converging volley from one or both sides of a channel on a vessel sailing past.

The possibility of delivering correct fire in this manner on a moving object, without aiming, and by an officer not even in the battery, was illustrated in one of my experiments with the 7-ton gun-carriage at Shoeburyness; and I trust I may be given some day a chance of showing to what perfection this system can be carried. Methods of determining the distanc of vessels from batteries are practised here and in some continental countries. My method is designed to be quicker, simpler, and, therefore, more effective. It is adapted to work in conjunction with the arrangements for submarine mines. That part of it which gives the required information for sighting the guns is of so simple a character that the most uneducated gunner cannot make a mistake in its application. There are many other features of the system besides those I have particularly referred to which I shall not now discuss; each requires different treatment. Among these there are methods of mounting guns in ships, in floating batteries, Moncrieff carriages for heavy guns of position, adapted for locomotion, for coast defence, siege carriages, &c.

I may remark in passing that some of these applications are considered by officers of eminence to be quite as important as the class of Moncrieff carriages best known. For instance, I take the liberty of quoting from a letter I received from Colonel Brialmont, the great Belgian engineer and military writer, in November, 1868. He says: —"I am at present engaged in publishing a great work on fortifications. I shall naturally speak of your invention in it, and if agreeable to you I shall likewise mention your proposal with regard to *barbette* system in batteries of attack. I believe this idea is designed to have a great future. This last invention will perhaps bring you less renown than the one you have experimented on at Shoeburyness, but it will have a more general and easier application." I am most anxious to impress the national importance of this question of coast defence in relation to the system of earthworks which are now possible.

The day has gone by when the general principles of any science need be considered a mystery, and I submit that any man of intelligence, without knowing all those details which are the particular business of officers trained to apply them, may, nevertheless, form valuable opinions on the general principles of coast defence, and may, with care and observation, be able to arrive at sound conclusions regarding them. The security of a country like this does not depend so much on fortresses as on the efforts that can be made by a contented, brave, and patriotic people. If it is known by those who would invade us that we have not only brave hearts, skilled hands, and powerful guns, but a system of applying our resources that is capable of making any coast position formidable to war ships, that knowledge will have its effect. In war time a good general disposes of his forces in that manner which will be most embarrassing and most formidable to the enemy. In time of peace we might arrange and prepare our coast defences on similar principles.

The improved artillery applied in earthworks made thoroughly efficient on the new system, together with the facilities which the existing network of railways slightly extended would supply, should be made to go some way in meeting the corresponding advantages that have been conferred

on the power of attack by steam navies and iron-clad war ships. If my labours have in any degree the effect of diverting the great resources of this country from a more expensive to a cheaper and more efficient system of coast defence both in the colonies and at home, and if thereby the security from outrage and disaster is increased, the consciousness of having helped to do so will itself be to me a reward for the delays, anxieties, and trouble that it has cost me to bring this matter forward.

WHITWORTH METAL.

It is well known to mechanicians that Mr. Whitworth has been long engaged in testing a new process of making and casting iron or steel, which he has invented with the view of getting rid of all those accidents which arise from the air-bubbles found more or less in all iron castings, and not removable by any amount of hammering. Mr. Whitworth has now perfected a mode of casting metal which renders it so homogeneous that it resists any given forces which can be brought to bear upon it. The following notice, which recently appeared in the "Times," gives an interesting account of the application of the Whitworth metal to ordnance. The notice is written by an officer of the Royal Artillery, thoroughly acquainted with the subject:—

Mr. Whitworth has long been known as a mechanician of the highest order. To him is due the accuracy with which machinery may now be made to turn out work almost perfect in its beauty and precision of dimensions. When once the transference of circular into direct or eccentric motion and the converse was achieved, it was easy to devise a thousand means of carrying the discovery into practice, and, theoretically, of producing any, even the most delicate forms. But the main difficulty had still to be surmounted. The machines themselves were imperfect in dimensions. There was no such thing as an exact plane in existence, much less an exact sphere, or cylinder, or cone. Every part of every machine was really rough and uneven in surface, however precise it might appear to the naked eye, and it is clear that wheels of imperfect roundness, turned by equally imperfect shafts, working in imperfect beds, could never turn out perfect productions. The defects continued to reproduce themselves, for the parts of new machines were made by the old ones A beginning had to be made somewhere. Mr. Whitworth set to work to make plane surfaces of mathematical accuracy. First manufacturing three flat pieces of hard metal as exact as was possible by the ordinary means, he then rubbed two of their surfaces together till there remained no perceptible friction. He then took the third and worked it on to the two others, continuing the process till the three were so equal that, if any two of them were laid one upon the other, they touched nowhere, the upper one floating on an extremely thin film of air between them, without friction. If the edge of the upper one was pressed on the lower surface and pushed along it, followed by the body itself, there was no air between, and the two adhered together, held fast by the pressure of the atmosphere above and below. Here was the germ from which sprang exact spheres, cylinders, and wheels, the parts of machines which could be relied upon. Henceforward there was no limit to the preciseness of the productions, except the wearing of tools or of the machinery itself. But a finer test of the work was required than any then in existence, so Mr. Whitworth designed a measuring instrument, capable of marking faults for correction even if they did not exceed the millionth of an inch. So the work produced and the parts of the machines could be rigorously tried, and many a new flight could be taken in the region of mechanics.

When the demand came for small arms and cannon of longer range and closer shooting, Mr. Whitworth carried out a series of experiments for the Government, laid down what he considered to be the laws governing the rifling of barrels and the shape of projectiles, and produced a rifle which attained results hitherto unknown. He proceeded to apply the same principles to artillery, and competed with Armstrong for the position of first artillerist in the world. But his rival had already not only designed but built a large number of guns fulfilling in their construction the demands of practcal soldiers, as well as those of scientific artilleirists. The ground was already occupied, and whe n it was found that neither inventor could claim any very decided superiority over his antagonist, the strong practical objection to complication of guns and ammunition, by the adoption of two complete systems side by side, was, very properly, allowed to weigh against Mr. Whitworth. If the public service be the first consideration, many an ingenious invent,or may find that there is no room for his works though he may well deserve a handsome acknowledgment in one shape or another.

Since the days of the Armstrong and Whitworth Committee, Mr. Whitworth has never dropped the subject of artillery. It was not enough for him to beacknowledged as the first machinist in England, he must also be accepted as in the front rank of artillerists—a desire which he shares in common with many others. Such an end is only to be attained by the manufacture of reliable heavy rifled guns, such as 300, 400, and 500 pounders, or pieces of even higher calibre, and Mr. Whitworth was long unsuccessful in producing anything higher than a 7-inch gun. His system of gunnery is acknowledged by himself to be very severe upon the piece from which his long projectiles are fired, and we have more than once heard from his own lips that he sought in vain for a material which could be relied upon, and produced in sufficient quantities. He adopted a mild steel as the metal theoretically most adapted to withstand both strain and wear, but he found, as all makers of steel guns have found, that the greatest care was unavailing to produce trustworthy steel tubes in large quantities and of large sizes. Many a fair-seeming piece of a gun would stand steady strains perfectly, but crack when the sudden shock of fired gunpowder occurred within it. So much material could not be wasted without increasing the cost of that which was sound, nor could guns be produced rapidly or in large quantities. The English Government would hardly accept 9-inch guns costing £3,200 each, except for purposes of experiment, when pieces of equal calibre could be bought from Armstrong for considerably less than half the price, or manufactured in the Royal Arsenal, on Fraser's still cheaper system, for little over a fourth. Two such guns were purchased before the late Conservative Government came into office, and their shooting was, what Whitworth shooting has always been, extremely good. The experiments with them seem to hang fire, chiefly, we believe, on account of some lack of harmony between Mr. Whitworth's idea of fair experiments and those of the Ordnance Department in the War Office.

The subject would have been of little importance, but for a most interesting and valuable attempt of Mr. Whitworth to solve the one great problem of artillerists, by producing guns at once strong, cheap, and capable of being manufactured in large quantities. In spite of all researches, the reasons for the peculiar qualities of steel are still doubtful, but the most important and undesirable quality, that which breaks the hearts of gunners, is the uncertainty of the metal. Of two tubes manufactured at the same place, about the same time, by the same workmen, one may stand 1,000 rounds, and the other burst destructively at the first or fiftieth round, sometimes without the slightest warning. One reason given is, that bubbles of gas formed in the molten steel before it is set are retained by the thickening fluid, and perpetuated as flaws in the ingot, no matter how severe a hammering it may have had. Mr. Whitworth claims to have succeeded in getting rid of these gas or air bubbles entirely by the application of immense pressure to the mass of molten metal while cooling. He has four qualities of this steel, or "Whitworth Metal" as he calls it. They are known as yellow (having most carbon), blue, brown, and red, the red being the most ductile. He has tried many experiments on a small scale, and considers himself to be justified in declaring that he will now be able to make heavy guns perfectly trustworthy at a price of about £120 a ton, or one-fifth higher than Sir W. Armstrong's present prices, and rather more than half his own old ones. A 9-inch gun would cost £1,800, but then its projectiles would be heavier, and its power greater than its rival of the service pattern. Mr. Whitworth is pre-eminently an advocate of small bores in guns as well as rifles, being ready of sacrifice many practical advantages for good shooting. He now asserts that he throws to the winds all fear of his guns bursting. Instead of seeking for powder of less severity, his only wish is to find means of igniting it more rapidly, and he is making preparations for the construction of 27-ton guns, or even pieces weighing over 43 tons.

It may be that Mr. Whitworth has achieved a task which would certainly lead to the adoption of his metal for the inner tubes, at least, of all guns, whatever might be their system of shooting; but the experience of all practical artillerists denies them permission to accept experiments on a small scale, as applicable to heavy guns, in which the force of the explosion is vastly multiplied, possibly even altered in its mode of action. The Government possesses two heavy Whitworth guns, but they are not made of the new metal, except in very small proportion applied to the exterior of the piece. They may be very useful to test ammunition, system of rifling, and so on, but their lasting qualities will prove nothing as to the strength of the new metal for guns, because they are made of the old metal. We understand that the superintendent of the gun factories applied to Mr. Whitworth for inner barrels, but was answered that the whole system or nothing must be taken. This seems a little obstructive; but here is a man of reputation asserting that he has the power of producing metal of extraordinary strength, and that he has actually commenced to make two 11-inch guns calculated to fire shells of 960 lbs. If he will not allow his material to be tried as part of the Government ordnance, we cannot but think that it would be worth while to order one gun from him, embodying his newest ideas, and test it in every way without competition, for it seems that in this way alone can the authorities arrive at truth regarding the strength of the Whitworth metal as applied to heavy guns. It should be distinctly understood that Mr. Whitworth's system of charges and projectiles is acknowledged by him to be extremely dangerous to the endurance of the pieces of ordnance themselves, and must be rejected unless he can find material to bear the severe strain put upon it. If the new metal fails, his case falls to the ground; but it is surely worth a trial.

There is, however, another experiment possible to be carried out with the two costly guns now in the hands of the authorities. Mr. Whitworth insists that flat-headed shot or shells, very long, and therefore containing a large bursting charge, are the proper projectiles to fire at iron plates, especially when the target stands obliquely to the line of fire. We have inspected certain plates containing holes pierced or punched by flat-headed projectiles fired from the Whitworth 1¾-inch gun of 7 cwt. A plate of equal thickness with the shell was completely pierced at an angle of 45 degrees, and with a charge of 10oz. At an angle of 65 degrees the shell did not pass through, but made a ragged hole. At right angles it passed easily through a 2¼-inch plate. A service gun of equal weight would have a calibre of three inches, and be capable of piercing at least the 2¼-inch plate directly, probably a 3-inch plate. But it is not with these tiny pieces of ordnance that artillerists' attention is now chiefly occupied, at least out of England. The great point is to make guns and projectiles that will pierce iron-clad ships at all sorts of angles. The rough-and-ready rule with our service guns is, that a shot or shell will pass through an iron plate somewhat thicker than its own diameters; 9-inch projectile through more than a 9-inch plate, &c. But Mr. Whitworth contracts the diameters of his projectiles for the same weight both of gun and ammunition. He makes his shells long and narrow, so the rough rule has no application to them. We should very much like to see what target would be pierced by the Whitworth guns with Whitworth flat-fronted projectiles, and at what angle. The experiment is surely worth the small sum of money it would cost. It is of no use to point to experiments made with 2-inch guns. All working artillerists have been disappointed, over and over again, at the difficulty of getting big guns to do as well, in proportion to their bulk, as small ones. But there are the big guns, why not try the long, flat-fronted projectiles? When the question comes before Parliament it is sure to be made as foggy as possible. Let us try for once to state it clearly.

Whitworth's system of artillery consists essentially in small-bore guns with long projectiles. The twist of the rifling must be rapid, because otherwise the long projectiles would turn over. All this involves a great strain upon the interior of the gun. Until now he has not succeeded in making heavy guns to stand this strain, except in small numbers, at a prohibitory price. He now asserts that he has found the material he has so long sought; but there is, as yet, no heavy gun in existence made of this material. We say, let him make one, and let it be tried. Then, there is that other question of his shells, which has nothing to do with the gun question, and may be settled by firing some projectiles out of the costly pieces now in possession of the Government. If the shells succeed, it will be interesting to know whether Mr. Whitworth can really make guns at a reasonable price capable of firing them. Then will come the last question, perhaps more difficult still to answer, where can such guns be placed without involving such a complication of ammunition and stores as would be detrimental to the public service? We hold that Mr. Whitworth has made out a case for experiment.

EXPANSION OF MINERAL OILS.

M. DEVILLE recently presented a paper to the Academy of Sciences at Paris on the physical character of mineral oils, in which he mentions the increase in bulk occasioned by an elevation of temperature as a prominent cause of danger by fire where petroleum may be stored. The "Tidioute (Pa.) Journal," in relation to this statement, says:—From long experience, oil dealers in this country have come to be well aware of the fact of such expansions, although without, in most cases, any idea of its amount. This is odd enough, too, when we consider the constant use made of olemeters, "measures of the density of oil." For this reason, the following remarks may not be inappropriate: "The scale of Baume's hydrometer, olemeter, or densitometer, a wholly arbitrary one, represents for each degree within the usual limits of crude American petroleum, as nearly as may be, four and a half thousandths of the density of water at 60deg. Fah. As every increase of temperature of 10deg. Fah. equals a decrease in density of 1deg. B., the expansion of oil may be taken, without sensible error, to be .00045 of its bulk for each degree of Fahrenheit's thermometer. Allowance for expan-

sion is always made in shipping oil, except in the old-fashioned wooden tank cars, where the oil is permitted to force its way through the hatches, roofs, and sides of the tanks. In shipping in barrels it is customary to leave about one gallon 'outage,' as in 50deg. (which may be considered the extreme variation in temperature likely to occur while the oil is in transit) 44 gallons would become 45. It would be safer and more economical to allow yet greater room, were it not for the advantage, in that case, apt to be taken of the shipper by the consignee. The allowance for expansion in Empire Line iron cars is very large, consisting of a cylindrical dome, about 40in. in diameter, and 30in. high—the capacity of which is about 4 per cent. of the whole car; 50deg. of temperature representing an expansion of but 2½ per cent. it is evident that these Empire iron cars are as safe and economical as they are convenient. The writer has no knowledge of the empty space left in the five-gallon cans so largely used for exported refined, but 5in. square by 1in. high would be sufficient. The increase in bulk, in the summer, of oil stored in iron tankage in winter is of considerable importance in these times of high prices. A twelve thousand barrel tank is 60ft. in diameter and 24ft. high, and holds in each inch of its height 1762·56 gallons. The mean temperature of oil here in Tidioute is, in winter, about 20deg. and in summer 70deg. both very nearly. The range being thus 50deg. the volume of oil to each inch, at 20deg. Fah., is increased 39.66 gallons; but as the tank has also grown larger, this amount is not shown by measure. Iron expands .000006964 for each degree, or for 50deg. about three and a half ten thousandths; so that the circumference of the tank is increased .7917 of an inch—the diameter by .252 of an inch; and the capacity for each inch height by .62 of a gallon. Therefore the apparent gain is only 39.04 gallons for each inch of the tank at 20deg. It is to be noted, however, that no allowance is here made for the fact that the temperature of the tank is always higher or lower than that of the oil; that the yearly mean is greater than 50deg. Fah., and that nothing was said of the increased height of the tank. All of course for the reason of their insignificance, and because the expansion of the iron was taken as not interfering with the figures of the tank."

SEPARATING ANIMAL FROM VEGETABLE FIBRE.

IN mixed fabrics or fabrics composed partly of animal and partly of vegetable fibres, the separation of animal fibres, such as, for example, wool, hair, or silk, from the vegetable fibres, such as cotton, flax, or jute, is a process necessary for certain purposes. The plan hitherto adopted for the purpose of separating these fibres has been to treat the material to be operated upon with acids. This is, however, objectionable, as the animal fibre is by their action rotted, and thereby loses its milling and felting properties. In a recent patent, Mr. James Stuart, of 40, Ropemakers' Fields, Limehouse, dispenses with these acids, and substitutes neutral substances. In this way, rags, carpet cuttings, old carpet, and other waste material of mixed fibres may be utilised to a greater extent than has hitherto been found practicable, and, as the separated animal fibre retains in most cases its colour, it can oftentimes be worked up again into articles for use without the necessity of its being re-dyed.

His invention consists in subjecting rags, carpet cuttings, old carpet, or other material of animal and vegetable fibre intermixed to the action of chlorides of the metals or sulphates of the oxides of the metals, preferring, however, to use as the active agent the chloride of aluminium. In thus treating the material, certain chemical reactions take place whereby the vegetable fibre is decomposed and the animal fibre is recovered uninjured either in substance or in colour. It is then in a fit state to be re-manufactured without re-carding, spinning, dyeing, or other operations that have hitherto been necessitated.

In practice, Mr. Stuart first makes a solution of ingredients in the following proportions:—In 100 gallons of hot water dissolve 100lb. of the sulphate of alumina of commerce; then add 50lb. of chloride of sodium; when this last-named ingredient is added, a reaction takes place; sulphate of soda is formed, and also chloride of aluminium. With the solution thus made the material to be treated is saturated. It is then drained so as to allow the excess of the solution to pass therefrom; or the material may be slightly wrung or pressed for the same purpose. The material is next dried and afterwards exposed to a steady temperature of 200deg. Fah. During the time of this exposure, the chloride of aluminium decomposes, and the resulting volatile products, as they pass off, act upon the vegetable fibre, rotting them, but leaving the animal fibre uninjured. The material treated is then scribbled, and the vegetable matter separates in the form of dust. This treatment refers more particularly to rags of light mixed fabrics.

When treating heavier or denser material, such as carpet cuttings or old carpet, the solution of chloride of aluminium is of greater strength. In 100 gallons of water dissolve 150lb. in weight of sulphate of alumina and 75lb. of chloride of sodium, and then proceed in the manner before described.

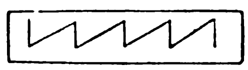
In some cases, it is found more convenient to treat the material by boiling than by heating in drying rooms. Mr. Stuart then proceeds in the following manner:—He makes a solution of sulphate of alumina by dissolving 100lb. of that substance in 100 gallons of water, and with this solution, he saturates the material. It is then drained, and afterwards placed in a boiling saturated solution of common salt. In this solution, the material is kept boiling until the vegetable fibre is decomposed or rotted; the material is then well washed and dried, and scribbled or carded.

Correspondence.

RIFLED *v.* SMOOTH-BORE GUNS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Permit me to place before the public, through the medium of the MECHANICS' MAGAZINE, a few thoughts on guns, rifling, and projectiles. I have discovered that a smooth-bore gun, with a suitable projectile, will shoot as accurately as a rifled gun; and that all that is required to answer this end is to flute spirally a cylindrical shot with a number of shallow grooves inclined to its axis at an angle of 45deg. The projectiles I have used have been flat at both ends. Suppose an 8in. shot, 2½ diameters in length, to be fluted with ninety-six grooves of this form—



each groove ⅛in. deep and ¼in. broad, the perpendicular side of the groove being the driving side; then, in this shot, we have 96 ⅛in. = 12in., the depth of all the grooves, and 20in., the length of the shot, giving a space of 20in. by 12in., or an area of 240 square inches, which is presented at right angles to the action of the inflamed gases. Thus, with an average windage of 1-16in., we have an area presented for rotation equal to five times the area presented by the shot for projection. The length of the shot may vary from half to three times its diameter. I have used a plano-concave wad made of tallow, with as slight a covering as possible to prevent choking the grooves; and I find that little more than the wad needs to escape in order to produce the rotation required. The cost of grooving would be small. Projectiles to be fired from the shoulder may be made in the way of lead pipe, or be pressed into form at once. Heavy shot will required coating with some soft metal in which the grooves may be cut in a few minutes.

It has been objected that the rotation of such a shot would be impeded during its flight by the action of the atmosphere on the inclined planes. I grant this; but I consider the effect to be so small that it may safely be passed unnoticed. However, the objection embodies a great idea. It is this—if the resistance of the atmosphere to the flight of a projectile will retard its rotation when acting on a number of planes inclined in one direction, then it is clear that if these planes be inclined in the other direction, the resistance of the atmosphere will accelerate its rotation. The whole of the resistance of the atmosphere to the flight of a projectile may be converted into a power which will increase its rotation in the ratio in which its projectile motion diminishes. Thus a shot may be sent five miles and possess the same quantity of motion with which it leaves the muzzle of the gun. Suppose a shot, the end of which presents to the atmosphere four inclined planes, inclination 45deg., to bury its jagged front in an iron plate at a distance of three miles, and there spend its projectile force, what would be the effect of the force accumulated during its flight from the resistance of the atmosphere? that is, what would be the effect of the rotation of the shot? I leave this to be answered by experiment.

If we are to have rifled guns and not plain bores, by no means let the rotation be produced by one piece of metal grating against another when it can be done without. In the small bore, the direct action of the gases upon the projectile will produce rotation by means of an escapement; in a rifled bore, the direct action of the gases upon the projectile will produce rotation without an escapement. Suppose a gun to be rifled parallel with its axis with one groove ½in. broad and ½in. deep. On the projectile is a rib projecting ½in. and ¼in. thick. This rib is inclined to the axis of the shot, so that, at one end of the shot, it touches one side of the groove, and the other end the other side, leaving a space of ¼in. on opposite sides at opposite ends. The rib thus lying across the groove fills it so as to prevent any escapement, though itself only ¼in. thick. If such a projectile be fired from such a gun, the rear end of the rib will be forced against that side of the groove that it touches, by the force of the gases, along the whole of its passage through the bore, the gases acting on one side of the rib, but not on the other.

Now, suppose the rifling of the gun to be spiral, and the pitch of the rib on the shot to be so much slower than that of the rifling that its opposite ends touch the opposite sides of the groove; then, in this case, as the side of the groove against which the rib is forced recedes all the way along to the muzzle, it is followed by the rib, which is forced against it by the gases, and thus rotation is produced. In this way a very quick pitch o rifling may be used without depending at all on the shot coming in contact with the rifling in order to produce rotation. The ribs may be varied as to form and number to suit anyone's fancy. I think, if our artillerists will take these few hints into their study, we shall soon see some different practice from that we are accustomed to.—I am, Sir, yours, &c., EDWARD HOYLE.

Crossbank, Meadow Bottom, Todmorden, October 18.

SUN SPOTS.

SIR,—In the diversity of opinion entertained by scientific men upon the nature of the spots that appear periodically upon the surface of the sun, there does not appear one that offers a satisfactory explanation. It is in the solar investigations, although we behold the flame and feel the heat, science remains unsatisfied. The absence of a superior mechanical invention retards the progress of philosophical ideas. But it appears to me that the elucidation of these phenomena does not altogether depend upon mere mechanical ingenuity. There is a higher philosophy. In the earth, we behold the features of a convulsive energy that has long ceased to exist. The spasmodic efforts which history records appear but the expiring efforts of that igneous or active state of which the central body of our system is the representative. In the great cavities now filled with the waters of the earth, we may trace the most intense action at the period of transition. The oceans, seas, &c., that fill those cavities are evidences of the convulsion. The more elevated parts, or those the least exposed to violent action, must (as in the sun) have become periodically exposed from the more united action of the surrounding bodies. It is these portions of the body of the sun that we behold. The attempts to explain these phenomena by clouds and caverns are unworthy the magnitude of the subject. The only way it can be philosophically explained is by observing the position of the various bodies which compose our system at the time of their occurrence.—I am, Sir, yours, &c., H. SALOWAY.

13, Standard-street, Dover-road, October 20.

PLAITING MACHINE.

SIR,—Can any of your readers inform me where I can purchase a plaiting machine for hemp and fibrous materials for engine packing? By so doing, they will oblige, Sir, yours, &c.,

J. E. REEVE.

Wolverhampton, October 16.

THE office of "Master of the Mint" is vacant. "Punch" says there can be but one opinion as to who should have the appointment—Mr. Lowe. He will then be able to do what he pleases with the sovereign, and having both the Exchequer and the Mint under his control, his happiness will be complete, unmixed with alloy!

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

Received.—R. T.—W. O. A. L.—J. C.—J. C. and Co.—J. N.—H. S.—E. J.—W. L.—H. A. H.—R. P.—G. E. S.—W. R.—L. M.—R. M.—G. T.—T. W. T.—G. L. R.—E. B.—E. H.—D. G. F.—A. R.—J. B. S. and Co.—J. S.—R. I. B. A.—P. J.—S. G. and Co.—F. W.—H. B. S.—R. T.—C. J. E.—T. H.—R. T. F.

Naval, Military, and Gunnery Items.

The death is announced of M. Borel, chief engineer of the works on the Isthmus of Suez Canal. The deceased was in his 48th year.

The fetes to be given at the inauguration of the Suez Canal will commence on the evening of November 16 at Ismaliar, and terminate on November 19 at Suez.

Several old guns converted into 64-pounders at the Royal Gun Factory Department, Woolwich, have just been put through the usual proof at that proof-butt and stood the test satisfactorily.

The ceremony of handing over into the custody of the Duke of Argyll the old colours of the 91st Highlanders, lately replaced by a new set, took place at Inverary Castle this day week.

The "Levant Herald" says that the question of opening the Dardanelles and the Bosphorus for navigation at night by merchant vessels has been solved, by the Porte having consented to allow in future out-ward bound vessels to pass through both, Straits at night.

The fishing smack "Jeune Desiree," of St. Malo picked up a dead porpoise, weighing 600lb. a few days ago. On opening it 23 cuttle fish were found in its stomach. It measured 8ft. in length, and, judging by the teeth, was of a great age. Some of the cuttle fish had got into the windpipe and choked it.

The "Monarch" will be undocked at Portsmouth on the 2d proximo. In addition to the alterations and repairs being carried out with her steam and other machinery, the area of the fore part of her balance rudder is being reduced, and the hull of the ship below the water line is being re-coated with Dr. Sims' anti-fouling composition.

This day week at Shoeburyness the 9-inch rifled wrought iron howitzer fired seven more rounds with 4lb., 6lb., and 8lb. charges, and light projectiles of 200lb. the full charge being 9lb. with 250lb projectiles. The practice has been temporarily stopped on account of the leakage of the gland of the hydraulic buffer, through its not having been properly packed.

It is understood that the Ocean Tea-Ship race has been won by the "Sir Lancelot," Captain Robinson, which left Foo Chow Foo on the 18th of July, and arrived in the East India Docks on Thursday morning week after a passage of eighty-nine days, said to be the shortest on record. The "Sir Lancelot" is a Clyde clipper. She was first in the tea race in 1867, and lost it last year only by a few hours.

We understand that the French Government is about to establish a great central school in Paris for the instruction of youths intended for the navy and mercantile marine. The education will not only include navigation and all connected with it, but the pupils will also receive a thorough commercial education, so as to render them fit for employment in any part of the world.

The "Sultan" is making very good progress, a large force of men being employed on her. Large numbers of heavy armour-plates have been affixed to her port side, and others continue to arrive from the contractors. Workmen are engaged in preparing the starboard side of the vessel for the reception of armour-plates. It is expected that this formidable ship will be ready for floating out of dock about next May.

In a return just issued the total amount received for pilotage of vessels in the port of London in 1868 is stated as follows:—British vessels, not towed by steam, £4,573 13s. 6d.; towed by steam £37,051 15s. 7d. For foreign vessels, not towed by steam, £16,117 9s. 4d.; towed by steam, £18,086 10s. 1d. For outward pilotage, British vessels, not towed by steam, £1,805 15s. 2d.; towed by steam, £24,217 19s. 4d. For foreign vessels, not towed by steam, £8,475 10s. 10d.; towed by steam, £9,714 15s.

The new wrought-iron pier, constructed opposite the Royal Gun Factory Department, Royal Arsenal, is nearly completed. The pier is supported upon iron columns and has a plain and neat appearance; it has a tramway running the whole length, about 350ft., and has three lines of rails upon it. The pier is intended for heavy stores to be conveyed over it from the shipping to the wharf, the depth of water being sufficient for vessels to be brought longside to disch rge.

Miscellanea.

The death is announced of the sculptor Pierre Hebert, author of the well-known group of the "Child and the Tortoise."

Professor Becas has now finished his statue of Schiller, which is to be erected in Berlin, and will shortly place it at the disposal of the commission.

Mr. Thomas Ball, an American sculptor in Florence, has just completed, for private commission, a statue of Eve, which will be for some days on view at his studio.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending October 16, was 4,375. Total number since the opening of the Museum, free daily (May 12, 1858), 1,667,032.

It is at last definitely arranged that the new bridge at Blackfriars and the Holborn Valley Viaduct are to be opened on Saturday, November 6. Her Majesty will be present, and the proceedings will be marked by stately ceremonial.

The City Gas Company have notified that, in accordance with the City of London Gas Act, 1868, the price of ordinary gas supplied by the company from and after January 1 next will be reduced to 3s. 9d. per 1,000 cubic feet, and that the illuminating power will be raised to 16 candles.

The powder works belonging to Messrs. Dixon and Co., situated about four miles from Lake Windermere, was the scene on Tuesday morning of a devastating explosion. The press and charge houses were utterly demolished and six mills completely wrecked. Unfortunately, there were three men at work at the time and they were blown to atoms.

The University of the South, the condition of which at the close of the civil war in the United States elicited so much sympathy from the English bishops and the Universities of Oxford and Cambridge, has conferred its honorary degree of D.C.L. on the Rev. F. W. Tremlett, vicar of St. Peter's, Belsize-park, honorary secretary of the fund raised in this country on behalf of the University.

The Middlesborough Association of Managers' Foremen, and Draughtsmen connected with all branches of the iron trade, is now fairly in existence, and at its first meeting on the 16th inst., 26 members were enrolled. Mr. John M. Oubridge, late of London, has been elected first chairman of the infant society, which has the whole of the Cleveland district for its field of action, and is therefore likely to be largely supported.

The number of births and deaths registered in the parish of Clifton (Bristol) for the quarter ending September last was as follows:—Births: boys, 84; girls, 82; total, 166. Deaths: males, 42; females, 56; total, 98. Of the deaths registered, 11 were aged 80 years and upwards—viz., one 96, 92, 91, 90, 88, 87, 85, 84, and 83 respectively, two 80 each—and seven 70 years and under 80. The return also includes the deaths of 19 children under one year old.

Consequent upon the repeated complaints of the inhabitants of the south of the metropolis respecting the quantity and quality of the water supply, and which have found expression in memorials to the Board of Trade, the companies are increasing the number of their filtering beds at Battersea, and a new store and subsidence reservoir is being constructed to contain a depth of 14ft. of water (25,000,000 gallons).

The number of visitors to the South Kensington Museum during the week ending October 16, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 14,029; Meyrick and other galleries, 1,867; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 2,015; Meyrick and other galleries, 135; total, 18,046. Average of corresponding week in former years, 12,149. Total from opening of Museum, 8,886,448.

The awards to the successful exhibitors at the Netherlands Exhibition were on Monday distributed by Prince Alexander in the name of the King. The ministers of State and the representatives of the various countries took part in the ceremony, and a report was read by Baron Mackay, the president of the central jury, as to the result of the exhibition. A large company assembled at the banquet given in the evening, illuminations and a display of fireworks bringing the exhibition to a close.

A congress of wine growers is to take place at Beaune, France, on November 8, 9, and 10. The following questions will be discussed:—1. On the means of interesting the labourer, by association or otherwise, in the success of the culture. 2. On the system of *metayage*, or a division of the crop between the landlord and the tenant, applied to vineyards. 3. The necessity of a school for instruction in the cultivation of the vine. 4. The intervention of the authorities in fixing the date of the vintage, &c. 5. On the use of machinery to meet the insufficiency of labour, as well as ploughing, vine props, &c.

At the meeting of the Royal Horticultural Society on Tuesday, in consequence of the inclement weather, fewer plants were exhibited than usual, though the orchids were magnificent, especially Vanda Cærulea, from the gardens of Lord Londesborough. Mr. James Bateman, F.R.S., presided, and called the attention of the meeting to a specimen of the Avocado pear as it is called (Persea gratissima), a fruit never before produced in Europe, and never plentiful even in the tropics; an exceedingly wholesome fruit, and larger even than any of the monster pears exhibited in Covent Garden. Mr. Charles Morgan was elected a fellow.

With reference to the application of sewage manure to farming purposes at Aldershott Camp, some of the members of the local board of health, who are practical farmers, while they do not impugn the accuracy of the statements published with regard to the crops realised, assert that the system nevertheless fails to remove the nuisance which before existed, and that the sewage water after filtration, although clear in appearance, gives out a most offensive odour, which prevents the beneficial occupation of any property adjoining the camp farm. The local board has been threatened with an action for conveying the sewage of the town of Aldershott into the Blackwater River, and, so far from concluding the experiments to be a solution of the problem of sewage utilisation, the board has resolved to memorialise the Home Secretary before carrying out any general plan of drainage.

The Serpentine is at last to be levelled to a uniform depth of 5½ft., and an attempt will be made to purify it from the filth which for several years past has been a source not only of disgust but of danger to those who have been in the habit of bathing there. It may not, perhaps, be generally known that previously to the Metropolitan Main Drainage scheme, certain sewers emptied their contents into the Serpentine, and, as there is no outlet, these deposits, with the rotten weeds accumulating, often produced in the summer months an effluvium which was at times almost insufferable. At the close of last session, after some opposition, a vote of £13,000 odd was passed for "reducing the depth, purifying, and otherwise improving the Serpentine," and the work will be forthwith proceeded with. As has been stated, it is intended to level it to a uniform depth of 5ft. 6in. and cover the bottom with a layer of concrete. The works, it is anticipated, will be completed by the ensuing spring.

On August 21, at eight minutes past three in the afternoon, a very alarming shock of earthquake was felt in and around Schemacha in the Caucasus, which destroyed not only the greater part of the houses in the town, but also those of the village of Sundi, at the distance of 18 versts. The approach of the catastrophe was announced by many precursory indications, such as the water in the fountains turning muddy and the prevalence of an odour like that of garlic in the air. Immediately before the shock, a noise like subterranean thunder was heard, and, at the same moment, dense columns of dust appeared moving from east to west. The magnet lost its attractive power.

An insect, pronounced by local naturalists to be a locust, has just been captured in Waterford. It flew into the open window of one of the houses on the quay on Sunday last, and was caught by the servant. The animal is about 2¼in. long, and of a greyish colour, with long narrow wings that meet near the tail, and are "humped" at the shoulder. At first sight, the animal appears like a huge dragon fly. There has been a large arrival of foreign grain vessels in Waterford during the past fortnight, and it was in a house opposite to where several of these vessels were moored that the locust took refuge on Sunday. No doubt, it was by means of one of those ships the creature was imported.

A correspondent of the "Times," writing from Transylvania, thus describes the happy town of Szék:—"Where no one is in absolute want, and

all are more or less on the same level, the greatest incitement to crime is gone; and so it is in this Transylvanian Arcadia. Except now and then a row on a Sunday evening, there is but little for justice and police to do, and even these rows can only be of rare occurrence when, in a population of 5,000 souls, only half a dozen are known as drunkards. Theft is unheard of; not a house has a lock; agricultural implements are kept in the fields; household property in the open courtyards, where not even watch dogs are kept. There is, indeed, a prison remaining, but it has been used for years as a lumber room."

On July 30, a flight of locusts, two and a half miles long by one and a half broad, going from west to east, passed over Rewarree Tehseel in the Goorgaon district. They deposited some eggs which were destroyed by the ploughing up of the land, and but slight damage was done to the crops. On August 2, the same or a smaller flight appeared in the same locality, moving in the same direction; it did no damage. On August 3, a flight extending six miles by two and a half, but moving from east to west, was observed in Tehseel Goorgaon, and on the following day a smaller flight moving south was seen in the same locality. In Tehseel Loodianah, on August 8, a very large flight appeared, but were not suffered to settle on the crops, shouting and tom-tomming having driven them away, though not before they had injured a number of trees.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—909, 945, 954, 959, 960

Buildings and Building Materials—893, 901, 916, 928, 967, 975

Chemistry and Photography—939, 942, 969

Cultivation of the Soil, including agricultural implements and machines—912, 927, 964, 968

Electrical Apparatus—917, 919

Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—918, 926, 953, 955, 963, 980

Food and Beverages, including the apparatus for preparing food for men and animals—920, 924, 978

Furniture and Apparel, including household utensils time-keepers, jewellery, musical instruments, &c.—923, 930, 932, 936, 944, 946, 948, 957, 966, 979

General Machinery—902, 913, 915, 933, 970, 971

Lighting, Heating, and Ventilating—956

Metals, including apparatus for their manufacture—905, 908, 942

Miscellaneous—903, 904, 906, 911, 914, 925, 937, 940, 943, 961, 972, 973

Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—922, 931, 9414 9 950, 951, 952, 958, 962, 974, 976

Ships and Boats, including their fittings—934

Steam Engines—965, 977

Warfare—910, 929, 938

895 J. Nevill, Abergavenny. *Securing window sashes* Dated March 24, 1869.

This consists in fitting a strip of wood or metal in front of the cords or lines by which the sashes are suspended. The strip is connected at its upper part by a link to the main frame, and is free to be moved inwards into the box in order that a pin or stud in it may be released from a hole in the upper sash and removed from bearing on the lower sash. This invention also consists in the employment of a clip or support by which the weights are held or supported when the sashes are closed. The clip or support is connected to the back of the strip of wood or metal before mentioned, and removes the strain of the weights from the cords.—Patent completed.

901 J. Woodhead, Bradford. *Flooring cramps.* Dated March 24, 1869.

This cramp consists of a screw spindle supported so as to be capable of sliding endwise, but without turning, in two bearings of a suitably formed frame of metal or other material, and betwixt these bearings is a bevel wheel, the boss of which is screwed to fit the spindle.—Patent abandoned.

902 W. J. Cunningham, New Oxford-street, and A. M'Carthy, Broad-street, Middlesex. *Motive power.* Dated March 24, 1869.

In a suitable frame are placed two cylinders containing springs, the cylinders being free to revolve partially on their axes, or the cylinders and their axes may revolve together when required. To any convenient part of the periphery of each of the cylinders is fixed a chain or its equivalent, the other ends of which are attached to levers having their fulcrums on suitable hollow bosses fixed to the frame and surrounding the shaft carrying the driving bog wheel. This wheel is supplied at suitable points near its periphery with pins or projections against which the levers press when operated upon by the springs, thus causing the bog wheel to rotate, and by means of intermediate cog gear of any desired multiplicity imparting its motion to one or more pairs of carrying wheels, by which means the machine is caused to travel, or cranks may be used with the cog wheel when required.—Patent abandoned.

903 E. Peyton, Birmingham. *Printing rollers.* Dated March 24, 1869.

A hollow cylinder made of a comparatively base metal or alloy, such as spelter brass, or other suitable metal or alloy, is combined with a surrounding surface of superior metal such as copper, or a superior quality of brass or alloy, so that the superior metal or alloy and the baser metal or alloy are united by fusion at the part where they come together.—Patent completed.

904 W. R. Lake, Southampton-buildings. *Folding paper* (A communication.) Dated March 25, 1869.

The paper to be folded is placed upon a table with its lower edge against the gauges so that the nippers, in approaching to grasp the sheet, will pass under its edge. The back board, against which the outer edge of the sheet is held, is so adjusted that the margin in the centre of the sheet through which the second fold passes shall be at right angles to the first set of rolls and in the centre of the same. The rolls which make the first fold are held horizontally in bearings secured on the frame of the machine. The first, or the roll nearest the table, is furnished with grooves, and the second roll is provided with spring bearings. Below these rolls and placed at an angle of 45deg. with them, is an inclined table formed of bars, on which the sheet is received from the first rolls. In the centre of this table the inclined rolls which produce the second fold are placed; these rolls are held in bearings secured to the cross bars of the frame.—Patent completed.

905 J. J. Bodmer, Newport, Monmouth. *Iron and steel.* Dated March 21, 1869.

In order to facilitate and regulate the cooling of the liquid iron or its alloys, or other metal or alloys, so as to expose the same to the action of the rolls just at the right time when it passes from a liquid into a more or less congealed condition. The inventor allows the same to run on plates or trays, the rims or sides of which determine the thickness of the layer. These plates or trays may be connected together and be formed into chain so as to find themselves by rotation passing over the rolls at the moment the iron is in the proper condition to be laminated or ground. When a plate reaches this position, it is made to tilt or swivel, and thereby to drop the charge on to and between the rolls.—Patent completed.

906 F. Hurd, Rochdale. *Excavating coal.* Dated March 25, 1869.

This consists in cutting horizontal, longitudinal, radial, and diagonal grooves in the coal or other mineral to be excavated by means of a series of link stocks containing the cutters, which are jointed together in such a manner that no rivets or connecting pins are required. This series of cutters passes around a pulley mounted in a radial arm and around a tooth wheel fixed to a shaft which fits in a telescope frame to increase or reduce its length. The radial arm is provided with grooves, which support the back of the cutter stocks and prevent them from being drawn out of the groove in the radial arm.—Patent completed.

907 The abstract of this specification will appear in a future number.

908 J. H. Johnson, Lincoln's Inn-fields. *Iron and steel.* (A communication.) Dated March 25, 1869.

This consists in lining the furnaces or apparatus employed in what are known as the Bessemer and Martin processes, or in analogous processes, with refractory magnesian products in lieu of using for that purpose as heretofore ordinary products, that is to say, silicate of alumina, which contains more or less of free silica.—Patent abandoned.

909 T. Champion, Northampton. *Flues and chimnies.* Dated March 25, 1869.

This consists in constructing flues with a passage for the combustion to pass off into the atmosphere, in combination with a separate and distinct passage leading from the outer air, at or near the top of the flues to the lower part thereof, terminating above the chimney bar or thereabouts.—Patent completed.

910 J. T. Greenfield, Dover. *Cleaning ordnance.* Dated March 25, 1869.

This consists of a brush made of coir (or bass) let into a drum of wood similar to that of the sponge head at present used; the bristles are set circularly around the drum, so that they have a lay or incline all in one direction horizontally. The inventor also proposes to form the hinder part of the brush head smaller in diameter than its fore part, and have the bristles longer than those in front, for the purpose of enabling the longer bristles to sweep well into the deep grooving of rifled guns.—Patent abandoned.

911 T. Baker, Duke-street, Brighton. *Fire escapes.* Dated March 25, 1869.

This consists of a strong box with a large eye painted white, which hooks upon a bracket previously fixed for the purpose only upon the top of the window. Inside this box there are four wheels working at the top. In the centre are three blocks with running wheels, and below these four strong rollers, one of which is cased with india-rubber about ¼in. thick, which form three very strong breaks.—Patent abandoned.

912 W. C. Dreyer, Gresham-street, E.C. *Tilling machine.* (A communication.) Dated March 25, 1869.

The inventor employs an axis mounted in a suitable frame or carriage, and which is caused rapidly to revolve whilst the carriage moves forward at a comparatively slow speed. On this axis a number of discs are fixed a short distance one from another and obliquely to the axis. They have upon them saw-like teeth, which are set to cut into the ground to any depth desired.—Patent abandoned.

913 J. T. Calow, Staveley. *Mining hoists.* Dated March 25, 1869.

This consists in the use of a spring or springs and a weight or weights, connected with and acting upon mechanical contrivances for gripping the slides or guides or conductors. In case of accident, these springs have a bearing or foundation on the cage or hoist while the weight or weights hang from or rest upon them, either directly or otherwise, so as to neutralise or counteract their tendency to bring the grips into action while the cage or hoist remains suspended or supported. The inventor also employs a check rope, or chain, or equivalent, to prevent accidents arising through "running," caused by overloading or by the breaking of the driving belt or from other cause.—Patent completed.

914 C. Marsden, Kingsland-road. *Water-tight flexible joint.* Dated March 25, 1869.

This consists in forming a flange on the end of a pipe (say No. 1 end), upon which flange a screw thread, rings, or other circular projections are formed. The opposite end of the pipe (say No. 2 end) is formed with a bulge or protuberance on the exterior thereof, which bulge has also a thread, rings, or circular projections on it in a similar manner to the end No. 1. The spaces between the threads or rings are fitted with yarn or other packing medium; two of the pipes are brought together, that is to say, the No. 1 end of the pipe is brought againt No. 2 end of another pipe, and the two ends are connected by being enclosed between two half rings or plates.—Patent completed.

915 W. R. Lake, Southampton-buildings. *Pressing oil tobacco, and cotton.* (A communication.) Dated March 25 1869.

The inventor connects with the bed plate, and the head plate uprights or posts. Between the latter, a follower is caused to slide to compress the material between it and the head plate. These parts are like those of a hydraulic press. Between pairs of posts the inventor places a standing frame which supports the several parts, the combined action of which operates the follower. The follower frame has grooved guides at each side of the standing frame.—Patent completed.

916 W. Meakin, Great Wood-street, Marylebone *Window sashes.* Dated March 25, 1869.

The sash being hung in the usual way with balance weights, a strong cord is attached to each of its sides near the top in any secure manner. One method is to form a knot in the cord round a stout screw, which is secured to the sash, and the whole concealed by a plate of suitable form and material. The end of each cord passes over a pulley secured to the under side of the reveal of the window, and hangs down to a convenient height from the ground, finishing with a tassel or other ornament.—Patent completed.

917 W. R. Lake, Southampton-buildings. *Electro-magnetic machine.* (A communication.) Dated March 25, 1869.

This consists, first, in the union upon a single axis of rotation of a number of armatures of soft iron, with two branches having the form of an electro-magnet, but not magnetised. The parts which would form the poles (if these armatures were magnetised) are placed upon one and the same circumference of which they assume the curves. Secondly, in the union of a number of electro magnets (magnetised the first time from any suitable source) disposed exteriorly to the circumference described by the soft iron armatures, in such a manner that they are placed in a circumference concentric to the first and very near to the same. It results from this double arrangement that at each turn of the axis of rotation, each one of the soft iron armatures will pass before all the poles of the fixed interior electro-magnets, and that electric currents will be developed.—Patent completed.

918 T. Sowden and J. Newton, Leeds. *Bobbins.* Dated March 25, 1869.

The object is to obtain the requisite drag without subjecting the spindle to lateral pressure by the bobbin. This is effected by placing at the bottom of each bobbin a plate or collar of soft iron and supporting the bobbin on a small magnet, either a simple steel magnet of the ordinary horse-shoe form, or upon pieces of iron rendered magnetic by contact with a steel magnet or an electro-magnet suitably attached to them.—Patent completed.

919 H. A. Bonneville, Sackville-street. *Electric clock.* (A communication.) Dated March 25, 1869.

This consists, chiefly, in forming and breaking the connection with the positive and negative poles of a battery, by means of a vibrating bar operated by the pendulum, arranged and operating in a peculiar manner.—Patent completed.

920 A. C. Kirk, Glasgow. *Cooling liquids.* Dated March 27, 1869.

This consists in injecting the liquid to be cooled directly into the cold compartment of the apparatus, and in injecting the liquid used for removing the heat produced during compression of the air directly into the hot compartment, by which means the extensive and elaborate surfaces hitherto used interposed between the liquids and the air are dispensed with.—Patent completed.

921 This application for patent is still under the consideration of her Majesty's Attorney General.

922 H. Downie and I. B. Harris, Edinburgh. *Horse-shoes.* Dated March 27, 1869.

The metal portion of each shoe is made in one piece, and indiarubber or other elastic or flexible materials is so fitted or combined therewith that it projects slightly beyond the metal or treading surface.—Patent completed.

923 W. E. Gedge, Wellington-street, Strand. *Match box.* (A communication.) Dated March 27, 1869.

The match box is constructed of metal, wood, cardboard, or any suitable material, and may have a cylindrical square, rectangular, oval, or any shaped body made by soldering, clasping, stamping or otherwise. The bottom and the lid are formed of two similar pieces, each acting indifferently as bottom or lid, and are connected together by a piece of indiarubber or by any kind of spring.—Patent abandoned.

924 G. Dymond, Birmingham. *Baking powder.* Dated March 27, 1869.

The inventor takes acid or superphosphate of lime together with bicarbonate of soda or potash. In order to neutralise the deliquescent property of the acid phosphate of lime, he mixes it with starch or other farinaceous matter. One part of the said phosphate of lime to two parts of starch or farina answers well in practice. He mixes the starch or farina and phosphate of lime with carbonate of soda or potash in the proportion of two

parts of the mixture to one part of carbonate of soda or potash.—Patent abandoned.

925 L. Hannart, Charles-street, Clerkenwell. *Muzzle for quadrupeds.* Dated March 27, 1869.

The muzzle is composed of a head-dress made partly of an elastic tissue or flexible material and partly of a non-elastic tissue or material, elastic transversely and non-elastic lengthwise. A piece of steel proceeds from the end of the head-dress and extends along the upper part of the animal's head, is bent at the extremity of the nose, and ends under the lower jaw, intersecting the front of the animal's snout in two equal parts. Two other pieces of steel proceed also from the end of the head-dress and are fastened to it, and extend along each side of the animal's head under the ears ending with two small balls placed in a line with the animal's teeth.—Patent abandoned.

926 G. Hodgson, Bradford, H. Bottomley, Low Moor, and E. Cockroft, Odsall Moor. *Looms.* Dated March 27, 1869.

The boxes at each end of the batten are affixed to a common axis, which is supported to rock in bearings carried by the batten or going parts, and has applied to it an arm which by connecting rod and pin joints is attached to one end of an elastic ended lever, the other end of which is by connecting rod and pin joints connected to a frame or fork applied to a rocking arm or lever with means of adjustment as to position for variations of distance of motion obtained. This frame or fork receives and is actuated by a cam or tappet on the tappet or other suitable shaft. Each arm of the elastic-ended lever referred to is formed in two parts hinged together with the part of one arm or one end of the lever capable of turning on its hinge joint in the opposite direction to that of the other.—Patent completed.

927 J. J. Bagshawe, Sheffield. *Manufacturing semolina.* Dated March 27, 1869.

The machine is composed of a series of circular discs or cylinders of steel or other metal, which are fastened on a central shaft or spindle, thus forming a roller of any desired length and diameter.—Patent abandoned.

928 N. Voice, Handcross. *Greenhouses.* Dated March 27, 1869.

This relates to the opening and closing of the ventilating apparatus in greenhouses and other like buildings. This ventilating apparatus consists of hinged glazed frames and the inventor regulates the opening and closing of the same in the following manner. He carries a horizontal bar through the mullions for the length of the glazed frames, and at each mullion he fits a rack which is connected to the glazed frame. On the horizontal bar is a cogwheel to gear into each rack, and near the outer end of the bar is an additional cog-wheel provided with a stop or catch. The horizontal bar is fitted with a crank handle or other appliance for rotating it. When it is desired to open or close the glazed frames the catch is disengaged from its cog wheel and the horizontal bar is then rotated so that the other cog-wheels act upon the racks, and, therefore, open or close the frames according to the direction in which the bar is rotated. When the glazed frames have been moved into the required position the catch is allowed to take into its cog-wheel, so that the parts are all held.—Patent completed.

929 H. Haschke, Watling-street, E.C. *Breech-loaders.* (A communication.) Dated March 27, 1869.

The head of a screw or bolt (with its ring) forms the pivot of the trigger guard, and by its removal the trigger guard and all the mechanism can be taken out without the aid of a tool. The head of the screw forms the pivot of the extractor; the trigger guard acts as a lever and moves all the mechanism. A bottom or projection forms a lock to the trigger guard, a screw is used for helping to fix the butt, and there is a hole for the screw which holds the obdurator and the striker to the trigger guard lever. A part of the trigger guard serves to cock the striker and prevent it acting before the arm is quite closed. Another part of the trigger guard causes the extractor to act by the movement of the lever. A projecting part of the spring of the extractor gives a sharp blow to the latter, when it is released by the movement of the trigger guard. The spring may, however, be dispensed with, as the part of the trigger guard has been found to be sufficient to give the necessary blow to the extractor. The transverse screw attaches the tail of the guard to the breech box. There is a hole through which the head of the striker strikes the cartridge, and a piece or hood covers the striker in order to protect the shooter from accident in case the priming should burst.—Patent completed.

930 D. Jones, Birmingham. *Buckets and pails.* Dated March 27, 1869.

The inventor takes a blank or flat piece of sheet iron and stamps or raises it to a required contour in section in the ordinary manner, and then introduces a ring of wire upon the inside of the flange or rim of the lid or cover to serve the purpose of a mandrel or core in the formation of the shoulder or bead upon the outside of the flange or rim, which is effected by means of the action of a lathe.—Patent abandoned.

931 F. Parker, Leeds. *Locomotives.* Dated March 27, 1869.

This consists in arranging two steam cylinders in the centre line of the engine, the one in front and the other behind the gripping wheels, and connecting the piston rod of the one cylinder to two cranks on the two gripping wheels nearest to it, such two cranks being arranged at or about right angles to two other cranks on the other two gripping wheels, to which they are coupled with two pair of coupling rods, and to which last named cranks the piston rod of the other cylinder is connected. By this arrangement when the piston of the one cylinder is at the end stroke, the other will be at or about half stroke, and therefore by the coupling of the gripping wheels the engine that is for the time being at or about half stroke will be enabled readily to assist the other engine which is at end over the dead centres.—Patent completed.

932 J. Jaquillard, Genoa. *Musical boxes.* (A communication.) Dated March 27, 1869.

The inventor changes the position of the cylinder or barrel by means of a winch handle keyed to a vertical shaft, provided with a lever projection for acting on the teeth of a ratchet wheel having the same number of teeth as there are airs in the instrument. The teeth of this ratchet wheel gear with a second ratchet formed on the snail or cam usually employed to shift the cylinder.—Patent abandoned.

933 B. J. B. Mills, Southampton-buildings. *Extraction of oleaginous matter.* (A communication.) Dated March 27, 1869.

The apparatus in its most approved form consists of a high vat to contain the meal or other material, through which bisulphide of carbon is caused to ascend carrying the oil with it. A receiver, located beneath or below the said vat, communicating with the latter in such a manner that the matter divested of its oil may be readily and instantaneously discharged to leave the vat ready for a new charge and appliances to assist the vaporisation and complete removal of any bisulphide of carbon remaining in the meal after the latter has been divested of oil.—Patent completed.

934 J. W. Girdlestone, Norfolk-street, Strand. *Constructing vessels to avoid compass deviation.* Dated March 27, 1869.

This invention relates to a novel method of correcting and preventing compass dievations in iron, steel, or composite ships or vessels by polarising on a regulated system such parts of the ships or vessels as may be requisite, and by the simultaneous employment in some cases of soft iron.—Patent completed.

935 E. H. Hirch, Brunswick. *Preserving provisions on ships.* Dated March 27, 1869.

This invention has for its object an adaptation of the cooling machine described in the specification of a patent granted to Windhausen on March 5, 1869 (No. 669). Windhausen's air cooling machine is erected on board the ship, and so arranged that it may be driven from the ship's engines. Loading or storing rooms for the meat or other articles of food are also constructed on board the ship, they are made with double walls or sides which should be airtight, and the spaces between the double sides may be filled with non-conducting material or left vacant. Pipes are led from the air cooling apparatus into the loading or storing rooms to convey into the rooms the cold air from the cooling machine, and also to draw out of the rooms the air which has become partially warmed by absorption of heat from the contents of the rooms. In this way the meat or other articles of food may be kept at so low a temperature as to remain unchanged during a voyage of any length.—Patent completed.

936 W. Riddell and T. Bletcher, Bishopsgate-street. *Sewing machines.* Dated March 27, 1869.

This consists, first, in the peculiar devices for operating the vibrating hook in a machine for making what is called a chain stitch. The invention consists secondly, in the peculiar construction of a rotating hook for a chain stitch machine; and, third, in the peculiar means whereby the same machine can be adjusted to form the "chain stitch." The invention, consists fourth, in the novel devices for producing the reciprocating action of the needle bar. Fifth, in a novel method of supporting and securing the shuttle of a lock stitch machine, and, sixth, in constructing the cloth plates and also the front plate, which covers the needle bar, of materials not hitherto used for such purpose, which materials render the said plates superior in cleanliness and less costly of manufacture than the ordinary metal plates, and diminish the noise made by the machine in working.—Patent completed.

937 F. B. Taylor, Glasgow. *Counting machine.* Dated March 29, 1869.

The improved machine or apparatus which constitutes this invention is intended for counting and recording or registering numbers. It operates or is operated in a peculiar manner, and is formed and constructed as described in a provisional specification thereof dated March 29, 1869, No. 937.—Patent completed.

938 G. Bloem, Dusseldorf, and E. Scheidt, New York. *Breechloaders.* Dated March 29, 1869.

To the breech end of the barrel of the gun is fixed a cylindrical chamber or shoe to receive a bolt or movable breech-piece, which is capable of being moved to and fro therein by means of a handle or knob fixed thereto, the cylindrical chamber or shoe being formed with a suitable opening to receive the cartridge when the movable breech piece or bolt is moved back so as to leave the breech end of the barrel open. This cylindrical chamber or shoe is also formed with a suitable slot or opening to permit of the to-and-fro motion of the bolt or movable breech piece, and to hold it in either position as required, the knob or handle coming against suitable stops for this purpose.—Patent completed.

939 W. R. Lake, Southampton-buildings, Chancery-lane. *Soda and potash.* (A communication.) Dated March 29, 1869.

This invention is based upon, first, the known decomposition of chloride of sodium and chloride of potassium by the oxide of lead in the presence of water at the ordinary temperature. By this decomposition is formed, on the one hand an oxychloride of lead, or, more correctly peaking, a mixture of chloride of lead and hydrate of oxide of lead (solid), and on the other hand caustic potash or soda, which remains in solution. This solution separated from the solid part is evaporated to withdraw from it the soda or potash. Second, the addition of lime which produces a remarkable increase in the production of potash and soda hitherto unknown.—Patent completed.

940 W. R. Lake, Southampton-buildings, Chancery-lane. *Blowing apparatus.* (A communication.) Dated March 29, 1869.

In the invention the periphery of the blower case, instead of being made integral with the side plates, is made of separate sections, which at their sides are fitted between the side plates, and are bolted thereunto and abut with their ends against each other.—Patent completed.

941 W. R. Lake, Southampton-buildings. *Horse-shoe nails.* (A communication.) Dated March 29, 1869.

The process consists first in reducing in grooved rolls soft tough wrought-iron from the form of bars into strips of any desired length or width. Next, the inventor submits the material to the action of punching dies. The blanks are then submitted to the action of a rolling machine, which forms part of this invention, by which machine the shanks of the blanks are elongated. Then the elongated blanks are compressed at the point by a punch or plunger acting against a solid bed so as to bevel the point ends across.—Patent completed.

942 E. Morewood, Rock Cottage, Glamorganshire. *Coating metals.* Dated March 29, 1869.

When coating sheets of iron or other metal with tin or terne metal or other readily fusible metal, the inventor removes the plates from a bath of the coating metal through a pair of rollers placed in contact with the molten coating metal, but with their nip or line of contact above it. On the outer sides of the rollers, and resting on the molten metal, grease or flux is placed so as to rise by preference nearly to the top of the rollers; but the grease or flux is not allowed to pass between the rollers, the rollers themselves stopping it back, and there are suitable guards or partitions at their ends.—Patent completed.

943 S. Firth, Leeds. *Cutting coal.* Dated March 29, 1869.

This consists in making a boss on that part of the pick nearest the point. In this boss is a socket of any suitable shape. By preference the inventor uses a circular taper socket, the loose point being cottered into the socket against a piece of india-rubber or other suitable substance at the bottom of the socket or around the outer edge of the socket, so that, when the blow is given, some part of the strain is taken off the point. The edge of the socket is brought as close as possible to the point, for, as the socket must enter the groove made in the coal, and must be clear of the top and bottom of the groove, and as, in some cases, the groove is not more than 1½in. in height, it will be readily seen that the closer the socket is to the point the greater the resisting strength of the point.—Patent completed.

944 A. Clark, Chancery-lane. *Stereoscopes.* (A communication). Dated March 29, 1869.

This consists mainly in the use of magnets for receiving and holding the pictures in the proper position for being viewed. It also consists in binding the ends of the card pictures or views with iron or other suitable material to be acted upon by the magnets, and in the method of delivering a single card or picture to the magnets and discharging it therefrom, by which arrangement any desired number of cards or pictures may be received and discharged from a revolving cylinder.—Patent completed.

945 W. P. Hope, Wouldham. *Cement kilns.* Dated March 29, 1869.

Instead of constructing the kilns of considerable height as hitherto, and open above, the inventor covers each with a firebrick arch, and causes the heat to pass through but a comparatively small thickness of the materials operated on. For each kiln he provides a chamber contiguous thereto, and capable of being placed in communication therewith through a suitable channel provided with a damper.—Patent abandoned.

946 G. T. Bousfield, Loughborough Park, Brixton. *Sewing machines.* (A communication.) Dated March 30, 1869.

The improvements consist, first, in a new form of hook; second, in an arrangement of the hook so that it revolves in planes perpendicular to the plane in which the needle reciprocates; third, in the employment of a case around the bobbin, whereby a thick bobbin containing in consequence much thread may be employed, and a tension be put upon the lower or bobbin thread; fourth, in the employment of a non-rotating support for the bobbin, said support being surrounded by the hook; fifth, in the combination with a rotating hook and a reciprocating needle of a take up or apparatus for pulling up the loop of needle thread when cast off by the revolving hook.—Patent completed.

947 The abstract of this specification will appear in a future number.

948 J. Bath, King William-street, E.C. *Telescopic pencils.* Dated March 30, 1869.

A helical spring is placed loosely within the pencil case and presses against the pencil holder for pushing the pencil out of the case. A spring catch holds the pencil within the case. When the pencil is pushed thereinto this spring is collapsed and the pencil pushed out.—Patent abandoned.

949 H. G. Dixon, Dundee. *Velocipedes.* Dated March 30, 1869.

The inventor forms those parts tubular which constitute the steering apparatus and those which connect the front and hind wheels together. That portion forming the steering apparatus consists, first, of the main tube screwed into a cross plate immediately above the periphery of the leading wheel; to the lower part of this tube the inventor attaches a second main tube which extends in a diagonal direction towards the periphery of the hinder wheel (or centre of the axle if two hinder wheels are used), where it is screwed into a cross plate similar to that of the first-named tube. The inventor connects one of the main tubes to the bearing of the front and the other to those of the hinder, wheel or wheels by smaller tubes screwed into or attached to the before-named cross-plates.—Patent abandoned.

950 W. W. Harris, St. John's Wood. *Velocipedes.* Dated March 30, 1869.

This consists of one or more toothed wheels, or other gearing, attached to the driving wheel and geared with one or more toothed wheels or other gearing attached to the crank in a manner somewhat similar to the arrangement known as the sun and planet wheel.—Patent abandoned.

951 A. Muir, Manchester. *Velocipedes.* Dated March 30, 1869.

This consists in making the saddle spring bar of such velocipedes adjustable in height so as to be available for any rider by the use and application of screws to the lower extremity of the back springs, which in the case of this invention pass loosely through holes formed at or near the junction of the main bar with the axle of the back wheel or wheels, and are secured at any height by lock-nuts.—Patent abandoned.

952 M. M'Leod, Edinburgh. *Railway.* Dated March 30, 1869.

The improvement consists in suspending or supporting a plate, plank, rail, rod, bar, rope or ropes, one or more of them, and working thereon, in or by suitable grooves or guides thereon, a carriage or machine having grooved or flanged wheels, and supplied on each side with suitable guide wheels when desired, and with adjustable or otherwise hanging seats or receptacles for passengers or goods, such seats or receptacles being preferably adjusted somewhat lower than the level of the rail.—Patent abandoned.

953 C. E. Brooman, Fleet-street. *Winding threads.* (A communication.) Dated March 30, 1869.

This consists in balling or winding threads so that the ball is unwound from the centre, although the thread proceeds from the outside. A needle is used which resembles a wool needle, the eye of which has been filed through,

When the ball is wound, the inner thread (or in some cases the outer thread) is drawn into the eye of the needle, which is then pressed into the ball at the inside and made to come out at its outside, drawing the inner thread with it. This thread is to be pulled when the ball is unwound. Modifications are described.—Patent abandoned.

954 A. Barclay, Kilmarnock. *Steam boilers.* Dated March 30, 1869.

This consists in making the space surrounding the boiler proper sufficiently large to receive a large number of tubes, which are connected at their lower ends to the water space and at their upper ends to an upper chamber. The water space of the boiler proper is provided with a large number of tubes, by means of which additional heating surface is obtained. From the upper part of the furnace a flue passes to the top of the chamber; this flue is provided with a damper, which may be opened or closed at will. The outer sets of tubes hereinbefore mentioned are surrounded with a casing, which may be either single or double, and when double it may be made to constitute an additional water space or an air space.—Patent completed.

955 J. Briggs and J. Almond, Blackburn. *Weaving looms.* Dated March 30, 1869.

Instead of tying up the healds directly to the top jacks, wires, or other lifters of the dobby, the inventors use longer cords, and change the direction of the same by means of small bowls or grooved pulleys, so as to bring the points of attachment of the cords much nearer to the ends of the healds.—Patent abandoned.

956 T. E. Williams, Newport. *Distilling hydro-carbon oils.* (A communication.) Dated March 30, 1869.

This consists chiefly in providing the still with means for alternately supplying and exhausting the oil, so that when the still is heated to the temperature required to vaporise all the distillable products, or so much thereof as may be desired, a succession of charges of the cold oils may be admitted, each of such charges being suddenly vaporised, and the evolved products successively removed. Also in making provision for a gradual condensation of the evolved products or so much thereof as may be desired, and in the means for producing a distillate, which may have in combination as many of the different chemical purposes resulting from the distillation as may be practicable or desirable.—Patent completed.

957 W. F. Proctor, Cheapside. *Sewing machine table* (A communication.) Dated March 30, 1869.

This relates to the mounting of a sewing machine upon a platform forming part of a sewing machine table top, which platform may be raised and dressed at pleasure, thus elevating the machine to the level for working or sinking it below that level and out of sight when not required for use.—Patent completed.

958 F. Bender, Manchester. *Railways.* Dated March 30, 1869.

The inventor forms notches across the ends of two rails to be joined, in which he places a piece formed with a T end on each side, and these T ends abut against the "fins" or other side of the rails.—Patent abandoned.

959 T. G. Webb, Manchester. *Glass furnaces.* Dated March 30, 1869.

The melting pots are placed upon the stage, and the firebars may be radial if desired. The walking stage may be opened or closed by a door, and there is an air trunk which may be regulated by a damper. An extension of the walking stage and a wall support a slab, on which is placed a plate, which in its turn supports a plate provided with a circular opening on which is placed a pipe, the latter portion fitting loosely on to the former.—Patent completed.

960 H. Y. D. Scott, Ealing. *Lime and other kilns.* Dated March 30, 1869.

The inventor arranges any convenient number of compartments in a series, side by side. Each compartment consists of three divisions, situated vertically over the other, and comprises, first, a cooling chamber at the bottom, into which the substances operated upon descend after their calcination, and whence they are finally withdrawn. Second, a middle chamber in which the substances to be operated upon are subjected to the egree of heat necessary for their calcination; and, third, a chamber in which these substances are subjected to a preparatory heating to expel moisture and raise them to a fitting temperature before they descend to the central chamber for calcination.—Patent completed.

961 W. E. Cadman, Holloway. *Decorating surfaces* Dated March 30, 1869.

This consists in backing up in close contact by means of any suitable material, transparent or otherwise, having a design or character printed, painted, or otherwise made thereon, transparent glass, globulous beads, or dust, or fragments of glass, or other transparent material, in such manner that the design or character shows through the transparent glass globules, and a crystalline effect suitable for decorative purposes is obtained.—Patent abandoned.

962 A. Chambers, Fairfield-road, Bow, E. *Manually propelled carriages.* Dated March 31, 1869.

The body of the vehicle is, by preference, suspended to springs carried by the main axle. In fixing the one driving wheel, it is placed freely upon the axle, to which a bar or bars is or are attached, and the end or ends of the said bar or bars is or are firmly secured to the rim or felloe of the driving wheel. In order that the vehicle may travel round curves or over uneven roads without twisting or straining the main shaft or axle, one only of the wheels is firmly fixed to the axle as described or otherwise; in order to enable either of the wheels to slip upon the axle as occasion may require, the rotary motion may be transmitted to the wheels by friction in such manner as to enable both to serve as driving wheels, and to allow either of them by slipping more or less upon the axle on encountering excessive resistance to rotate at a slower speed than the other without hoisting or straining the shaft or axle.—Patent completed.

963 B. Dobson and J. Eastham, Bolton. *Carding engines.* Dated March 31, 1869.

The inventors make use of the usual radial arm with a slot at the other end. In this slot are two slides, which are raised by a bowl or cam on the cam wheel and drawn down by the cam or by a spring. The upper end of the lower slide is provided with a serrated plate, and a second serrated plate is fixed to the upper slide. To the upper and lower sides of the ends of the top flat are fixed serrated plates; when the top flat is to be raised, the cam or bowl raises the lower slide and brings the lower serrated plate against the serrated plate at the lower side of the top flat, and when the top flat has been raised sufficiently, it brings the upper serrated plate of the top flat against the serrated plate of the upper slide.—Patent completed.

964 F. W. Follows and J. Bate, Manchester. *Lawn mowing machine.* Dated March 31, 1869.

This consists in an improved mode of giving motion to the knife barrel shaft of lawn mowing machines, for which purpose the inventors make in one of the travelling or supporting wheels an internal toothed gear, and on the same end of the knife-barrel shaft is keyed a small pinion which gears into and receives its motion from the internal gear or wheel in the travelling wheel. The same result may be obtained by friction rollers. By these means we are enabled to dispense with the back roller now required for giving motion to the knife barrel.—Patent completed.

965 T. A. Dillon, Dublin. *Utilising waste steam.* Dated March 31, 1869.

A bell-mouthed steam pipe leads from the side of the blast pipe to the firebox, where it is formed into a zigzag coil beneath the firebars, and terminates in some convenient part of the firebox or water tank. The pipe of which the coil under the firebars is formed is perforated with small holes alternating (that is to say, that no two steam jets shall be directly opposite each other) through which a portion of the waste steam rushes. The steam jets thus produced are caused by the arrangement of the coil to play partially on the firebars and partially into the fire, the effect whereof is first to abstract from and utilise the excessive heat of the firebars and keep them cool, thus preventing the accumulation and adherence of clinkers thereon. Second, the steam is thus forced into contact with the heated bars, the incandescent part of the fuel, and the carbonic oxide (which may be generated therefrom) is decomposed into its elements, and free hydrogen is liberated.—Patent completed.

966 T. Greenwood, Leeds, and J. Keats, Leek, Staffordshire. *Boots and shoes.* Dated March 31, 1869.

The front part of the boot upper is shaped in such a way as to provide two folding pieces, which act the part of gussets. The edges of these gussets are securely sewn to the "back quarter" of the "upper" in the lines, and to form an additional connection between the front part of the upper and the back quarter, elastic side pieces are applied to the boot, but these may be dispensed with if thought desirable. A strap or tongue, which is part of the back quarter or attached thereto, passes round the front of the boot to connect with a button or a buckle on the other side, and thereby close the upper part of the boot. By cutting the front part of the upper in one piece, and connecting it with the back quarter as explained, the inventors leave no vertical openings in the boot, and thus make it practically waterproof.—Patent completed.

967 A. F. Baird, Pimlico. *Earth closets and urinals* Dated March 31, 1869.

A light iron framing, which should be of ⅜in. round iron with a piece of wood fixed to one end, is hung in brackets secured to the framing. In front of the hopper, from a crossbar in the front part of the frame, a small bar is swung, the end of which hangs a little below the rail of the framing, up to which the weighted part of the valve rises, and, as the latter rises, it strikes up this bar, which causes the wood at back of hopper to strike the latter briskly, which never fails to agitate the earth even when it has stood forty-eight hours, and thus settled down nearly 2in. When the weighted end of the valve falls, the frame and striker also fall of their own weight ready for other use.—Patent completed.

968 R. Johnson, Waterloo-place, Pall Mall. *Continuous bar fences.* Dated March 31, 1869.

The inventor makes the standards of continuous bar or strained wire fences of a bar of iron with a flange or flanges so that it shall somewhat in section resemble the letter L or T, or a double or single fish hook; or he otherwise forms the bar with a flange or flanges so that, after the horizontal wires or bars of the fence have been passed through holes in the stems of the standards, keys or wedges may be driven down vertically between the horizontal bars or wires of the fence and the flange or flanges of the standards.—Patent completed.

969 G. Wells, Westminster. *Separating copper and bismuth.* Dated March 31, 1869.

The ore is first reduced to an impalpable powder mixed with a given quantity of saltpetre. It is then placed in shallow pans supplied with a hood to retain the vapour arising therefrom, heat is applied under the pans, the temperature not being raised above 300deg. Fahr., and, when the ore is well heated, a small quantity of water or steam is introduced so as to keep the surface of the ore covered with vapour. The ore is kept continually stirred, atmospheric air being freely admitted thereto, by which means the sulphur is converted into sulphuric acid, which unites with the copper in the ore and converts it into a soluble sulphate.—Patent completed.

970 J. H. Lloyd, Llangefin, Anglesey. *Working, cutting, and shaping tools.* (A communication.) Dated March 31, 1869.

In sawing small or large stones, either in one block or several together, the inventor employs endless metallic bands without teeth and moved by revolving wheels or drums of any diameter required, as hereinafter described. The chiselling or dressing of the stones is performed by a tool or tools in a heavy hammer block or tool holder, the weight and fall of which is regulated as required, the stone or stones being held on a movable platform and moved by mechanical arrangements in all directions to meet the blows of the hammer.—Patent completed.

971 H. Davey, John-street, Adelphi. *Hydraulic machinery.* Dated March 31, 1869.

This invention chiefly consists in a valve which is in two parts, and is provided with a collar of leather or other suitable material covering the point of junction of these two parts. This valve is designed for an ordinary simple hydraulic crane or engine.—Patent completed.

972 W. Langer, Whitechapel-road. *Manufacture of cigars.* Dated March 31, 1869.

This consists in forming or shaping the inside or "bunches" of cigars by placing them in moulds or shapes of the size or sizes of the cigars to be made, and in filling or building up the tobacco in the moulds.—Patent abandoned.

973 B. J. B. Mills, Southampton-buildings, Chancery-lane. *Envelopes.* (A communication.) Dated March 31, 1869.

A band or border is formed on or fixed to one edge of the envelope, and at the opposite edge the envelope is perforated or pierced through both the front and back in a line at a suitable distance from the edge thereof.—Patent completed.

974 T. Corbett, Shrewsbury. *Carts, waggons, and drays* Dated March 31, 1869.

The inventor forms at or near the inner end of each of the arms or parts of the cranked axle upon which the naves of the wheels turn, a strong upright rod. Each of these upright rods are in a line with the vertical part of the cranked axle, and parallel with the side of the body of the cart. On each side of the body of the cart an eye or ring is fixed, which eyes or rings work upon the upright rods of the axle. Around these rods strong coiled springs are placed, their upper ends bearing against the eyes or rings on the body of the cart, and their lower ends bearing against the arms of the axle.—Patent abandoned.

975 B. and H. Craven, Sheffield, and J. N. Craven, York. *Brick and tile pressing machine.* Dated March 31, 1869.

Upon a suitable rectangular framework the inventors mount standards which support an overhead steam cylinder, to the lower end of the piston rod of which is affixed a platten or plunger of a form suitable to the shape and size of the brick or tile to be pressed. Between the sides of the frame, and at or near the top of the same, is a sliding table upon which are fixed two moulds, one near either end of the table. A rack is formed on or affixed to the under side of the table, into which rack is geared a tooth sector, secured to a shaft which has a motion of partial rotation in the frame. On the outer end of the shaft are affixed curved wings or levers, which are acted upon alternately by a reciprocating clutch mounted upon the lower end of a vertical rod affixed to a crosshead carried by the piston rod of the cylinder.—Patent completed.

976 J. Livesey, Victoria Chambers, S.W. *Permanent way.* Dated March 31, 1869.

This consists in making the fish plates of greater vertical depth from simple rolled bars for the purpose of increasing the strength and power of resistance to vertical deflection in the joint. The fish plates are made to project downwards to any required extent below the bottom of the rail, and are rolled into a suitable form at the lower part. A cotter may be driven through both plates immediately underneath the joint if required. The invention consists, second, in the construction of wrought-iron sleepers formed by bending plates into the form of saddles with tiebars passing through each side.—Patent completed.

977 J. A. and J. Hopkinson, jun., Huddersfield. *Steam engine indicators.* Dated March 31, 1869.

An arm or pencil holder is fixed upon the top of the ordinary piston rod of the indicator, which arm turns on a swivel centre, and at a lower point there is fixed a swivel guiding arm, which is so formed as to admit of a drop guiding rod passing through it so that by turning the swivel arm the pencil can be brought upon the paper, which is usually fixed on the revolving barrel, thereby facilitating the taking of diagrams.—Patent completed.

978 R. Jones, Botolph-lane. *Preserving food.* Dated March 31, 1869.

The cases (usually formed of tin) containing the matters to be preserved, are attached each by a small pipe having a tap in it to suitable exhaust apparatus, in order that as desired a vacuum or partial vacuum may be created in the cases through the pipes connecting them with the exhaust apparatus. The cases thus arranged in respect of the vacuum apparatus are also placed in a bath of boiling water, when the tap in each pipe from a case to the exhaust apparatus is turned so as to admit of free passage between the interior of each case and the exhaust apparatus for (say) one or two minutes, by which the air contained in the cases will be withdrawn therefrom, and wholly or in part from the contained substances, thus getting clear of the greater portion of the decomposing or destructive element in the substances to be preserved before the cooking thereof begins.—Patent completed.

979 W. E. Gedge, Wellington-street, Strand, W.C. *Belt buckles.* Dated March 31, 1869.

This fastening is made of tinned iron or other suitable material. It is formed of a plane part riveted at each angle at the points to one of the ends of the belt. On this part, and of one piece with it, rises the buckle properly so called having a sloping shape. This piece having to receive the wedge which is to fix the free end of the belt is so made that the three faces of its upper part present a development insensibly diminishing down to its base, thus its top as well as the sides each presents a greater breadth than the corresponding part of its base.—Patent completed.

980 J. B. Gridley, Ingram-court, Fenchurch-street. *Paper pulp.* (A communication.) Dated March 31, 1869.

This invention is based upon the discovery that the entire stalk (the fibrous and ligneous portions and pith) of the okra plant (Hibiscus Esculentus) can be applied to the production of pulp suitable for the manufacture of paper and papier mache of the various quantities in demand, and that this plant also yields the matter suitable for sizing the paper.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated October 12, 1869.

2958 A. B. Childs, Mark-lane, Middlesex. An improved process for reducing wood to a fibrous condition for the manufacture of paper stuff or pulp.

2959 E. A. Snuggs, Sheet-street, Windsor, Berks. Improvements in cocks, taps, and valves.

2960 R. L. Hattersley and J. Hill, Keighley, Yorkshire. Improvements in looms for weaving.

2961 T. Cope, J. Hignett, and G. Lander, Liverpool. Improvements in machinery for twisting or spinning tobacco.

2962 J. B. Blythe, London-street, City. Improvements in the mode of, and apparatus for, vaporising and burning liquid hydrocarbons for the production of heat in furnaces and for generating steam.

2963 M. Andrews, Birmingham. Improvements in locks and latches.

2964 W. Bennett, Aston, near Birmingham, and J. Currall, Birmingham. Improvements in kitchen ranges.

2965 E. Farrington, Grande Rue Passy, Paris. Improvements in breech-loading firearms.

2966 E. Brown, Lyme Regis, Dorsetshire. An improvement in the mode of propelling carriages, boats, and other vehicles by the hands or feet.

2967 J. Morrison and J. Thomas, Ferry Hill Ironworks, Durham. Improvements in the fireplace and grate of puddling furnaces, mill furnaces, and other reverberatory and boiler grate furnaces.

2968 T. Stevenson, George-street, Edinburgh. Improvements in iron girders.

2969 W. Lincolne, Glasgow. Improvements in fastening or securing the joints of belts, and in the means employed therefor.

Dated October 13, 1869.

2970 J. H. Selwyn, Woodland Crag, Grasmere, Westmoreland. Improvements in firearms, parts of which are applicable for use as a digging tool.

2971 J. Halford, Brettel-lane, Kingswinford, Staffordshire. Improvements in puddling furnaces used in the manufacture of iron, and in other reverberatory furnaces.

2972 L. M. Casella, Hatton-garden, Middlesex. An improved apparatus to be employed in lighting gas burners, lamps, and other articles.

2973 J. Smith, Cockspur-street, Charing Cross. Improvements in instruments for timing ships' logs.

2974 J. Kennedy, Westminster. An improved sanitary composition or cement for building and ornamenting purposes.

2975 R. Scholefield, Leeds. Improvements in pumps or apparatus for raising or forcing water or other liquids or fluids, and for transmitting the motive power thereof.

2976 T. Parry, Balham, Surrey, and J. M'Hardy, Edinburgh. An improved drag, applicable to waggons, omnibuses, and other wheeled vehicles.

2977 S. Osborn, Sheffield. Improvements relating to knife bars and knives for reaping and mowing machines.

2978 W. Challiner, Winco-road, Grimesthorpe, Sheffield. Improvements in the manufacture of forks and spoons.

2979 C. Brakell, North Moor Foundry, Oldham. Improvements in fans, pumps, and machinery for propelling air, fluids, and other substances by centrifugal force.

2980 J. Hartley, Leeds. Improvements in apparatus for registering billiards or other games.

2981 R. J. Ellis, Castle-street, Liverpool. Improvements in apparatus for desiccating animal and vegetable matters.

Dated October 14, 1869.

2982 W. J. Bonser, Highbury New Park, Middlesex. Improvements in apparatus to be used for feeding and watering cattle in railway trucks.

2983 W. E. Gedge, Wellington-street, Strand. A novel mode of putting up or incasing packets of needles.

2984 J. H. Roberts and E. Simons, Manchester. Improvements in brakes for railway carriages.

2985 B. Calvert, Bolton, Lancashire. A machine for cleaning hose pipe used for fire engines and other purposes.

2986 F. M. Cotton, Foulis-terrace, Brompton, Middlesex, and W. Field, Lower Tooting, Surrey. Improvements in apparatus for facilitating the copying of drawings and other representations, forms, or designs.

2987 S. Wilson, Manchester. Improvements in applying power to the knee-joint levers of certain presses used in pressing cotton, and suitable for other materials.

2988 C. W. Siemens, Great George-street, Westminster. Improvements in smelting iron and steel, and in apparatus and furnaces employed in connection therewith.

2989 L. A. Lesage, Rue Ste. Appoline, Paris. Improvements in closing and securing vessels containing alimentary substances.

2990 E. Lane, Paddington, Middlesex. Improvements in parts of the permanent way of railways.

2991 C. L. Page, Westminster. Improvements in packing cases or boxes for containing bottles or other articles.

2992 J., J., and C. Hudson, Newcastle-upon-Tyne. Improvements in machinery for the manufacture of paper.

2993 W. Kloen, Birmingham. A new or improved method of water colour printing.

2994 E. L. Parker, Birmingham. A new or improved combined pocket corkscrew and carriage key.

2995 J. Taft and J. C. Edwards, Manchester. Improvements in machinery for opening, cleaning, and preparing cotton and other fibrous materials.

2996 W. Barbour, Glasgow. Improvements in the arrangement of stage lights, and in shades for covering or protecting the same.

2997 N. Washburn, Massachusetts, U.S.A. Having reference to railway carriage wheels.

2998 W. Avery and A. Fenton, Redditch, Worcestershire. Improvements in cases or receptacles for needles, pins, matches, pens, cards, stamps, photographs, cotton, and other similar articles.

2999 E. Roe, Popham-street, Nottingham. Improvements and additions in or to machinery or apparatus for the manufacture of looped or knitted fabrics, and also of warp and weft fabrics.

Dated October 15, 1869.

3000 G. W. Bowley, Addle-street, City. An improved ladies' and children's combined under garment.

3001 D. Brown, Clerkenwell Green, Middlesex. An improved method of treating iron and other metal surfaces, so as to render the same better adapted to advertising and other purposes.

3002 L. Byrne and W. Payne, Birmingham. An improved packing applicable for buckets, pistons, and stuffing boxes, and for all other purposes where packing is employed.

3003 J. Mackie, St. James'-street, Westminster. An improvement or improvements in lock fast breech-loading firearms.

3004 W. R. Lake, Southampton-buildings, Chancery-lane. An improved machine for drilling or boring rocks, chiefly designed for working mines, tunnels, and quarries, and for submarine operations.

3005 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in sewing machines.

3006 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in chain cable stoppers.

3007 S. Barber, Liverpool. Improvements in the propulsion and steering of navigable vessels.

3008 J. Walker, Glasgow. Improvements in apparatus for measuring fluids.

3009 J. W. Robinson and T. Murray, Glasgow. Improvements in the burning of liquid carbons, as the tarry residues left in the refining of mineral oils, as a fuel in furnaces, and in the construction and arrangement of apparatus and furnaces therefor.

3010 E. T. Hughes, Chancery-lane. Improvements in means and apparatus for regulating or controlling the delivery of tickets at railway stations and other similar places, part of which improvements is applicable to telegraphic purposes.

3011 E. T. Hughes, Chancery-lane. An improved lift for raising and lowering merchandise and weights of all descriptions.

3012 W. B. Leachman and J. Holroyd, Leeds. Improvements in hydraulic apparatus for raising and forcing water.

3013 H. Smith, Henrietta-street, Covent-garden. Improvements in dish covers, and in the manufacture of the same.

3014 J. H. Lyon, Sutton, Lancashire, and W. Lyon, Runcorn, Cheshire. Improvements in furnaces for making glass.

3015 W. E. Gedge, Wellington-street, Strand. An improved elastic horseshoe.

3016 A. H. Douche, Boulevart Bonne-Nouvelle, Paris. Apparatus termed Douche's regulating valves, for regulating the supply of water to turbines and hydraulic wheels.

3017 H. M. Marsden, Sheffield. An improved method of manufacturing sheep shears and other articles of cutlery.

Dated October 16, 1869.

3018 J. Horton, Milverton, near Leamington, Warwickshire. Improvements in castors for furniture.

3019 F. F. Whitehurst, Cambridge-terrace, Richmond-road, Putney, Surrey. Improvements in apparatus and machinery for mashing grain and obtaining products therefrom.

3020 J. Willats, Kingsland-road, Middlesex. Improvements in playing cards.

3021 J. J. Nancy, Hatton-garden, Middlesex. Improved holders for supplying thread to sewing and embroidering machines, and apparatus for filling such holders.

3022 A. Angell, Banbury, Oxfordshire, and J. J. Perry, Red Lion-square, Middlesex. Improvements in machinery or apparatus for heating and delivering metal bars.

3023 W. H. H. M'Neight, Dublin. Improvements in venetian and other blinds.

3024 J. Raper, Dudley Hill, near Bradford, and M. Pearson and D. Mills, Bradford, Yorkshire. Improvements in looms for weaving.

3325 J. Player, Philadelphia, Pennsylvania, U.S.A. Improvements in the manufacture of iron and steel.

Dated October 18, 1869.

3026 W. Rogers and G. Tidcombe, Watford, Hertfordshire. Improvements in the manufacture of balls and mallets used in the game of croquet and other games, and in apparatus employed therein.

3027 N. Hodgson, New Barnet, Hertfordshire. A motive power engine.

3028 J. M. A. Stroh, Tolmers-square, Hampstead-road, Middlesex. Improvements in electro-magnetic clocks, part of which improvements are applicable to mechanical clocks.

3029 G. Collins, Preston, Lancashire. Improvements in carding engines.

3030 J. C. Martin, Gray's Inn-road, Middlesex. Iron or other metal name plates for shop window stall plates, door plates, &c.

3031 J. and W. Bottomley, Bramley, near Leeds. Improvements in machinery for fulling or milling woollen and other woven or felted fabrics.

3032 J. and W. Bottomley, Bramley, near Leeds. Improvements in machinery for washing and scouring woollen and other woven or felted fabrics.

3033 P. Jacques, Rue Turgot, Paris. An improved process for purifying and decolouring blood albumen.

3034 C. and W. Bradley and E. Thackray, Bradford, Yorkshire. Improvements in wool-combing machinery.

3035 R. S. Bartleet, Redditch, Worcestershire. Improvements in cases for the holding of needles and other articles.

3036 A. P. Price, Lincoln's Inn-fields. Improvements in the purification of coal gas.

3037 M. Ker, Mansfield-road, St. Pancras, Middlesex. Improvements in hanging and drawing window and other curtains.

3038 C. E. Spagnoletti, Telegraph Department, Great Western Railway, Paddington, Middlesex. Improvements in apparatus for signalling by means of electricity.

3039 A. Welch, Southall, Middlesex. Improvements in cattle trucks.

3040 A. V. Newton, Chancery-lane. Improvements in fabrics to be used as a sacking for bedsteads and couches, and in frames for supporting the same at tension.

3041 W. R. Lake, Southampton-buildings, Chancery-lane. An improved nut for screw bolts.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2250	2787	2817	2841	2857	2871	2884	2898
2692	2791	2819	2842	2858	2872	2885	2900
2763	2793	2821	2843	2860	2873	2886	2001
2765	2797	2822	2846	2861	2874	2887	2902
2767	2799	2823	2847	2862	2875	2888	2903
2769	2801	2825	2849	2863	2876	2889	2904
2771	2803	2827	2850	2864	2877	2890	2905
2772	2805	2829	2851	2865	2878	2892	2906
2773	2807	2833	2852	2866	2879	2893	2907
2775	2809	2836	2853	2867	2880	2894	2908
2777	2810	2837	2854	2868	2881	2895	2909
2779	2811	2838	2855	2869	2882	2896	2910
2783	2813	2839	2856	2870	2883	2897	2911
2785	2815	2840					

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2638 D. Evans
2658 F. Meyer, W. Wainwright, and T. P. Pascoe
2659 G. Lake
2670 W. H. P. Gore
2679 J. Bronner
2672 J. Smith and J. Rowe
2686 C. A. Girard
2710 E. B. Bigelow
2714 O. L. Hopson and H. P. Brooks
2744 J. Watts

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2756 C. Thomas
2789 E. A. Cowper
2813 R. Lauth
2836 G. T. Bousfield

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," October 19, 1869.

1724 J. Edge
1764 C. E. De Loriere
1767 H. Carter and G. H. Edwards
1768 D. Cole
1776 D. J. Field and L. W. Lister
1779 W. Madders and J. Wood
1783 E. Bishop
1788 R. Harrison
1794 T. Hodgson
1796 W. Cook
1798 W. A. Gilbee
1807 R. Duckworth, W. Greenwood, J. Pearson, and J. Langtree
1809 A. Lafargue
1810 J. H. Riddell
1819 W. S. Underhill and J. Smith
1821 J. Young
1828 M. Benson
1829 M. Benson
1830 M. Benson
1840 J. T. Masbon
1841 T. Knowles
1845 D. Dishart
1851 R. Hornsby and J. E. Phillips
1852 R. Hornsby and J. E. Phillips
1854 E. Cardon
1855 T. Routledge
1864 W. M'Nabb
1866 J. H. Johnson
1867 C. and E. Brightman
1887 C. E. Brooman
1916 J. H. Johnson
1921 A. M. Clark
1926 S. Joy
1957 W. R. Lake
1991 E. Roe
1998 G. White
2015 G. Palmer
2177 A. M. Clark
2413 D. Barker
2418 D. A. Gibbs
2427 W. Richards
2547 W. R. Lake
2569 W. E. Newton
2624 W. E. Gedge
2666 S. Simpson
2697 W. E. Newton
2719 N. J. Dor
2731 A. Tylor
2807 G. T. Bousfield
2813 F. Armstrong
2819 J. Buchannan
2859 A. Bodart
2894 J. Clayton
2917 W. P. Gregg
2948 J. H. W. Biggs

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed October 15, 1869.

1184 E. T. Hughes
1193 J. Horsley
1199 A. V. Newton
1202 L. Goetz
1205 N. Wilson
1210 K. S. Mackenzie
1216 W. F. Reynolds and J. A. Mays
1238 G. White
1272 A. Jack
1377 D. Adamson
1521 F. Walton
2343 G. W. Murray and G. M. Garrard
2366 A. B. Ibbotson

Sealed October 19, 1869.

1219 P. R. Hodge
1220 E. O. Catrin
1222 J. W. M'Carter
1227 C. D. Abel
1228 C. M. Barker
1234 J. Holding
1242 G. G. Tandy
1247 W. Palliser and T. English
1250 W. A. Lyttle
1254 J. Whittaker
1258 E. Tatham
1288 W. E. Newton
1314 T. Bostock
1327 R. Elsdon
1328 W. Spence
1344 W. B. Robins
1402 R. Fennelly
1407 F. Leonardt and H Hewitt
2544 B. Hunt

LIST OF SPECIFICATIONS PUBLISHED

For the week ending October 16, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
312	1 2	590	1 6	633	0 10	675	0 4	710	0 4	744	0 4
383	0 4	591	0 8	635	0 10	676	0 4	713	0 4	747	0 4
421	0 6	592	1 0	640	0 10	679	0 4	716	0 4	751	0 4
513	0 8	595	0 10	643	0 10	681	0 4	719	0 4	753	0 4
519	0 10	596	0 8	647	0 10	682	0 4	720	0 4	756	0 4
549	0 8	599	0 10	649	1 0	683	0 4	721	0 4	757	0 4
556	3 6	610	1 4	650	0 10	686	0 4	722	0 4	761	0 4
559	1 0	611	0 4	652	0 6	688	0 4	723	0 4	762	0 4
560	0 8	612	0 10	654	0 8	689	0 4	725	0 4	764	0 4
561	0 8	616	0 10	656	0 6	691	0 4	726	0 4	765	0 4
564	1 0	617	0 8	657	0 6	696	0 4	731	0 4	768	0 4
566	1 0	618	0 10	666	0 8	701	0 4	734	0 4	771	0 4
570	0 8	622	0 10	667	0 6	702	0 4	735	0 4	772	0 4
577	0 8	623	0 10	668	0 4	703	0 4	738	0 4	797	0 4
582	1 4	625	0 6	669	1 0	705	0 4	741	0 4	835	1 2
585	0 10	628	1 4	671	0 4	706	0 4	742	0 4	1096	4 2
587	1 6	630	0 10	672	0 4	708	0 4	743	0 10	1156	0 8
589	1 4	631	1 0	673	0 4	709	0 6				

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, OCTOBER 29, 1869.

THE METROPOLITAN MAIN DRAINAGE AND ITS WORKING.

THE most important of the numerous important improvements undertaken by the Metropolitan Board of Works is undoubtedly the main drainage of the metropolis. With the exception of a portion of one of the main lines of sewer, the system has been in operation about four years. The uncompleted sewer is the low-level line on the north side of the river, portions of which have been delayed in consequence of their having to be formed in connection with the Thames Embankment, between Westminster and Blackfriars, and also with the embankment of the river at Chelsea. The principal portion of the system, however, having been so long in operation, an opportunity is afforded of considering the effect which it has produced upon the health of the metropolis. But before proceeding to this part of the subject, we will notice what progress has been made in the works generally during the past twelve months or so. From the annual report of the Metropolitan Board of Works, which has recently been issued, we find that about four miles of the low-level sewer between Tower-hill and the Pumping Station at Abbey Mills have been completed and are in operation. A further portion, rather more than a mile in length, has been formed under the Thames Embankment, and the western portion of the sewer, to a length of more than 3½ miles between Hammersmith and the temporary pumping station at Cremorne, has for some time been in operation. Of the remainder, a further part, between the Temple Gardens and St. Andrew's-hill, is in course of construction under the Thames Embankment. From St. Andrew's-hill to New Earl-street the sewer is to be constructed by the Metropolitan District Railway Company in connection with their works, and it had also been intended to construct the portion between New Earl-street and Tower-hill in connection with the railway. But as it was uncertain when that part of the line would be formed, the Board wisely determined to forego the advantages offered by a joint execution of the two works rather than delay the construction of the sewer; for until this part is complete, the other portions westward cannot be made available. The Board, therefore, accepted the tender of Mr. W. Webster for the construction of the sewer between New Earl-street and Tower-hill for the sum of £67,500.

It has also been decided to proceed with the formation of that part of the sewer between Westminster Bridge and Chelsea Suspension Bridge, at which point it is proposed to erect the pumping station to lift the sewage from the low-lying western districts. The Board accordingly accepted the tender of Messrs. Hiscox and Williams for the construction of these works for the sum of £72,700. When these portions of the sewer are completed, the drainage of the whole of the low-level area, east of Chelsea Bridge, will be intercepted from the river and conveyed to the outlet at Barking Creek. The only portion of the Low-Level Sewer which will then remain to be formed will be that between Chelsea Bridge and Cremorne, which will be constructed in connection with the Chelsea Embankment.

One of the principal features in the Main Drainage scheme is the splendid Pumping Station at Abbey Mills, West Ham, which is the largest establishment of the kind in existence. This came into operation during the past year, having been formally opened by the Board on July 30, 1868. The sewage is there pumped from the Low-Level Sewer into the Outfall Sewer, a height of 36ft., by eight engines, together of 1,140 nominal horse power. The buildings were erected by Mr. W. Webster, the cost of the whole having been £218,300. The eight engines and machinery were constructed and erected by Messrs. Rothwell and Co., at a total cost of about £61,000. A detailed description of the pumping station, engines and machinery, and of all the arrangements connected therewith, will be found in the MECHANICS' MAGAZINE for August 7, 14, 21, and 28, 1868. The total cost of the Main Drainage works up to June 30 last had been about £4,128,000.

Having then seen the general position of this great undertaking, let us now glance at the effect produced by it on the public health. A reference to the tables given in the Registrar General's reports shows that the deaths in the metropolis, especially in the low-lying districts, have been fewer since the execution of the Main Drainage Works than in previous years, which may be considered evidence of the improved sanitary conditions which now prevail in consequence of those works. In districts which are lower than the level of the river at high water, the contents of the sewers used formerly to stagnate during a large portion of each day. The sewers could only discharge at the time of low water, and as the tide rose it closed the outlets, causing the sewage flowing from the higher grounds to accumulate in the low-lying portions of the sewers, where it remained stagnant until the tide was sufficiently low for the sewers to discharge. In times of heavy and long-continued rains, the closed sewers were unable to store the increased volume of sewage, which then rose through the house drains and flooded the basements of the houses, thus causing not only injury to health, but considerable damage to property. The construction of the Main Drainage Sewers at deeper levels has afforded better outfalls for the local sewers, of which advantage has extensively been taken by the vestries and district boards to re-construct their sewers, and thus the evils from which the inhabitants of the low-lying localities suffered have been removed. Further proof of the benefits derived from the main drainage is to be found in the increased and increasing purity of the river, of which the number of fish which continue to be found, even in those parts of the river which were formerly the most polluted, affords undoubted evidence.

Closely connected with the subject of the Main Drainage scheme is the question of the utilisation of the sewage of the metropolis. In this matter the Metropolitan Board has not made such progress as it has in its constructive operations. Our readers are doubtless aware that in the year 1865 the Board granted a concession of the sewage of the northern portion of the metropolis to the Metropolis Sewage and Essex Reclamation Company, upon the understanding that the company would construct culverts for the purpose of conveying the sewage from the outfalls of Barking Creek, for distribution on sands to be reclaimed from the sea at Maplin on the Essex coast. The company deposited with the Board the sum of £25,000 as a guarantee for the due execution of the works within four years from the passing of the Act; that is, the works were to be completed by June last. By an amending Act, however, which the company obtained in 1866, the time for the completion of the works was extended till July, 1870. The company entered into a contract for the construction of a culvert to convey the sewage to Maplin, in accordance with their agreement with the Board, and a portion of the culvert was constructed. The sum total of the matter, however, is that the company have not been able to continue the works, which is to be regretted.

Turning to the utilisation question upon the south side of the Thames we find that at the date of their last report, the Board had before them proposals from parties who were desirous of obtaining the concession of the southern sewage. The Board then stated that active steps in the matter had been delayed in consequence of the difficulty experienced in raising funds for public companies. Those proposals were the subject of a report of a committee to the Board on January 8 in the present year. The committee stated that many circumstances tended to prevent their recommending the acceptance of either of the proposals. Mainly, however, this result was attributed to the financial depression consequent on the crisis of 1866, which more or less affected adversely all commercial schemes, but particularly such as partook of a new or experimental character. The committee stated that they had several times adjourned the consideration of the tenders in the hope that the Board might be able to deal satisfactorily with them, but as that was not the case, and as the works of the company who had the concession of the sewage on the north side of the Thames had been for some time in abeyance, it appeared desirable to postpone for the present the consideration of the question of the southern sewage. We trust, however, that this postponement of the question will be only temporary, and that a revival of enterprise and the re-establishment of more favourable financial conditions will enable the subject to be more successfully dealt with at some future period.

We cannot conclude our present notice without referring to the ventilation of sewers in the metropolis. This question, which is one of great importance as affecting the health of the metropolis, is surrounded with many difficulties, and it appears that the Board have hitherto been unable to adopt any mode of dealing with it sufficiently sure and practicable to enable it to be applied generally throughout the metropolis. Two or three years ago various experiments were made by the direction of the Board, first, by the use of charcoal ventilating grates, second, by ventilation through chimney shafts and furnaces, third, by ventilation through pipes carried to the tops of buildings, and fourth, by dilution of the sewage with water. The subject is now under the consideration of a committee of the Board, and by their direction, the engineer has recently caused the whole of the sewers to be examined, in order to ascertain the number of untrapped gulleys and open air-shafts connected therewith, the number of cases in which these various methods of improving the ventilation have been adopted, the approximate cost thereof, and how far they may be deemed to have been successful.

The engineer has submitted his report to the committee, but they have not yet been able, having regard to the importance of the subject and the serious consideration it requires, to submit their views thereon to the Board. We trust, however, that they may shortly be enabled to do so, and that some effectual means of preventing the escape of foul gases from the sewers may soon be arrived at.

FOREST CONFLAGRATIONS.

THERE are three principal causes to which may be attributed the ignition of forests. They are wilful incendiarism, accidental incendiarism, and spontaneous combustion. Many persons are sceptical on the subject of the last-mentioned cause, but there is abundance of the most reliable evidence to prove that it has been productive of destruction not only to vegetable but also to animal life. In investigating the liability of forests to these several chances of conflagration, the first may be omitted, as it is scarcely possible to prevent an evil-disposed person setting

fire to a wood if he be so inclined. The other two causes may be guarded against, as they depend upon a variety of existing contingencies, which are well known and recognised as imparting an inflammable tendency to the standing timber. As may be anticipated, the nature of the trees, the character of the soil, and the geographical locality exercise considerable influence upon the chances of combustion. That the mineralogical constitution of the soil plays an important part in these instances becomes evident as soon as attention is directed towards forests, some of which spring from a calcareous and others from a granitic substratum. The oak, the pine, and the arbutus, which together are frequently met with growing upon the former description of geological formation, are thus comparatively secure from ignition. There is very little, if any, accumulation of brushwood, and moreover it is not of a very inflammable nature, so that even when a fire does occur it rarely commits any very serious or extensive devastation. The case is widely different when the character of the soil is granitic, and is in fact composed of the disintegrated particles of primitive rocks. This imparts an especial resinous property to the vegetable productions, and also largely increases the quantity of brushwood, particularly of the heather, which is the most dangerous specimen of the class. It is in this mass of dry wood and *debris* that lurk the seeds of future conflagrations, and which feed them until they acquire sufficient fierceness to seize upon the larger trees, and extend their ravages sometimes over a whole district. During the hot season this inflammable mass becomes desiccated to so extreme a degree as to be ignited by the merest spark, and the rapidity with which the flames spread seldom leaves much chance of extinguishing them. As a rule, the fire is extinguished by consuming itself. It dies out.

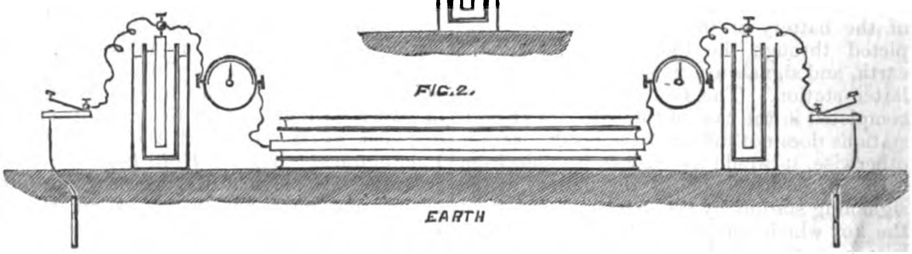
A peculiar feature in these conflagrations, where pine trees are among the victims, is the burning of their cones, which materially adds to the violence and extension of the catastrophe. Under the influence of the intense heat, the strobeels of these cones, still green and filled with sap, burst open with considerable violence and propulsive effect, sending their ignited contents to a distance of several hundred yards, there to act as the agents of fresh fires. From this cause it has frequently happened that all attempts to cut off and separate the burning area from the rest of the forest have been frustrated, and those engaged in the task have beheld with dismay and despair flames springing up in different parts of the forest without any apparent or assignable reason. Bearing in mind what an accumulated mass of inflammable materials exists in a large forest, there is need of no comment to indicate that stringent precautions should be taken to diminish to a minimum the causes that might conduce to a conflagration. Among these are the careless use of the pipe or cigar, the imprudence of hunters, or the negligence of charcoal burners. As there are now no actual forests in England, our remarks apply principally to those of foreign countries. A very frequent cause of the firing of forests is due to a habit, or rather custom, of the agricultural population to procure a manure for the ground. For this purpose they arrange here and there on the field or plot which is to receive the next sowing, a number of small bonfires composed of dead boughs, dried leaves, and other timber *debris*, and covered by grass sods, with the grass turned inside. By the incineration of these vegetable components a very excellent manure is procured. However desirable in an agricultural point of view these operations may be, the danger of conducting them in close proximity to a large forest ready to ignite at the shortest notice is so imminent that it is a wonder the authorities permit the practice to be continued.

The attention of our neighbours on the opposite side of the Channel has been recently very forcibly directed towards this subject by a conflagration in Corsica, which lasted over eight days, and destroyed an enormous quantity of valuable timber, together with a large amount of miscellaneous property. Although a fire of this nature is by no means an uncommon event in the Napoleonic isle, yet when it arrives at such a magnitude it unquestionably demands an inquiry. Accordingly, the officer of the Crown, who in our country would answer to the Commissioner of the Woods and Forests, was directed to institute an inquiry into the cause of the disaster, with especial view to the prevention of so lamentable an occurrence hereafter. One of the precautionary methods which that gentleman recommends will at first sight appear rather startling. He proposes to set fire to the forest, although not exactly to the same extent that prevails when it takes place under other circumstances. But it is very properly pointed out in the report that, by the lighting and maintenance of small fires under careful surveillance, the brushwood could be easily destroyed, and thus the principal danger removed. It is also strongly insisted upon that the larger trees should be more frequently and more thoroughly thinned, and that their dead branches should be removed instead of being permitted to fall from the tree and so serve as convenient fuel for the next fire. As an additional precaution, the forests ought to be more intersected by roads than they are at present, so that they might be better commanded in the hour of danger, and more accessible to the means employed for their rescue and preservation. Other advantages would accrue to the proprietors of forest property by the multiplication of the means of intercommunication and transport. Not the least of these would be the rise in value of the property itself, which in every country is directly proportional to these pioneers of civilisation. The comparative security or non-security of a forest from fire altogether fixes its value. The forests of Corsica that are regarded as exempt from conflagration are valued at about £14 the acre, and those that are considered inflammable at just half that sum. At the approaching legislative session it is intended to lay before La Chambre a bill embodying the measures best calculated to diminish, if not prevent, the occurrence in future of disasters so calamitous.

FITZGERALD'S SYSTEM OF ELECTROLYTIC INSULATION.

FIG. 1.

FIG. 2.



ELECTROLYTIC INSULATION.

We have recently met with some very interesting and striking improvements in telegraphy which involve an entirely new system of constructing lines of electric telegraph, or of insulating a signalling current, and which have been patented by Mr. D. G. Fitzgerald. In this system, which is equally applicable to aerial, underground, and submarine lines, no insulating material properly speaking—that is to say, no dielectric—is employed; the lateral passage of the signalling current being prevented by a combination of metallic and electrolytic conductors so arranged as to generate an electromotive force which opposes the escape to earth of the current. The principle upon which is based this somewhat startling innovation in telegraphy will be seen on reference to the accompanying diagrams. Fig. 1 represents a battery of two cells constructed according to Mr. Fitzgerald's invention. The outer vessel is of lead or copper, the inner vessel of the same metal covered externally with zinc, and the central element is a cylinder of zinc. The two cells may thus be said to be included in one. Supposing the tensions of the poles of a single couple constructed of similar elements, and excited with dilute acid or a saline solution, to be respectively + 5 and − 5 when the couple is insulated, the tension of the zinc pole of the battery here represented will be − 20 when the outer vessel is in contact with earth. The same will be the case if hemp, slightly impregnated with a good electrolytic conductor, be interposed between the metallic elements in lieu of the ordinary exciting fluid.

It is to be observed that the zinc pole of this arrangement constantly retains its minus charge, although it is directly connected with earth by a series of metallic and electrolytic conductors. In the case of ten cells similarly arranged the free negative pole would constantly retain a charge at the tension of − 100; and under no circumstances could electricity at this or a lower minus tension escape to earth by traversing the conductors intervening between earth and the central zinc element. It is evident therefore that a series of metallic and electrolytic conductors, disposed as shown in the diagram, is capable of effecting the insulation or preventing the passage to earth of a negative charge, or of a current from the negative pole of a battery. In order to distinguish this mode of insulation from that which is effected by non-conductors of electricity, Mr. Fitzgerald terms the former "electrolytic insulation" and the latter "dielectric insulation."

The rationale of the construction and working of an electrolytically-insulated telegraph line will be explained by fig. 2, in which an underground cable, constituting an elongated battery analogous to that which has been above described, is supposed to extend between two signalling stations. The central conductor, both in the cable and the station batteries, will here acquire a negative tension, precisely as in the case of the battery shown in fig. 1, since the arrangement may be regarded as simply a longitudinal extension of this battery. Until the signalling key at either station be depressed, no current can traverse the line and influence the receiving instruments; the conductive circuit being otherwise incomplete, or the negative

pole of the longitudinally extended battery insulated from earth. To trace the effect of depressing the key at the right side of the figure, for instance, it is necessary only to consider that this key is in connection on the one hand with the line conductor, that is to say, with the negative pole of the battery on the left side of the figure, and on the other hand with earth, that is to say, with the positive pole of this battery, which is in contact with earth. By working the key at one station, therefore, the circuit of the battery at the other station is completed through the line, instruments, and earth, and signals are thus transmitted to the latter station. The fact that the circuit is completed in the case of the batteries at both stations does not influence the result; were it otherwise, it would be easy to insulate from earth the positive pole of the battery at the signalling station by the same movement of the key which completes the circuit of the battery at the receiving station.

The electrolytic conductor employed in the construction of the cable is hemp or other vegetable fibre which has been saturated with a saline solution and subsequently dried, though it still retains sufficient moisture to allow of its generating, by contact with dissimilar metallic surfaces, the electromotive force which opposes and prevents the lateral passage of the signalling current. In overland lines, the electrolytic insulation of the conductor, instead of being continuous, is effected only at the points of support along the line, the dielectric air being, as in the ordinary system of overland construction, the principal insulating medium.

The foregoing remarks suffice to explain the main points of the theory of a system of insulation which may very probably ere long be adopted in telegraph construction. We shall await the conclusion of the experiments now being carried out under distinguished scientific; supervision to determine the most advantageous form of electrolytically insulated cable before entering into further and more practical details of the invention.

ATMOSPHERIC INFLUENCE ON THE TIDES.

A GREAT deal of anxiety and curiosity was excited in the public mind in reference to the spring tides of October 6th. This resulted from a widely circulated prediction of inundations to low-lying districts. But the event completely falsified the dismal prophecy. The tides were as nearly as could be in accordance with the scientific information furnished by the Admiralty Tide Tables. It has been since argued that the tides were experienced as a consequence of the state of the weather, and that had the weather been different the inundations might have occurred. Although this reasoning seems to have been most appreciated after the event, there is no doubt that there is truth in it. In calling attention to the matter, we have in view a suggestion which, if carried out, would relieve the public of any necessity of alarming itself in a similar manner without an existing cause.

The astronomical data upon which tide predictions are calculated are well known, and, so far as astronomical causes are concerned, the height and times of tides can be accurately computed beforehand. But the tides are affected by meteorological causes, as the presence of storms, prevailing winds, and atmospheric pressure; and these are variable causes which cannot be employed as data in tide calculations, and, indeed, are barely recognisable within one or two days before the event. The tide tables give the tide elevations for what may be considered the ordinary state of the atmosphere. Conditions of great or of low atmospheric pressure, or of storms or strong winds, can only be taken into account a few days or perhaps a few hours previous to the time when the tide is due.

Meteorologists have shown that wherever over the sea an area of low atmospheric pressure exists there the level of the water rises proportionally to the deficiency from the average; the contrary occurring with a prevalence of high pressure. Theory would give about thirteen inches rise of tide for one inch fall of mercury in the barometer; and this has been verified by tide-gauges. In this manner the cyclonists account for the cyclone wave, which is a kind of heaping up of the water under the centre of the meteor, and being carried forward by it is virtually a wave. They also account for the formation of storm-currents, or drifts of the sea occasioned by the force of the storm-wind. Piddington's "Sailor's Horn-book" quotes from the "Geological Report on Cornwall, Devon, and West Somerset," by Sir Henry De la Beche, the following very interesting account of the influence of winds on the tides:—

Mr. Walker* has observed with respect to the influence of the pressure of the atmosphere upon the tidal waters on the shores of Cornwall and Devon, that a fall of 1in. of the mercury in the barometer corresponds to a rise of 16in. in the level of the sea, more than would otherwise happen at the same time under the other general conditions, a rise in the barometer of 1in. marking a corresponding fall in the sea level of 16in. This he has found to be the usual rate of such alterations in level, but very sudden changes in the pressure of the atmosphere are accompanied by elevations and depressions equal to 20in. of sea water for 1in. of mercury in the barometer. Regarding the whole pressure of the atmosphere over the globe as a constant quantity, all local changes in its weight merely transfer a part of the whole pressure from one place to another, and hence he concludes that the subjacent water only flows into or is displaced from those areas where, for the time, the atmospheric pressure is either less or greater than its mean state, in accordance with the laws which would govern the indication of two fluids situated in the manner of the atmosphere and sea. We might account for the difference observed by Mr. Walker in the amount of depression or elevation of sea level produced by sudden changes in atmospheric pressure by considering that a sudden impulse given to the particles of water, either by suddenly increased or diminished weight in the atmosphere, would cause a perpendicular rise or fall in the manner of a wave beyond the height or depth strictly due to the mere change of weight itself.†

As regards the influence of the winds on the mean level upon the south coast of Cornwall and Devon, Mr. Walker observes that east and west winds scarcely affect it, but that southerly winds raise the sea above it from 1in. to 10in., and off shore winds depress the water beneath it as much according to their force. On the morning of November 29, 1836, when the velocity of the wind was estimated at about 100ft. per second, the sea at Plymouth was raised 3ft. 6½in. above the mean level, the greatest height above the equilibrium level he has seen. The hurricane began at S.W., and the barometer was very low, therefore this great increase in height is due both to the wind and diminished atmospheric pressure. A gale of wind from the southward, a low barometer, and a high spring tide concurring, cause damage and inundations on the southern coast of Cornwall and Devon. From the form of the British Channel and the absence of a free passage for the waters, such as exists at the Straits of Dover, in the English Channel, westerly winds force up and sustain a great body of water, thereby raising the sea above the mean level several feet. It appears from an account of the great storm of November 26, 1703, that the tide flowed over the top of Chepstow bridge, inundating all the low lands on both sides of the Severn, washing away farmyards, drowning cattle, &c., and it is worthy of remark that the barometer is recorded to have then fallen lower than had ever been previously noticed.

This quotation leads to the suggestion which we have to make, namely, that the indications of tide-gauges at critical times of the tides should be carefully watched and reported by telegraph to the Meteorological Office; and that the office should be charged with the duty of interpreting these indications, in connection with its duty of watching the weather, and should make known its opinions or conclusions to the public as speedily as possible by the same means as it adopts to disseminate a knowledge of the weather. The subject is the more worthy of the consideration of the Meteorological Committee because their staff alone has the means of keeping a daily watch upon the weather. Neither the Admiralty nor the Board of Trade could attend to this matter. It would appear that every facility will shortly be afforded for undertaking this duty. By a Bill to consolidate and amend the Acts relating to Merchant Shipping and Navigation, brought forward in the House of Commons on the 9th August by Mr. Shaw Lefevre, it is proposed to enact that "The harbour authority shall, on being required to do so by the Board of Trade, provide, and until relieved from this duty by the Board of Trade shall always hereafter maintain in good order, at such place and in such manner as the Board of Trade direct or approve, an efficient self-registering tide-gauge with a barometer; and shall cause accounts of the workings thereof to be kept and to be sent to the Board of Trade, in such manner and at such time as the Board of Trade direct or approve." Penalties are to be enforced for not providing or not attending to these instruments.

* Assistant Master Attendant H.M. Dockyard, Devonport.

† A circumstance connected with this subject of considerable practical value has been noticed by Mr. Walker during his long-continued observations. He has found that changes in the height of the water's surface, resulting from changes in the pressure of the atmosphere, are often noticed on a good tide-gauge before the barometer gives notice of any change. The practical value of the observation is, be the cause of the phenomenon what it may, that if tide-gauges at important dockyards show that a sudden change of sea level has taken place, indicative of suddenly decreased atmospheric weight, before the barometer has given notice of the same change, all that time which elapsed between the notices given by the tide-gauge and barometer is so much gained, and those engaged with shipping know the value of even a few minutes before the burst of an approaching hurricane.

TELEGRAPHIC NOTES.

IN our issue for the 8th inst., we gave particulars of the proposed Falmouth, Gibraltar, and Malta submarine cable, which will be 2,462 knots in length. We are glad to find from the directors' report—which has just been issued in anticipation of the meeting to be held on the 2nd proximo—that preliminary matters are progressing satisfactorily. The shares have been allotted, and the allotment money has been almost entirely paid. The order for the cable has been given to the Telegraph Construction and Maintenance Company, and the sum of £30,000 has been paid to them, in accordance with the contract. They have commenced the manufacture of the cable, and there is every reason to believe that it will be completed within the contract time. The directors have been in communication with the Postmaster-General with reference to the transmission of their messages between London and Falmouth and have obtained the promise of special wires for their traffic, together with other accommodation at the Metropolitan terminus, and the enjoyment of equal privileges with those accorded to any other telegraph company. This company has joined with the Anglo-Mediterranean Company in purchasing from the Telegraph Construction Company the steamer "Hawk," with her machinery and stores, to be used as a repairing ship, which will be very advantageous to the interests of the company. The directors have appointed Sir James Anderson the managing director of this company, an office which he also holds in the Anglo-Mediterranean and British-Indian Companies, thus practically bringing the three companies under one management. They have also appointed as their permanent secretary Mr. E. B. Bright, the secretary of the British and Irish Magnetic Telegraph Company, which is now about to be absorbed by the Government. Mr. Bright's great experience in connection with telegraphy will render his services peculiarly valuable to this undertaking. The manufacture of the cable for the British-Indian Company is rapidly approaching completion. True to her time, the "Great Eastern" steamship left Sheerness for Bombay on the 23d inst. with upwards of 2,200 miles of cable on board, and the remainder will follow very shortly in two other steamships. The laying is expected to be finished in March next. The Falmouth cable is expected to be laid within a few weeks afterwards, so that the whole line of submarine communication between England and

India will be completed sooner than had been originally announced.

A few remarks which recently appeared over the initials "H. G." in the Society of Arts "Journal" will serve to illustrate the manner in which government control over the telegraphs in France is exercised for the convenience and benefit of the public. After the 1st November next, the charge for a message from any one port of France to another will be reduced from 2fr. to 1fr., or to something under one shilling. The reduction of the uniform rate of 1fr. was enacted by the Chamber of Deputies in July, 1868; but more than a year has been required to make preparations for the increased correspondence which is expected to ensue on the increase of facilities and diminution of charge. Besides the construction of numerous branch lines, the Morse instrument has been replaced by the Hughes' printing apparatus at all the important stations. The use of Hughes' apparatus doubles the rapidity of communication, in other words, will enable twice as many messages to be forwarded in the same time. The number of offices has been greatly increased; it now amounts to 2,701, of which 1,071 are government offices, the remaining 1,000 being at railway stations, whence messages are forwarded according to an arrangement made with the government. No difficulty is experienced in obtaining the required number of signallers. At the last examination 230 were admitted. At present the French telegraph extends over 25,000 miles of line, and the number of messages annually amounts to 3,500,000. In the year 1865, according to Mr. Bright, the United Kingdom possessed 16,000 miles of line, over which 4,650,000 messages were forwarded. The principal improvements effected by the French government, within the last few years, may be briefly enumerated:—1. Reduction of the charge to the uniform rate of 1fr. 2. The introduction of Hughes' printing apparatus, improved by the late M. Froment, who rendered the instrument workable, which it was not previously. 3. A new and very efficient organisation of the pneumatic system, by which messages are forwarded collectively from the centres of various districts to the centres of other districts, instead of transmitting the messages successively, or one after the other, as was formerly the case. 4. The introduction of Meyer's instrument, which forwards a *fac-simile* of the message received, and thus renders any error on the part of the telegraph impossible.

Mr. W. J. Conlan, the secretary of the Pacific Steam Navigation Company, writes to the "Times" the following letter, which beautifully illustrates the manner in which the telegraph system between this country and Portugal is conducted:—Sir,—Allow me to call attention to the extraordinary manner in which telegrams from Lisbon reach this country. This company's outward-bound mail steamship "Cordillera" arrived at that port at noon on the 19th inst., and left on the evening of the same day. The homeward-bound mail steamship "Araucania" arrived on the evening of the 19th, and left again on the evening of the 20th; and the telegrams in connection with these movements came to hand as under:—No. 1, private telegram, 21st, 9 a.m., despatched from Lisbon 18th, 8 p.m.; No. 2, departure of "Araucania," 21st, 11 a.m., despatched from Lisbon 20th, 7.30 p.m.; No. 3, departure of "Cordillera," 21st, 5 p.m., despatched from Lisbon 19th, 6 p.m.; No. 4, arrival of "Cordillera," 22d, 12.30 a.m., despatched from Lisbon 19th, 3.53 p.m.; No. 5, supplementary news by "Araucania," 22d, 1 a.m., despatched from Lisbon 20th, 2 p.m.; No. 6, arrival of "Araucania," 22d, 9 a.m., despatched from Lisbon 20th, 10 a.m. We have been in the habit of receiving telegrams from Lisbon for several years past, and the irregularities all along have been considerable, but the extraordinary confusion in the arrival of the above messages is without a parallel in our experience. I need scarcely add that the telegrams were all more or less unintelligible. No 5, which consisted of 83 words, afforded scarcely a chance of interpretation, and we were obliged, in consequence, to withhold its contents from publication. "Congress has gefealted cuantie," and "ronesings generally brisck accept in niahete hade" are fair samples of the "news" it contained.

The Post-office authorities are actively proceeding with the arrangements necessitated by the impending transfer of the telegraphs to that department. At Lincoln the new telegraph office is expected to be located in Guildhall-street, as near the post-office as possible, the wires being continued thereto from the post, which is about midway between the High-street and The Holmes. Alterations have been commenced at the Leicester post-office for the accommodation of the new branch of postal business; the contract has been let to Messrs. Neale and Son, and Mr. G. Reavell will act as clerk of the works. In Suffolk, Essex, &c., the extensions involved by the new system are being carried out under the superintendence of Mr. Sach. Among the towns to which the telegraph will be extended are Botesdale, Bungay, Brightlingsea, Dedham, Eye, Framlingham, Haughley, Haverhill, Hadleigh, Halesworth, Harleston, Ixworth, Long Melford, Leiston, Needham Market, Orford, Scole, Stowmarket, Wivenhoe, Walton-on-the-Naze, &c.

The number of messages through the French Atlantic Telegraph during the week ending the 23d of October was 692, the cable charge thereon being £1,636, showing a decrease of £252 from the preceding week.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

ARTIFICIAL PORPHYRY FROM IRON SLAGS—NEW WAY OF MAKING LEAD PIPES WITH A TIN LINING—NEW SEWING COTTON—THE ORNAMENTATION OF PLASTER CASTINGS—A NEW RED DYE.

At the ironworks of Aulnoye, in Belgium, the slag is utilised by casting it into slabs for paving, garden rollers, and other things. For the former purpose, moulds are excavated in the ground around the furnaces of sufficient extent to receive all the slag running from them, and trenches are cut to carry the liquid slag. The only precaution to be taken, we are told, is to cause the slag to run under the vitreous layer, which solidifies at the beginning of the running, and to keep the moulds warm, so that the slabs may not solidify too rapidly. For this purpose it is often necessary to cover up the trenches and moulds with cinders and small coal. The cooling should, indeed, be made to occupy several days; and, in that case, there will be found under the vitreous crust a compact homogeneous slab, in appearance very much resembling natural porphyry. The masses are often divided by fissures, but the pieces can be dressed and trimmed into blocks for paving. To obtain sound rollers, it is necessary to take especial care in the cooling and solidifying It is hardly necessary to add that the slags employed for these purposes must be solid and lasting, and not at all brittle.

A new way of manufacturing lead pipes with a lining of tin has been devised by M. J. Grand, jun. The first step is the formation of a muff coated with tin on the inside. This is made in a horizontal mould, which is made to revolve with great rapidity, and is provided with a hollow axle through which the metals are introduced. The metals are fused in a crucible furnished with a stopcock or a clack valve opening into the hollow axle of the mould. One crucible will suffice, the lead being placed at the bottom and the tin on the top, the two being separated by an iron grating; or the tin may be melted in a separate crucible provided with a valve and placed above that in which the lead is melted. The object is, of course, to run the lead into the mould first, and to allow the tin to follow while the former metal is still liquid. A rapid movement of rotation keeps the two metals from mixing, while a perfect junction is formed as they solidify. When sufficiently cooled, the muff is transferred to the press, and the pipes are squeezed out in the usual way. Tin lined pipes ought to command an extensive use for carrying soft waters and beer, and, no doubt, would be employed if they could be produced at a small advance on the price of lead piping. The plan of manufacture described here deserves attention, although it seems open to doubt whether the lining surface of tin would be perfectly continuous in the pipes. No doubt the adhesion of the two metals would be perfect.

M. Masson has introduced a sewing cotton of increased strength made by spinning together linen and cotton fibres. The proportion of the two fibres may be varied according to the work the thread is to be used for.

There has been a difficulty in getting a good ground for painting upon plaster ornaments and cements which seems to us to have been entirely removed by M. Rimbaud, a Parisian sculptor. This gentleman first applies a coating of solution of albumen in acetic acid. The proportions he employs are one part of albumen and five parts of acetic acid. He does not mention the strength of the acetic acid, but it need not be strong. This solution completely stops the pores of a plaster or of a spongy stone, and forms a firmly adherent skin to which any paint or varnish can be applied. The inventor suggests various modes of ornamentation, marbling, graining, &c., which will readily occur to a painter and decorator when he is furnished with a ground he can easily work upon.

By the action of oxidising agents, M. Girard has succeeded in converting pyrogallic acid into a red dye very like alizarine. It is, like pyrogallic acid, a volatile substance, and, by the further action of nitric acid, it is converted into picric acid. The cost of pyrogallic acid in comparison with that of madder will leave little chance of any commercial application of M. Girard's discovery.

ENGLISH AND CONTINENTAL INTER-COMMUNICATION.

By Mr. Perry F. Nursey.

(*Concluded from page 297.*)

BATEMAN.

The uncertainty of the strata in the bed of the Channel and the risks of tunnelling under the sea have led Mr. J. F. Bateman, in conjunction with M. Julian J. Rèvy, an Austrian engineer, to propose a cast-iron tube for carrying a railway across the Channel. The distance to be crossed, and the cost to be incurred, undoubtedly require that the mode to be adopted shall be absolutely free from serious doubt and risk, and shall be as evidently capable of accomplishment as the most ordinary mechanical operation. Some degree of uncertainty must exist in every contrivance and speculation; but, unless a scheme can be proposed which will be free from all doubt and objection so far as human knowledge and foresight can extend, it will hardly deserve, and will probably not receive, the support of the public. The various proposals for constructing submarine tubes have been carefully studied by Mr. Bateman and M. Rèvy, who have come to the conclusion that none of them are free from serious objections, both on the score of difficulty of construction and the dangers which would attend the operations as proposed. Their object, therefore, has been to devise a scheme by which all difficulties of operating in water should be avoided.

They propose to lay a tube of cast iron on the bottom of the sea, between coast and coast, to be commenced on one side of the Channel, and to be built up within the inside of a horizontal cylinder or chamber, which shall be constantly pushed forward as the building of the tube proceeds. The chamber within which the tube is to be constructed will be about 80ft. in length, 18ft. internal diameter, and composed of cast-iron rings 8in. thick, securely bolted together. The interior of the bell will be bored out to a true cylindrical surface like the inside of a steam cylinder. The tube to be constructed within it will consist of cast-iron plates in segments 4in. in thickness, connected by flanges, bolted together inside the tube, leaving a clear diameter of 13ft. when finished. Surrounding this tube, and forming part of it, will be constructed annular discs or diaphragms, the outside circumference of which will accurately fit the interior of the bell. These diaphragms will be furnished with arrangements for making perfectly water-tight joints, for the purpose of excluding sea water and securing a dry chamber, within which the various operations for building up the tube, and for pressing forward the bell as each ring of the tube is added, will be performed. There will always be three and generally four of these water joints contained within the bell. A clear space between the end of the tube and the end or projecting part of the bell of 36ft. will be left as a chamber for the various operations. Within this chamber powerful hydraulic presses, using the built and completed portion of the tube as a fulcrum, will, as each ring is completed, push forward the bell to a sufficient distance to admit the addition of another ring to the tube. The bell will slide over the water-tight joints described, one of which will be left behind as the bell is projected forward, leaving three always in operation against the sea.

The weight of the bell and of the machinery within it will be a little in excess of the weight of water displaced, and, therefore, the only resistance to be overcome by the hydraulic presses when

pushing forward the bell is the friction due to the slight difference in weight and the head or column of water pressing upon the sectional area of the bell against its forward motion. In like manner, the specific gravity of the tube will be a little in excess of the weight of water which it displaces; and in order to obtain a firm footing on the bottom of the sea, the tube will be weighted by a lining of brick in cement, and for further protection will be tied to the ground by screw piles, which will pass through stuffing boxes in the bottom of the tube. These piles will, during the construction of the tube within the bell chamber, be introduced in the annular space between the outside of the tube and the inside of the bell, and will be screwed into the ground as they are left behind by the progression of the bell. The hydraulic presses and the other hydraulic machinery, which will be employed for lifting and fixing the various segments of the tube, will be supplied with the power required for working them from accumulators on shore, on Sir William Armstrong's system, and the supply of fresh air required for the sustenance of the workmen employed within the bell and within the tube will be insured also by steam power on shore. As the tube is completed, the rails will be laid within it for the trains or waggons to be employed in bringing up segments of the rings as they may be required for the construction of the tube, and for taking back the waste water from the hydraulic presses, or any water from leakage during the construction.

The tube will be formed of rings of 10ft. in length, each ring consisting of six segments, all precisely alike, turned and faced at the flanges or joints, and fitted together on shore previous to being taken into the bell, so that on their arrival the segments may, with certainty and precision, be attached to each other. Every detail of construction has been designed, and, so far as the authors of this project can see, no contingency has been left unprovided for. The possibility of injury by anchors or wrecks, or submarine currents, has also been investigated. The tube when laid will be secure from all dangers arising from such causes.

The building of the tube will be commenced on dry land above the level of the sea, and will be gradually submerged as the tube lengthens. The operations on dry land will be attended with more difficulty than those under water, but all these circumstances have been carefully considered and provided for. The rings forming the tube will be made by special machinery, to be expressly constructed for facilitating the work and economising the cost. This machinery is all designed and specified. The first half mile will test the feasibility of construction, for that will have to be built both above and under water. When once fairly under water, the progress should be rapid, and it is estimated that the whole undertaking may be easily completed in five years from the commencement.

The precise line to be taken betwixt the English and French coasts can hardly be determined without a more minute survey of the bottom of the Channel than at present exists. It will probably be between a point in close proximity to Dover on the English coast, and a point in close proximity to Cape Grisnez on the French coast. From an examination of the Admiralty charts, and of such information as at present exists, the sea bed on this line appears to be the most uniform and level, and, while free from hard rocks and broken ground, to consist of coarse sand, gravel, and clay. The average depth of water is about 110ft., the maximum about 200ft. On the line suggested, the water increases in depth on both sides of the Channel more rapidly than elsewhere, although in no instance will the gradient be more than about 1 in 100. The tube, when completed, will occupy about 16ft. in depth above the present bottom of the sea. Up to the point on each shore at which the depth of water above the top of the tube would reach (say) 30ft. at low water, an open pier or other protection would have to be constructed, for the purpose of pointing out its position, and of preventing vessels striking against the tube. These piers may be rendered subservient to harbour improvements. The tube at each end would gradually emerge from the water, and on arriving above the level of the sea would be connected with the existing railway systems, so that the same carriage may travel all the way from London to Paris.

The distance across the Channel on the line chosen is about 22 miles. The tube as proposed is large enough for the passage of carriages of the present ordinary construction, and to avoid the objections to the use of locomotives in a tube of so great a length, and the nuisance which would be thereby created, and taking advantage of the perfect circular form which the mechanical operation of turning, facing, &c., will ensure, it is proposed to work the traffic by pneumatic pressure. The air will be exhausted on one side of the train and forced in on the other, and so the required difference of pressure will be given for carrying the train through at any determined speed. Powerful steam engines, with the necessary apparatus for exhausting and forcing the air into the tube, will be erected on shore at each end; and supposing one tube only to exist, the traffic will be worked alternately in each direction. This system of working the traffic will secure a constant supply of the purest air, which will accompany every train.

The estimated cost of the whole undertaking, including the stations and approaches at each end, the engine power and machinery, the interest of outlay during construction, and engineering superintendence, with a large margin for contingencies, is £8,000,000.

Grantham.

Mr. John Grantham's proposition for improving the communication between England and France is to turn the present system to account, and to make an efficient means of transit whilst the more elaborate schemes are being perfected and rendered practical. Mr. Grantham proposes steamships 400ft. long, 45ft. beam, and 600 nominal horse power, to be built of steel, and to draw 6ft. 6in. water, and to steer from either end, to avoid the necessity of turning. The lower part of the ship is to be cellular, so as to avoid the danger of sinking if injured by a collision, and to add to her strength. This cellular portion is 6ft. in depth; over it would be the main saloons, these to be 10ft. in height, and provided with ample accommodation for reclining in bad weather; good refreshment tables also would be provided, with light and air to avoid that gloom and closeness so painful to landsmen when on board ship. Between the paddle boxes would be a promenade deck, 100ft. long, on the extremities of which would be the houses from which the vessel would be steered. To strengthen her amidships, with the least amount of weight, there would be provided four open longitudinal girders, about 250ft. long, so arranged as to cause very little obstruction on the ship, and longitudinal bulkheads, about 90ft. long, would run through the engine compartment. In addition to these precautions, the plates of the sides would be extended up, and form the inner side of the paddle-box, drawn off towards the ends at the same angle as the trussed girders.

In order to facilitate the transfer of passengers and luggage from the piers to the ship, wide and ample means are provided, at three different elevations, to receive the stages from the shore. The lowest of these is on the level of the main deck; the next is on the level of the promenade deck, and the upper one is on the paddle-boxes or on the captain's platform; so that, whatever should be the state of the tide, the stages may rest on the top of the piers, and be nearly level. On the piers are to be erected sheds, under which the trains are to run, as in ordinary railway stations, to be well enclosed and lighted, so that but little delay or discomfort would arise. The staircases leading from the promenade platform to the deck should be easy, wide, well-lighted, and sheltered. The great bulk of the luggage would be stowed in trucks, the bodies of which would be hoisted by hydraulic cranes on to the deck, and again lifted off on the other side, and placed on wheels provided for them. In all this there is no novelty introduced; all that is proposed may be seen in operation in other places. The only question that can be raised is as to the facility of working a vessel, such as is here described, in and out of the harbours. For experience in this, Mr. Grantham refers to the American steamers, which are managed with wonderful precision. These vessels have in some instances exceeded 400ft. in length. Those on the rivers draw 5ft. and 6ft. of water, and those which put to sea vary from 7ft. to 10ft.; but all are of immense height out of water, the wheel-houses of some being upwards of 40ft. above the water-line. Mr. Grantham's vessel, though drawing only 6ft. 6in., will not exceed 15ft. above the water-lines at the ends. Long vessels steer much more steadily in heavy weather than short ones, and will, therefore, enter such harbours as Calais or Boulogne with more safety than the present vessels, and, when fairly entered, there is time to bring them to a standstill before reaching their berths.

Mr. Grantham gives the following reasons for not adopting a vessel in which the trains should be carried bodily across:—First, there is the necessity of placing the vessel in a position of perfect stillness before taking the trains on or off the ship. This involves new harbours on each side, with dock gates and breakwaters to protect them. Second, the large ships necessary to carry the trains will take a long time in bad weather before they can be placed in position and the gates closed. Third, very few persons would remain in the carriages when being put on board, and, in the event of sea-sickness, they could not be allowed to remain, so that the passengers must have time to leave the carriages and walk on board. Lastly, the large outlay in forming the harbours, appliances for shipping the trains, and the extra cost of the ships, together with the heavy cost of working them.

Boutet.

The great bridge scheme for connecting the two shores which is at the present time attracting a large amount of attention both in England and France—especially in the latter country—is the project of M. Charles Boutet. This gentleman, who is a French engineer, has been engaged during the past ten years in maturing his plans and constructing models in order to satisfy himself of the correctness of the principles he has enunciated. M. Boutet selects a point on the Dover Hills near the Shakspeare Cliff for the commencement of his International Bridge, which is to touch the coast of France at Blanc Nez, a short distance from Calais, at which place the cliffs are about the same height as those on the English coast. These cliffs, at either extremity rising nearly 400ft. above the level of the sea, serve as abutments for the proposed viaduct. To protect them against the destructive action of rain, winds, and frost, they will be faced with a solid construction of dressed stone. The project depends in effect on two remarkable innovations in the construction and establishment of the piers—of which there will be twenty-nine—and girders. In addition to the considerable height to which the former rise above the water (120yds.), the bases of the piers are sunk to the bottom at a depth varying from 28yds. to 52yds. The centre pier will be half as large again as the others. All the pieces composing the work are of cast iron.

As such ponderous piers could not be erected by the ordinary means, M. Boutet proposes to construct on the shore their lower parts or bases to a height sufficient to rise 10yds. above high water, and as soon as the iron skeleton is put together and bolted, a number of large sheet-iron buoys are distributed about the surface of the base. At low water the metallic framework thus prepared is made to slide upon the shore to low water mark. The tide in rising raises this raft or base of iron lightened by the buoys, and floats it. A tug steamer then removes it to its place, previously indicated by one of a line of buoys attached to an iron cable stretched across the Straits at a depth of 18yds. By raising one of the buoys attached to the raft it is made to descend very slowly, the top being just above the level of the sea when the base touches the bottom. It is foreseen that it may become necessary to rectify its position, and a strong metal screw is therefore placed in the interior of each pier, extending from base to summit, to which is attached a large buoy which can thus be moved from the top to the bottom or *vice versa*. The buoy disturbing the equilibrium renders the specific weight of the pile heavier or lighter than the displaced water, and the whole structure when floated to its place can be sunk without the least shock. It is manœuvred like a ship, and its position is verified by a special glass, invented by M. Boutet, to be placed on the cliffs. The base of the pier is provided with large screws or spiral feet, which on being turned bind it firmly to the solid bed of the sea, and serve to establish the level if necessary. Such is the method of moving and fixing the enormous bases of the piers, the component parts of which it would otherwise be extremely difficult to unite under water. The construction of the upper portion of the pier above the sea is effected piece by piece. Thus are avoided all the preliminary works under water, which constitute the greatest difficulty in the way of a bridge across the Channel.

Next with regard to the superstructure, M. Boutet has hit upon a plan whereby the difficulties of transport, &c., are overcome. He constructs rigid beams endowed with great powers of resistance of a weight relatively very small, and capable of being placed in position piece by piece, by the aid of a system of scaffolding constructed as follows:—Between the abutment on the shore

and the first large pier, 3 temporary piers are placed at equal distances. This done, there are stretched in parallel lines a number of wire cables 2 metres (*i.e.*, 2yds. 6in.) apart. They are connected and bound together by ties made of smaller cables, which interlace the large ones and hold each in its place. The whole forms a truss of 63yds wide. The truss thus made is covered by a wooden flooring, a guard is fixed on each side, and there is at once obtained a service bridge upon which scaffolding is erected to support the roadway of the bridge during its construction, the scaffolding being always at a sufficient height above the sea to allow the largest vessels to pass under it. Upon such scaffolding are supported the wire cables forming the roadway of the bridge —each of which is strained as nearly to a right line as possible, after which smaller cables are interwoven, bracing together the main cables and holding them firmly in their places. Each cable is composed of eight iron wires parallel to each other and bound together at intervals with strong wire collars. The straining of the large cables is to be managed by means of weights, which are removed after the proper degree of tension has been attained and the cables fastened down to the tops of the piers. For example, we will assume the cable to be fixed at the abutment and laid loosely over the other piers, the weight would then be applied to the length of cable between the first and second piers. This would bring the length between the abutment and the first pier taut, and it would be made fast to the first pier. The weight would then be removed to the cable between the second and third piers, and the process would be repeated until every span of cable was stretched to its proper limit. The cables are carried without a break over the tops of the piers; each cable, therefore, will be 21 miles long. Above and below these cables are fastened beams of timber, over which the permanent way will be fixed. The author is informed that Mr. Ordish has pronounced that portion of the scheme relating to the piers to be practicable, and the method of floating the bases exceedingly ingenious. Another eminent engineer, the chief of one of our leading railways, but whose name the author is not at liberty to mention, has examined M. Boutet's plans for the superstructure, and states that the scheme is perfectly feasible. He, however, sees a difficulty about the piers, but, as we have it on the authority of Mr. Ordish that the piers are practicable, we may conclude the whole structure to be so. The bridge is estimated to cost £8,000,000, and to occupy three years in completing. It is stated that experiments in progress give reason to expect that this estimate will not be exceeded

The carrying out of M. Boutet's principle by the construction of bridges generally on a smaller scale than would be required for the Channel appears to be now imminent. The author understands that two small bridges have already been constructed, one for the college at Verviers and one at Senlis. A company has been formed in Paris, and the Emperor has directed a bridge to be constructed across the Seine, the first cable for which is already made. A span of half a mile at St. Malo is to be bridged upon the same principle. It would be premature to discuss the scientific details of M. Boutet's project, as they are not yet made public, and, indeed, cannot be determined until the result of some experiments in Paris, and which are now pending, are made known. The arrangements for these experiments are now nearly completed, and it is proposed that they shall be attended by the principal engineers in France and England, to whom invitations are to be sent. We may, therefore, conclude that its merits and demerits will then be investigated, and the practicability of the scheme thoroughly ventilated.

A preliminary meeting of the Channel Bridge Company was recently held in Paris, when several models of bridges upon M. Boutet's system were exhibited. One model in particular illustrated the principle of the proposed Channel Bridge. It consists of one span, and is constructed upon a scale of 1-50th of the proposed international bridge, and is formed of 21 small cables, 13 millimetres in diameter, bound together at intervals by ties at right angles, which have the effect of keeping the larger cables separate, and at the same time preserving them in their relative positions. The whole forms an open truss, which is bolted between planks of wood, thus securing perfect rigidity, which is further increased by the balustrades. It is reported that the weight of 40 persons stamping together on this model failed to produce any sensible deflection. It is estimated that it would require a weight of over 50,000 kilogrammes to break it. This model rests on abutments which have been roughly hewn in logs of somewhat decayed timber; this is a convincing proof that the abutments are not subjected to any strain.

Colburn.

Mr. Zerah Colburn has recently proposed a novel method of facilitating the laying of a tube across the bed of the Channel. He has worked out all the details, but inasmuch as the idea forms the subject of a pending patent, only a general outline of the proposition can be given. He proposes to construct a dry dock on the coast at the point where the tube is to be carried across. This dock is to be of any reasonable length, from a thousand feet to a mile, and only a few feet wider than the outer diameter of the tube. The sections of the tube are to be united together in this dock, the seaward end being fitted with a water-tight bulkhead and projecting through a water-tight opening in the dock gates. When a length of (say) a thousand feet of tubing was ready, the rear end would be fitted with a bulkhead, the water admitted into the dock, and the tube slowly towed or floated out until the last section reached the dock gates. The gates would then be closed, the water pumped out, and the work proceeded with as before. The specific gravity of the tube is to be such as that it shall just sink to the bottom, and each time it is drawn out it is to be slightly raised off the bottom by a system of buoyage, which is also to assist the flotation of the tube as it progresses in its gradual passage across the Channel. On reaching the opposite shore the tube, after being made secure, is to be lined with brick in cement, and rails laid, and in other respects the work is to be completed.

Parsons.

A pontoon vessel, of shallow draft, for the Channel passage has recently been proposed by Mr. J. H. Parsons. He connects four pontoons together by cross girders, leaving a waterway between the pontoons for the paddles, of which there are to be six—three forward and three aft. The boilers, coal bunkers, &c., are to be placed in the centre of the vessel, and the engines at each end. In the deck arrangements, the idea is to have a sleeping and a general saloon, separate from each other. A clear passage is to be left from stem to stern for working the vessel and for a promenade for passengers. This vessel, it is contended, would be rendered independent of the tide in crossing the bar at Boulogne, and would make the service direct instead of tidal as at present. The author believes that Mr. W. Bridges Adams has also proposed a somewhat similar vessel to that of Mr. Parsons.

Waring.

The present paper would be incomplete—as far as the author's knowledge extends—were he to omit to mention a proposition by Messrs. Waring to effect the Channel passage. But what that proposition is the author cannot say, as, on inquiry at Messrs. Warings' office, the representative of that firm could only say that they "had a concession." What that concession was for, whether for a tunnel, a tube, a ferry, an embankment, a bridge, or an overhead railway, the author cannot say, inasmuch as, to the author's inquiries on this point, the gentleman alluded to was specially reticent and painfully mysterious. The only subsequent light thrown upon the subject is a paragraph in a Dover paper to the following effect:—We hear from good authority that a "committee for the defence of the Channel ports" has been formed at Calais, Boulogne, and Havre, to oppose the project attributed to Messrs. Waring, the English contractors, of constructing a more convenient port near Cape Grisnez, which is certainly a very illiberal piece of obstructiveness. That the scheme is one of larger vessels and increased port accommodation appears from a statement of the Paris correspondent of the "Morning Post" of the 12th inst., and who writes thus:—We are again talking about a bridge over the Channel; the subject is sure to crop up periodically. If it is not a bridge it is a tunnel, and whether one or the other, or the proposed comfortable large boats of the Messrs. Waring, every traveller, even the non-seasick, will wish the project success.

As an embankment has been proposed as a means of facilitating the means of communication between London and the continent, it may here be briefly referred to. An embankment, however, appears to be about the worst possible solution to the problem, firstly, because of the difficulty of carrying it out, and, secondly, because of the tremendous loss of property that it would cause. In other words, it would be very difficult to find the pecuniary means, and the project would encounter the most formidable opposition from the neighbouring populations of the French and English coasts. This would arise from the damage an embankment would cause to the fishing populations of Ramsgate, Deal, Dover, Calais, Boulogne, &c. Besides, the proposer of this scheme would be puzzled to find the necessary amount of soil, making a liberal allowance for the slopes, which might be washed away a dozen times before they could settle down and acquire cohesion and stability.

Mr. W. H. Barlow has proposed a submerged bridge, but the particulars of this scheme have not come under the author's notice.

Mr. Charles Boyd proposes a marine viaduct from Dover to Cape Grisnez, constructed with iron girders on 190 towers, 500ft. apart, and 500ft. above the sea, and he estimates the cost of such a bridge at £30,000,000.

Mr. Hawkins Simpson has addressed the Board of Trade on the subject of working a submarine tunnel on a pneumatic system, which he has termed his "Eolian system," for which he claims cheapness, expedition, superior ventilation, and greater utility.

Mr. Alexander Vacherot has a scheme, on which he has been engaged several years, and which he laid before the Emperor of the French in 1856, for laying on the bed of the sea a tunnel made or formed of concrete, so as to form, when completed, a monolith. He would construct it on the shore, and draw it down to its place in sections. And he considers that greater economy and security might thus be obtained than by the other methods that have been proposed.

Estimates.

It is of course taken for granted that the adoption of either tunnel, tube, or bridge, would prove a success commercially. But as this is an important point, and one upon the proof of which any project must be dependent, it may be as well to state a few facts in support of the argument that such an undertaking will pay. It, however, needs not that very much be said upon this point, for as soon as England is directly united with the European continent, practical advantages of incalculable value will result. The resources of each country, and mutual exchange of produce, will be developed to a degree of which it is impossible to form anything like a correct idea. Mr. Chalmers went very carefully into the subject of the probable revenue to be derived from the establishment of a Channel railway. Writing in 1867, and referring to his estimate, he says:—"I published these figures in a brief prospectus of this project five years ago; and I see no reason to alter them now, unless to increase them. After I adopted them I became acquainted with the work of M. de Gamond, and on comparing figures, found a wonderful coincidence in the items of freight and passengers,

his being .	£1,041,666	13	4
and mine .	£1,049,375	0	0

He seems to have overlooked the mails* as a source of revenue, his figures were compiled in 1856, and based on the actual business then done between England and the Continent; and as he could not have foreseen the impetus that has since been given to traffic between England and France by the recent Treaty of Commerce, and by the change in the passport system, his figures are more sanguine than mine, compiled in 1861, after these important changes had actually taken place."

Mr. Chalmers estimates the probable revenue as follows:—

2,500 tons freight daily or 912,500 per annum at 12s. 6d. . . .	£570,312	10	0
1,500 passengers daily each way, or 1,095,000 per annum at 8s. 9d.	£479,062	10	0
Mails, express freight, coin and bullion, extra baggage, &c., (say)	£250,645	0	0
Total annual revenue	£1,300,000	0	0

These figures, he observes, may appear too high to those who have overlooked the affinity between improved means of transit and the increase of traffic resulting therefrom. In the infancy of railway enterprise, the anticipated traffic on a given line was based upon the business done by the stage-coaches and waggons of the day. It needs not that we compare the anticipated with the actual railway traffic, but we should bear in mind that our experience in that case did not prevent our falling into a similar error in the case of ocean steamers, though fleet after fleet of these vessels have taken their places on the ocean, each creating for itself a trade

* Mr. Chalmers and M. de Gamond have both omitted the revenue which would now be derivable from the electric telegraph companies.

where none such existed before. Between 1820 and 1830, in the good old times of sailing packets, the number of travellers between England and the continent did not exceed 80,000 per annum. The establishing of a regular steamboat service raised the number in 12 years to 350,000; and since the introduction of railways, it has risen to upwards of a million. This great increase is not to be attributed to the increase of the populations, but mainly to these improvements; and the effects that would result from the completion of any work connecting England with the continent would be even greater than were produced by those two important revolutions in locomotion, which respectively raised the figures from 80,000 to 350,000, and from the latter to upwards of a million.

In confirmation of these views we find Captain Tyler stating, in a recent report upon the improvement of the means of communication between England and France, that, omitting from consideration the ports of Hamburg, Rotterdam, Antwerp, and Ostend, the passenger traffic between England and France for the year 1868 amounted to 309,479 altogether; 141,633 passengers having travelled by Calais, 109,006 by Boulogne, 41,871 by Dieppe, and 17,469 by Havre. A large proportion of these, namely, 46,411, crossed the Channel in the month of August, as against 12,946 in January, and 13,514 in February. In the year 1867, of the Paris Exhibition, the numbers were 454,350 altogether; 199,837 having travelled by Calais, 146,226 by Boulogne, 86,914 by Dieppe, and 21,373 by Havre. Of these, 84,684 crossed in August, against 13,163 in January, and 13,721 in February. Captain Tyler observes that in addition to the ordinary annual increase, which is considerable, there would naturally be a very large augmentation in these numbers if better arrangements were made for crossing the Channel.

Conclusion.

We have now definitively before us three propositions for effecting the desired communication by means of an excavated tunnel, three for laying a tube on the bed of a channel, three for improved steam vessels, and one for a bridge, besides several other propositions of minor importance and questionable practicability. Of all these projects undoubtedly those which have of late made the greatest progress are the bridge scheme of M. Boutet and the tunnel scheme of Messrs. Hawkshaw, Brunlees, and Low. The documents relating to this latter scheme are now before the Board of Trade. The results of the deliberations of a French Commission appointed by the Emperor to inquire into the scheme are, on the whole, favourable as regards the geological and engineering features of the project. In this scheme it is proposed to commence by driving preliminary driftways through the grey chalk, at a great depth below the bed of the Channel, between a point near Dover and another point near Calais. It is conceived that this material would be easily cut through, and would not be likely to present insuperable difficulties from the influx of water. Mr. Remington, as we have already seen, selects the line from Dungeness to Cape Grisnez, in order to avoid the chalk and the fissures which he fears to encounter in it, and to work in the Wealden formation, which would, he believes, afford a greater chance of success.

Turning to M. Boutet's bridge scheme we find that an association has been formed for making experiments, two small bridges have been built in France, and arrangements are made, near St. Malo, for a third, whilst a fourth is to be constructed over the Seine. The great features of the bridge are that it will be less costly than a tunnel; will occupy less time in construction; will give no trouble in ventilation; and will avoid the danger of sudden inundations. As to its merits in an engineering point of view, we may hope shortly to be satisfied by practical demonstration.

Looking broadly at the schemes which present the most reasonable features, and irrespective of their engineering merits in detail, it appears to the author that, of the tunnel schemes, that of Mr. Remington for driving through the Wealden formation would be attended with less danger than that of Mr. Hawkshaw, which it is proposed to carry through the chalk. Of the methods of connecting the two shores by tubes along the bed of the Channel, that of Mr. Bateman certainly appears the most practicable. If these tubes could be constructed in a dry dock and drawn gradually over upon Mr. Colburn's method, it would be a very summary method of settling the question, as Mr. Colburn assures the author he could effect the connection in three months, although, he admits, at a great cost. But, both in subterraneous and subaqueous works, there is an admitted possible risk. In the former, there is the contingency of flooding from the nature of the soil, whilst, in the latter, some of the operations would be dependent on comparatively delicate arrangements. The bridge scheme has also its perils of storms and tempests, but there appears to be a possibility of guarding against the consequences of these more readily than against the insidious advances of a great head of water. The bridge scheme, too, as has already been observed, has had its substructure approved by one independent engineer, and its superstructure by another. As far, then, as we have at present advanced, the bridge scheme appears to present the most reasonable chance of success. But either a tunnel, a tube, or a bridge would be the work of perhaps eight or ten years, for the author does not think the various projectors have allowed sufficient time for the contingencies that would arise in the course of carrying out works of such unparalleled magnitude. We must, therefore, turn to some plan by which the existing requirements of the travelling public can be promptly and inexpensively met.

Captain Tyler, R.E., has examined the English and French coasts and investigated the various projects, and has reported to the Board of Trade thereon. Referring to Mr. Fowler's plan for improved steam vessels and harbour accommodation, Captain Tyler observes that the project would require some modifications in detail, and that it is a question whether it would be worth while to ferry the railway carriages as well as the passengers across the Channel. But the main features, of an improved harbour at Dover and a new harbour south of Cape Grisnez, are sound, if means can be found for meeting so great an expense.

With regard to Mr. Grantham's proposition to utilise the existing harbours by vessels of light draft, Captain Tyler states that it is asserted by some of the officers engaged in the performance of these services that vessels of the class now employed are, upon the whole, the safest that could be devised for the particular duties required of them. It is argued that the sea-passage, in which greater length and size might lead to increased comfort, is comparatively short, while the entrance of the French harbours, by day and night, in certain states of the weather, which is already the more difficult and dangerous part of the service, would be attended with still greater disadvantages. The existing vessels are fitted to encounter any weather with which they can meet in the Channel, and are handy for entering the harbours, while longer vessels would be exposed to increased risk at the moment of entering the harbours. The bow of a long vessel getting under the shelter of one pier, and a heavy sea striking her on the quarter, she might be driven against the other pier. There is, no doubt, much truth in this argument. Such a risk must increase in proportion to the length of a vessel, to the narrowness of the entrance to a harbour, to the exposed position of its entrance as regards winds and currents, and to any necessity which may exist for reducing the speed before entering it. Having regard to the existing state of the French harbours, the employment of longer vessels would, for this reason, be attended in bad weather with greater danger. But the argument would no longer apply if the service were performed from a convenient and well constructed pier on the one to a similar pier on the other side of the Channel. The longer and larger vessels having increased proportional power, with disconnected engines, so as to be able to use either paddle at pleasure, could be under no disadvantage in approaching the lee side of a pier. The above argument, therefore, tells in favour of the construction of an extended pier at Boulogne, as proposed some time since by Mr. Brunlees, to be used on the French, in combination with the pier at Dover on the English coast, for an improved Channel service.

The matter, then, in general terms stands thus:—The steam packet service between England and France is greatly in need of improvement. This service is important in its character, and the existing steamers, restricted as to their dimensions for want of better pier and harbour accommodation, are not proportionate to the importance of the service. Larger vessels, with less movement in rough weather, more shelter, and better accommodation generally, would do much to mitigate the discomforts of the sea passage; and even contemplating the successful issue of a tunnel or bridge project, these improvements are much required, and should be effected in the meantime. But larger vessels cannot be employed for a fixed service until better provision is made for embarking and disembarking passengers, especially on the French coast. The pier at Dover is not only ready, but has frequently been used for military transport-vessels of the largest size, though certain improvements are required in the jetties for greater convenience in embarkation and disembarkation. The difficulties in the way of fitting the harbour of Calais for the reception at all times of larger vessels are great, but by a judicious extension of the west pier at Boulogne, similar accommodation might be provided on the French side. Captain Tyler estimates that at a cost of about £100,000 at Dover, and £500,000 at Boulogne, the desired object might, apparently, be attained in the most economical and most expeditious manner. By the adoption of steamers capable of moving with equal facility in either direction, the difficulties incidental to turning round in small harbours may be avoided; and the existing harbours at Dover and Boulogne might, with certain modifications, be made available, to some extent, for improved vessels.

Captain Tyler suggests that the question might thus be temporarily solved if the two governments were not prepared to carry out a larger scheme. If they are prepared to face a greater expense, there is the more extensive project of Mr. Fowler, for constructing, at a cost of two millions of money, special harbours for special steamers. There can be no doubt that this project presents, whether the railway carriages be ferried over or not, a more comprehensive mode of dealing with the subject. The relative distances may be stated to be:—Between Dover and Audresselles, 24, Dover and Calais, 26, and Dover and Boulogne, 30 English miles; while the passage to Boulogne, though longer, is admitted to be better than that to Calais. Either by the construction of new harbours at Dover and Audresselles, at a cost (as estimated by Mr. Fowler) of £2,000,000, inclusive of steamers, or by the improvements above suggested at Dover and Boulogne, at a cost of £600,000, exclusive of new and improved steamers, the immediate object should be to provide an improved fixed service, irrespective of wind and tide, between London and Paris in eight hours. It would appear to be desirable now to refer the whole matter, through the Foreign Office, for the consideration of the French government, with a view, perhaps, to the appointment of an international commission, in which that government would, no doubt, readily acquiesce, and without which the important interests involved could not be authoritatively dealt with, nor the general question satisfactorily decided.

Whatever be the plan ultimately decided upon for connecting England and France in a direct manner, such a plan must have the best wishes of those here present this evening as well as those of the whole civilised world. It should not be so much the honour of adopting this, that, or the other scheme that should influence us as the reflection that the accomplishment of the object will be attended by advantages to the nations of the earth. In former times, when Europe was regarded mainly as a theatre of war, it was, perhaps, no disadvantage for this country to be separated from it. But, since the introduction of steam has so completely changed the character of marine locomotion, any advantage formerly arising in this respect from our insular position has been materially diminished, and, in the present day, it is continental commerce from which we are separated and not continental wars. Such a direct bond of union, then, as is proposed would establish on the firmest basis the spirit of amity now subsisting between England and France.

We understand that last week several of the principal coal and iron masters of the South Wales district received a communication from Mr. A. Basset, C.E., of Cardiff, asking their support towards the construction of a line of railway between Lydney and Stonehouse. The scheme, which is 11¼ miles in length, includes the construction of a tunnel 1,320 yards in length, under the River Severn, at a point about a mile and a quarter above Lydney; the line will join the Midland Railway near the Berkley-road Station, and the Great Western Railway near Stonehouse. By this route the distance between the South Wales district and London will be shortened to the extent of 17¾ miles, thereby reducing the cost of coals alone to London by upwards of 1s. per ton. The time saved by the passenger express trains will be at least 30 minutes, and ordinary trains 48 minutes. The cost of the works is estimated at £300,000, which includes a double line laid with broad and narrow gauge.

IMPROVED PUMPING MACHINERY.

BY MR. J. VIVIAN.

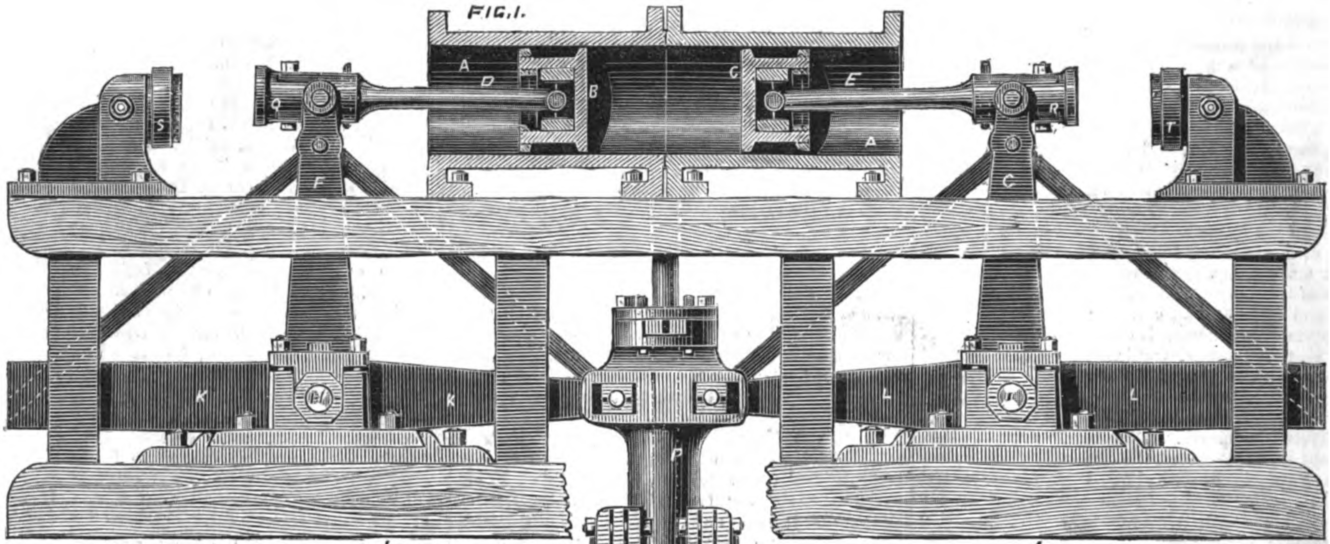


FIG. 2.

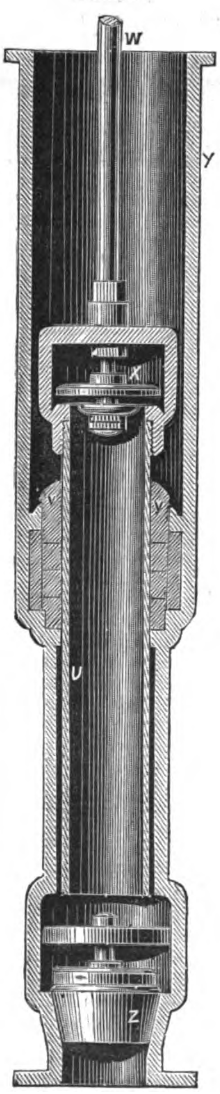


FIG. 3.

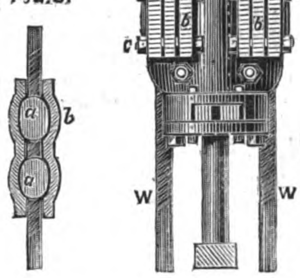
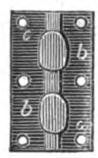


FIG. 4.



IMPROVED PUMPING MACHINERY.

SOME special improvements in engines and pumps have just been patented by Mr. James Vivian, of Falmouth, through the agency of Messrs. Robertson, Brooman, and Co., patent agents, of 166, Fleet-street, London. The invention consists, first, in fitting two pistons in one cylinder; these are driven outwards by the action of steam admitted to the cylinder at about the middle of its length. The rods of each piston are connected to vertical arms of rocking frames free to oscillate on arms or axles. The inner ends of the rocking frames are jointed to a crosshead or coupling plate capable of having an up-and-down movement imparted to it on a guide rod. This crosshead supports the ropes or rods by which the plungers are worked. When the steam has driven the pistons the full length of their stroke, the exhaust leading to the condenser is opened, whereby a vacuum is formed. The outer air then acts upon the pistons and drives them inwards to their first positions to be again acted upon by the steam as before mentioned.

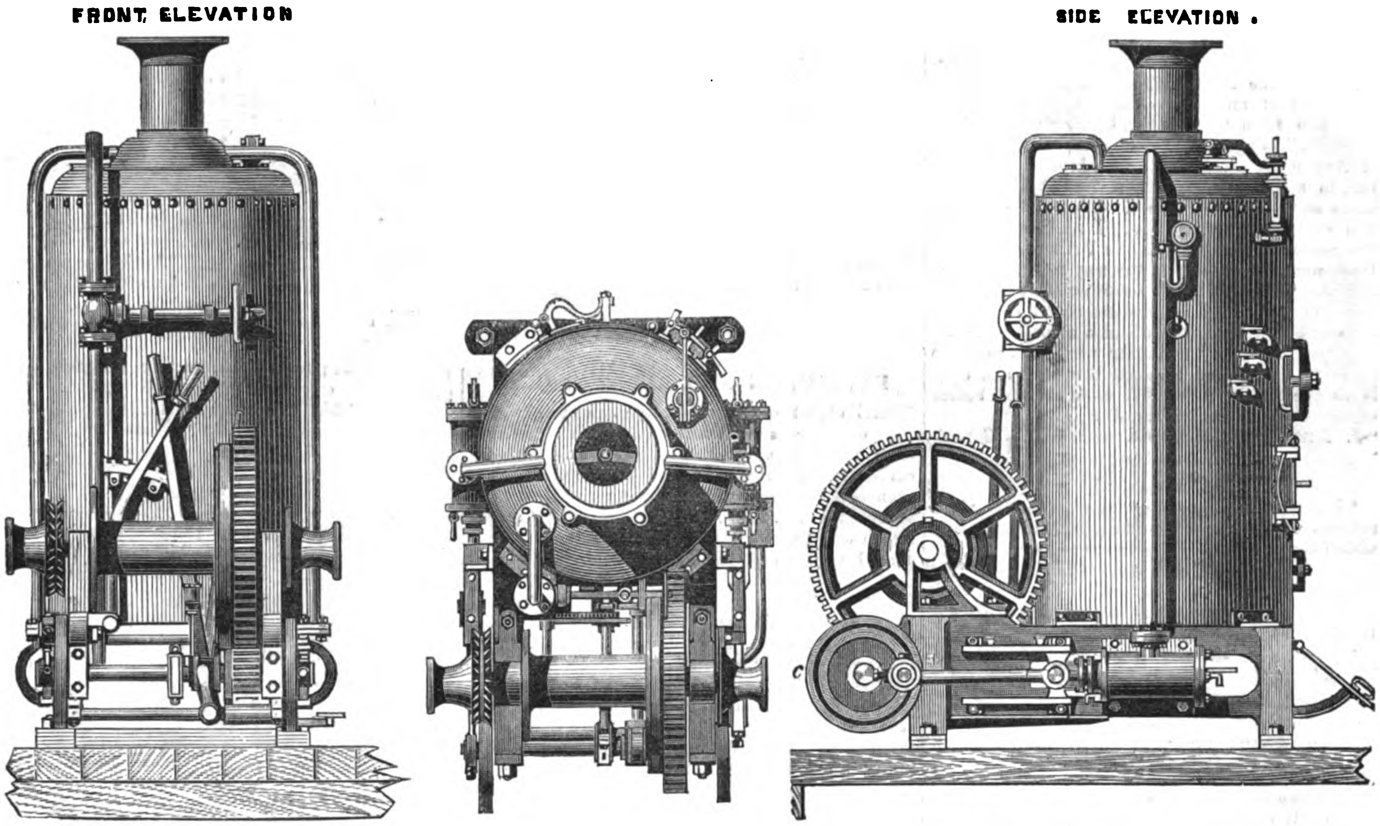
Fig. 1 of the accompanying engraving shows a sectional elevation of a cylinder A, in which two pistons B C are fitted according to this invention. Both pistons are shown at about the middle of their stroke, that is, about mid-distance between the central part of the cylinder and the outer ends. The entrance for the steam into the, cylinder may be at any part of the central portion, either at the top, at the sides, or at the bottom, as found most convenient; and its pressure causes both pistons to travel towards the ends of the cylinder at the same time, each piston forming an abutment for the steam to act against. The supply of steam may be cut off at any part of the stroke, so that the quantity admitted may be used expansively or not, as required. When the pistons have travelled a fixed distance, they uncover a port at each end leading to a condenser, so that the cylinder becomes empty. The ends of the cylinder A are open for allowing the connecting rods D E, which are jointed to them, to follow the course determined by the motion of the vertical arms F G pinned to their outer ends. These vertical arms are centred upon journals H I within bearings upon a foundation J, and admit of a rocking motion being given to the vertical arm F G and the other parts K L of the rocking frame, of which **they form part, when the pistons are at work. The parts K L, with the tie rods M N, form a compact and strong framing for lifting the pump crosshead or coupling plate P, which is connected to the inner ends of the parts K K, while the parts L L act as a counterpoise, and, from their situation, they assist in bringing the inner ends of the parts K K upwards while the steam is acting upon the pistons. The crosshead P is provided with slots for the blocks of the journals of the parts K K to slide in during the up-and-down movements of the pump plunger. The crosshead** P is hollow and rides upon a fixed guide rod Q, which passes through it, so that it shall work in a straight up-and-down easy manner without any liability to jamb, either in the up or in the down stroke. Both ends of the crosshead are furnished with endpieces, which are screwed down upon them to retain the lubricated material in place. The lubricant with which the material is supplied serves to keep the guide rod Q well greased. The outer ends of the connecting rods D E are fitted with springs or buffers R R, so that, when the pistons have been driven the required distance, the buffer ends strike against fixed abutments S T, whereby the springs receive the blow or shock which would otherwise be given to the frame, and which of course would, in a short time, prove detrimental to the effective working of the engine and machinery.

The second part of Mr. Vivian's invention consists in fitting a tube inside the pump barrel; one end of this tube carries a valve on which it finds its seating; the valve is guided in its movements by a stud or pin on which it is free to rise and fall. The upper end of the tube is connected by a bracket or loop to the plunger rod. A portion of the barrel in which the tube works is packed to prevent passage of water from one part to the other. The lower part of the barrel has a valve fitted in it, and, as the tube is lifted, the lower valve rises from its seat (the upper valve being shut and resting on the end of the tube) by the suction of the tube, the water rises up above the lower valve and fills the space between it and the tube. On the down stroke of the tube the lower valve shuts, and the water from the space lifts the tube valve and passes up into the space in the pump head, from which it flows away in the required direction.

This second part is represented in the sectional **view fig. 2. U is the tube, which is fitted inside the barrel V and receives an up-and-down motion from the rod W. The upper end of the tube is looped as shown for the rod W to be connected to, and also to retain the upper valve X in place. The stem of the valve rides in an aperture formed in the loop so that the valve is guided into position both in the up-and-down stroke of the tube U. The barrel in which the tube works is packed, and, to facilitate the packing being got at, a cover or plate Y is fitted on one face of the barrel; this plate is secured by screw bolts as shown. Below**

PORTABLE OR FIXED STEAM WINCH.

BY MESSRS. GRAVELEY.



the tube U, and in a recess formed in the barrel is a valve Z, which has an up-and-down movement imparted alternately to it by the suction and the back pressure of the water. This mode of constructing pumps is applicable to all kinds of pumping apparatus, and may be employed in pumps which work horizontally as well as in those which work vertically.

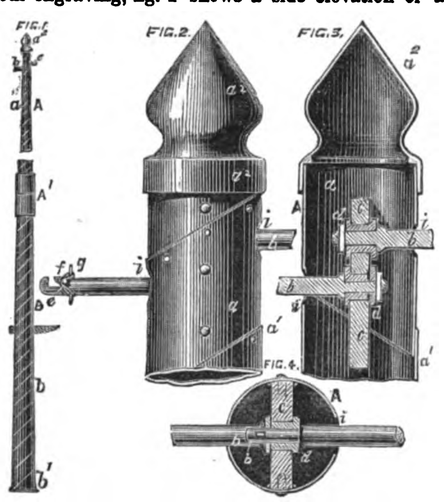
Mr. Vivian's invention consists, thirdly, in fitting balls or lumps on the ends of the wire ropes by which the plungers of the pumps are worked. These balls may be formed of metal secured to them by soldering, or they may be formed of solder. The ropes are connected to the plungers and to the crosshead or coupling plate by fixing the balls between plates formed with recesses to receive them, which plates are firmly clamped by bolts and nuts. Fig. 3 is a view of the end of a rope, with balls or lumps *a a* formed on it. These lumps are received in recesses formed for them in the inner faces of the plates *b b*, which are firmly bolted together by bolts being passed into the holes *c c c*, as seen in fig. 4. If it is desired to connect the ropes to the crosshead direct, the recesses for the lumps are formed in one or more of the faces of the same as shown in fig. 1, and plates similarly recessed are secured over them. These lumps may be made by bulging the rope out at the required part, by placing loose pieces of metal under and between the strands, or loose pieces of metal may be secured on the ropes by solder. This way of connecting ropes for mining and other purposes will be found of great service in repairing broken or overstrained ropes, or ropes in which weak places are found.

STEAM WINCH.

In the accompanying engraving we illustrate a very cheap and simple form of steam winch, introduced by Messrs. Graveley, to meet the wants of shipowners who do not require heavy and expensive apparatus. The construction of the winch is so clearly shown that no particular description is required. The motion of the valves is changed for reversing by a very simple and ingenious arrangement of inclined gear, which works to perfection. The entire arrangement is neat, compact, and calculated to meet the desired end. Distilling apparatus can be combined with the engine when required.

METAL TUBES FOR TELEGRAPH POLES.

The manufacture of metallic tubes for various purposes has been improved upon by Mr. F. N. Gisborne, of 445, West Strand, and Mr. H. Allman, of Ampthill-square. In a patent recently obtained by these gentlemen we find that they employ strips of metal coiled spirally around so as to form a spiral lap joint. These joints or laps are either riveted, welded, soldered, brazed, or galvanized together. By forming tubes thus, it is claimed that a maximum amount of strength with a minimum weight of material is obtained. In constructing posts or poles for telegraphic purposes, the inventors form each post of two parts in the following manner:—The base is made of strips of galvanized iron, and a plate of larger diameter is affixed thereto, so that when it is sunk into the ground it may be filled internally with earth previously to the upper portion of the tube being fitted. The upper tube is provided with an inner piece of ebonite, to which the metal arms are attached. These metal arms pass through openings in the tube. At the outer extremities of these arms the telegraph wires are carried. In our engraving, fig. 1 shows a side elevation of a



telegraph post. It is composed of two parts, A and B. The upper part A is at its lower end fitted with a socket A [1], which fits on to the upper end of the part B. The parts A and B are tubes composed of strips of metal *a* and *b* wound spirally on a mandrel, and the strips *a* and *b* are, in this case, as they are wound, lapped slightly the one over the other, and these laps are connected by riveting. The lower end of the tube B is provided with a flange or plate *b* [1] extending outwards beyond the width of the tube; it serves to give additional strength as well as to steady the lower part, which is embedded in the ground.

At the upper portion of the part A of the telegraph post arms are mounted; the outer ends of these arms carry the telegraph wires. The arms are insulated from metal posts as seen by figs. 2, 3, and 4, which show respectively a side view, a sectional elevation, and a horizontal section of the upper part of the telegraph post A upon an enlarged scale. *a* is the strip of metal of which the post is formed by lapping, as shown at *a* [1], with a top or cover *a* [2]. Arms *b b* are supported by an insulating block *c c* of suitable material connected to the tube A, and fitting into openings formed in this block are tubes or insulating pieces of vulcanite *d d*. Into these the supporting arms *b b* are placed, their ends being secured by keys. The telegraph wires *e e* are carried by the arms *b b* at their outer ends, where they are secured by wires *f f* to a cross pin *g*. The holes *i i* in the tube A are sufficiently large to allow of a clear space around the arms *b b* so as to ensure perfect insulation to the telegraph wires from the metal posts.

THE EDMUNDS CASE.

The Court of Arbitration in what is popularly known as "the Edmunds Scandal Case" commenced its sittings yesterday week at Westminster. The case against Mr. Edmunds was opened by the Attorney General in a speech of great detail, in which the defendant was charged with numerous irregularities and defalcations. Mr. Edmunds alleges that he accepted the office upon the understanding that out of the amount of his salary he was to pay £300 a-year to the Brougham family, which was to be applied to the maintenance of the widow and children of Mr. James Brougham, and that the arrangement was conducted by Mr. William Brougham. At a subsequent sitting, the Court decided that the question whether out of a salary of £400 Mr. Edmunds was to allow the Brougham family £300, was wholly irrelevant to the present inquiry. The inquiry continues to drag its slow length along, the Court having decided to sit *de die in diem* until the investigation is concluded.

DR. LIVINGSTONE.

THE following is the text of the letter (dated August 31, 1869), received by the Bombay government from Dr. Kirk, political agent at Zanzibar, relating to the supposed arrival of Dr. Livingstone at Ujiji:—

"Sir,—I have the honour to report for the information of the Right Honourable the Governor in Council that an Arab caravan arrived here two days ago from the interior, bearing a letter from Synd Majid's agent at Anyayembe, in the country of Anyamwezi, addressed to his brother at Zanzibar, in a P.S. to which the arrival of Dr. Livingstone at Ujiji is mentioned. I forward a copy of this extract in translation. I am informed that the native messenger who saw Dr. Livingstone at Ujiji was one month on the way to Anyayembe, and that, therefore, this information is at least a few months old. I understand that a caravan is expected on the coast in about a month, when we may possibly receive further news of the great explorer. The road between the coast and Ujiji is at present open and safe, even to small bodies of men.—I have the honour, &c.,

"J. KIRK, Political Agent and H.M.'s Consul, Zanzibar."

(Translation.)

"Postscript.—Be good enough when the slave returns to send a box of brandy similar to that which came for the white man, one of which was broken on the way, so that none remained. And he (the white man) has reached Ujiji, and may pass this way, and on his coming we will give it to him. Do not neglect this.

"Dated 4th Rabin-el-Awul 1286 (June 12, 1869)."

SUBSTITUTE FOR FIRE-BRICK.

MR. JOHN CLIFF, of Runcorn, has patented some improvements in the method of using and applying certain materials in an unmanufactured state, in order to form a substitute for fire-bricks or fire-goods hitherto employed in the construction of furnaces in which fire-bricks, tiles, and other various forms of fire-goods are usually applied. Instead of using fire-bricks, lumps, stones, tiles, or other forms of materials or compounds in construction burnt or unburnt, he uses powdered ganister stone, quartz, sand, mica, sandstone, or other siliceous material, plumbago, lime, baryta, steatite, and magnesia, alone or separately, or in varied proportions with fire-clays, or with each other, or with siliceous or other solutions, mixed or not with hair, fibre, sawdust, shavings, or pulverised coke, or with other analogous materials. In applying the materials in a plastic state wire may be used as a supporter, or a skeleton or light framework may be used to support the materials while in course of application to the furnace until the material is dry enough. Thus the furnace is built entirely of such materials in their raw or plastic state in connection with brick or other walls, the object being the substitution for fire-goods, and their consequent cost of manufacture, fuel, carriage, and skilled labour, of unmanufactured materials that can be used and applied by cheap labour more speedily and economically. Thus time and expense will be saved in construction, andit will not be necessary to keep large stocks of var ed shapes of bricks, the loss of material and la our in making joints will be saved, whilst, inc se of actual wear, additions can be supplied inter lly or externally to the structure so that it ma be easily and speedily repaired.

OUR SHIPS OF WAR.

TWO Parliamentary returns, which were moved for in the House of Commons by Mr. Laird, have recently been issued relative to Royal Navy vessels of all classes now building, or that have been ordered to be built during the current year. Of iron-plated ships and batteries 14 are now being built, all of which, with one exception, were designed in the Controller's Department of the Admiralty, and all, with two exceptions, on Mr. Reed's plan. The "Captain" and the "Glatton" are designed on Captain Cole's turret plan, the former being specially designed by Captain Coles and Mr. Laird. The engines of these vessels will be furnished respectively by Messrs. Penn, Laird, Maudslay, Ravenhill, and Napier, and all, with the exception of those in the "Repulse," will be constructed on the improved expansive plan, with surface condensers. Seven are building or will be built in the Royal dockyards, two in that of Messrs. Laird Brothers, three at the works of Messrs. Napier and Sons, Glasgow, and two at those of Palmer's Company. No floating batteries are building or ordered to be built. The return of vessels not armour-plated shows that a total of 12 vessels of this class are now building or ordered to be built—two by the Thames Company, Blackwall, two at Woolwich, two at Portsmouth, one at Devonport, two at Sheerness, two at Pembroke, and one at Chatham. One will be built of iron, nine of wood, and two of iron cased with wood, and three will be furnished with double screws. The vessels vary in tonnage from 212 to 2,322 tons, the estimated first cost of their hulls from £5,653 to £75,453, and the labour and materials from £3,090 to £68,608.

EXTRACTING AND REFINING OILS.

THE object of the invention we are about to describe is to obtain oils and other products from mineral and other materials containing carbon and hydrogen in a more satisfactory and economical manner than heretofore. It has been patented by Mr. Townsend, of Glasgow. According to one method, steam generated in a boiler is passed through piping immersed in a bath of melted metal or alloy, or of a salt in solution or fused, which superheats it and keeps it at a uniform temperature, and it is then admitted into a retort or still containing the materials from which the oils or other products are to be extracted. The superheated steam enters the upper end of the retort, and is maintained therein at a pressure of at least ½lb. per square inch above that of the atmosphere. Pressures ranging from 10lb. to 20lb. per square inch, and the steam superheated to from 600deg. to 1,000deg. Fah., are preferred by the inventor. The retort is in the form of a vertical cylinder of a large size, 12ft. high by 12ft. in diameter, and built of iron plates lined with firebrick. It is made with a perforated bottom, down through which the steam and what it extracts pass to an inclined bottom leading to an exit pipe at the side, and this pipe first descends a little and then ascends, whilst at the top of it a loaded valve is applied, which prevents the passage of liquids or gases except at a predetermined pressure, to which the valve is loaded and which is that intended to be maintained in the retort. A safety valve is provided on the retort itself to act in the event of the exit pipe being choked; and the retort is also fitted with man-hole doors for introducing the materials and for removing the coke or residue.

The exit pipe from the retort communicates with condensing coils of piping in cisterns maintained at different temperatures, and branch pipes are provided to drain off whatever condenses in the condensing coils. The products of distillation are passed first through the hottest condensing bath or cistern, and then whatever remains in the form of vapour passes on to the next colder one, and so on throughout the series. If a hotter condensing bath is wanted than one with boiling water in it, it is obtained by making the bath of melted metal or alloy, or of a salt in solution or fused, and the temperature of the colder baths is regulated by adjusting the supply of water, the coldest water passing first into the coldest bath and then through the hotter ones in succession. The steam may be superheated by means of metal filings, or of metal, sand, or other refractory materials in a granular form, or by any convenient apparatus already in use for such a purpose, but the temperature must be carefully regulated, and the arrangements here described are preferred on account of their facilitating the maintenance of a regular heat.

In refining oils or in extracting oils or other products from tar or from substances which are more or less liquid when heated, a retort or still of a somewhat different construction is employed, being made with horizontal platforms with ledges, and extending alternately from opposite sides to within short distances of the other sides. The tar is put on the top platform and overflows in succession down upon each lower one, whilst the heated steam or gas flows over its surface and passes off with what it extracts by the exit pipe. Man-hole doors are provided in the sides of the retort at the ends of the several platforms for removing solid residues from them.

SALE OF GOVERNMENT STEAMERS.

LAST week saw another batch of her Majesty's steamers put up for sale at public auction at Lloyd's Captains' Rooms, by order of the Lords Commissioners of the Admiralty. The sale attracted a large attendance, and among those present were the leading shipowners of London, Liverpool, Glasgow, and most other seaports on the coast. Mr. Geo. Bayley, of the firm of Bayley and Ridley, was the auctioneer. The first vessel offered was her Majesty's gun vessel "Ranger," now lying at the Royal Dockyard, Sheerness. She is described as 427 tons builder's measurement, built of wood, at her Majesty's Dockyard, Deptford, in 1859, having screw and paddle engines of 80-horse power; her average speed was reckoned at about nine knots per hour. The biddings commenced at £500, and she was knocked down for £1,725. The next vessel was her Majesty's gun steamer "Surly," also lying at Sheerness. She was stated to be 337 tons; built at Newcastle, of wood, in 1856; flush deck, copper fastened, and fitted with engines of 50-horse power. She fetched £1,025. The next offered was her Majesty's iron screw store ship "Dromedary," lying at Sheerness. She was represented by the auctioneer as a very strongly-built vessel, well adapted for mercantile purposes. She is 654 tons, built by Messrs. Samuda Brothers, at Millwall, in 1862, barque-rigged; engines of 100-horse power, and has wire rigging. Her stores and fittings were included in the sale. She was knocked down for £5,100. The last sale was that of her Majesty's screw corvette "Malacca," lying at the Royal Dockyard, Portsmouth. She is 1,034 tons, principally built of teak, in her Majesty's Dockyard, at Bombay, in 1853; ship-rigged, with engines of 200-horse power, her average speed about 8 knots. The biddings offered ranged from £5,000 to £7,800. Mr. Bayley then stated that the reserve price on the ship was £12,000, and he therefore bought the vessel in for the Admiralty. The vessels sold were considered to have realised more than their actual value.

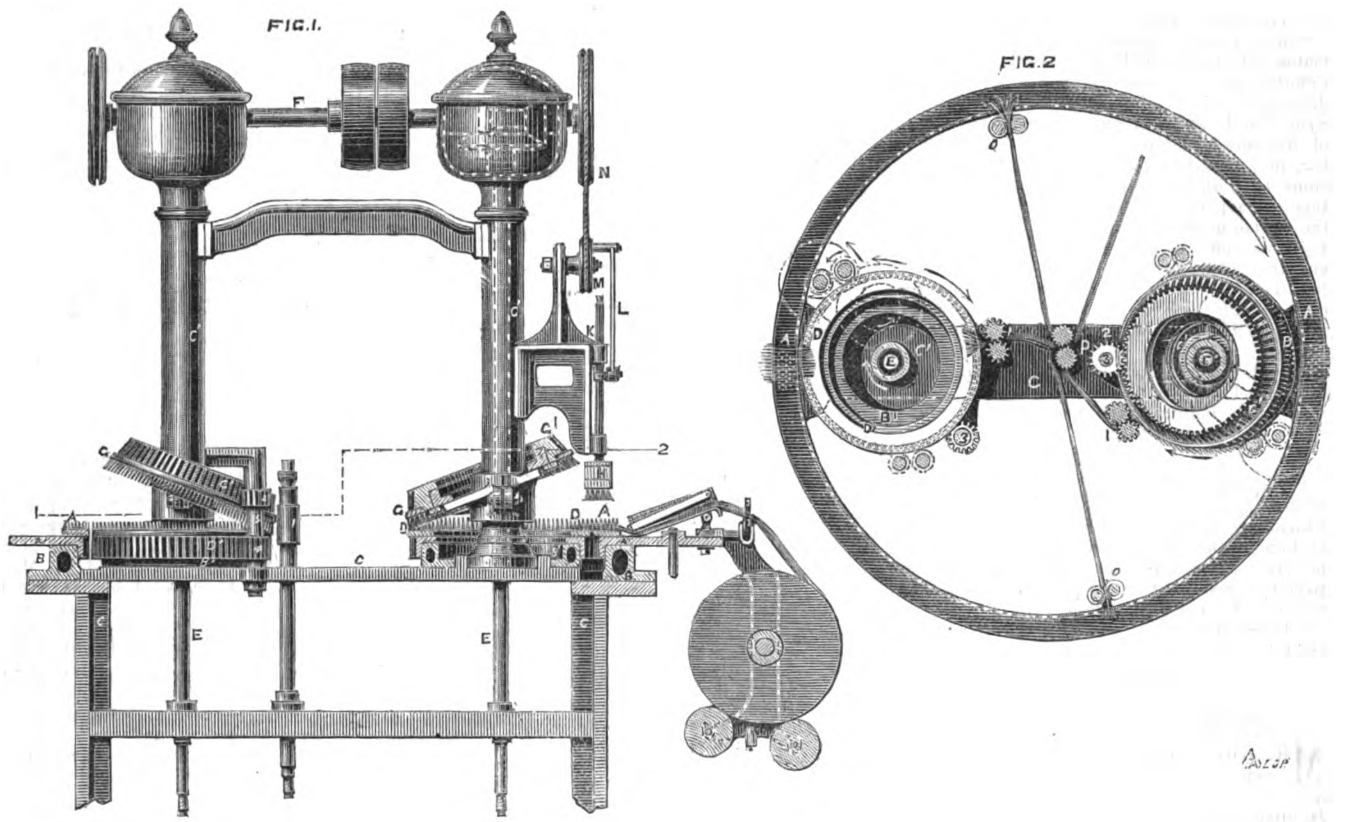
MACHINERY FOR COMBING WOOL.

THE invention illustrated herewith relates to improvements on the machine known as Noble's combing machine, in which two horizontal circular combs are employed set one within the other and in tangential contact at the point where the fibre to be combed is supplied to the comb teeth. This machine has from time to time undergone several changes, but by the present mode of combing in Noble's machine there are certain noil neps, burrs, and other impurities which get between the large and small combs, and are not cleared in consequence of the separation by revolution of the two combs. The object of some improvements recently patented by Mr. H. W. Whitehead, of the firm of Taylor, Wordsworth, and Co., of Holbeck, Leeds, is to effect the clearing of the fibre from the noil and other impurities. This is done by causing the teeth of an inverted circular comb to work between the inner and smaller circular comb and its drawing-off rollers. By this means the noil neps or other impurities are prevented from passing off with the combed top or sliver band, a cleaner fibre being thus obtained.

In our engraving, fig. 1 shows in sectional elevation so much of the improved combing machine as will serve to explain the invention, and fig. 2 is a sectional plan view of the same, the section being taken in the irregular line 1 2 of fig. 1. A A is the large circular comb affixed to an annular plate A^1 A^1, which slides on an annular bed B carried by the framing C of the machine. Within this comb A are mounted two small circular combs D D, which virtually touch the outer and surrounding comb tangentially at opposite points of its inner periphery. These combs D are affixed to annular slides D^1 which rotate on annular beds B^1 carried by the framing. The slide A^1 is cast with rack teeth on its inner periphery, and the slides D^1 have spur teeth on their outer periphery for the purpose of receiving rotary motion from gearing, as we shall presently explain. Through the centres of the circular combs D and through hollow pillars C^1 concentric therewith pass vertical shafts E, which turn in bearings in the framing C. These shafts are each fitted at top with a bevel wheel into which gear bevel pinions carried by the horizontal driving shaft F. The rotation therefore of this shaft by a belt passing over its fast driving pulley will give rotary motion to the shafts E E. A spur pinion

MACHINERY FOR COMBING WOOL.

BY MR. H. W. WHITEHEAD.



on these shafts below the level of the combs serves by means of a train of gearing 1 1 (see fig. 2) to drive the comb A and the combs D D in the direction of the arrows and at a uniform surface speed.

Mounted on circular tilted beds affixed to the pillars C^1 are the inverted circular combs G G. These combs overlie the combs D and work at such an angle thereto as to allow of the free motion of the dabbing brush H, which strikes vertically into the teeth of the combs A and D to press the fibres (as they are fed to the machine) well into the combs. The combs G are made conical and of a somewhat larger diameter than the combs D, so that they may respectively overlap the teeth of the combs D at the point opposite which the drawing-off rollers I are situated, and by that means intercept the noils and other impurities in the fibre contained in the combs D. The comb plate G is secured to a conical annular slide G cast with teeth on its periphery, which teeth when they arrive near the drawing-off rollers assume a vertical position. Into these teeth gears a pinion 2 keyed to a short vertical shaft 3 supported in bearings, and which carries also a second pinion 4 in gear with the teeth on the comb slide D^1. Thus rotation is transmitted from the comb D to the comb G, and the gearing is so arranged as to ensure an uniform surface speed to the two combs.

The dabbing brush stems slide in guides in brackets K on the framing (one of which is shown at fig. 1); pivoted to this stem is a rod L hung on a crank pin projecting from a pulley M. A band from a pulley N on the shaft F drives this pulley M, and thus a rapid up-and-down motion is given to the dabbing brush. This mode of driving greatly diminishes the wear and tear of the brush, which owing to the teeth of the combs (in their continuous rotation) dragging through the depressed brush have hitherto been rapidly deteriorated. At fig. 1 is shown an arrangement for feeding the combs, which is to be provided in duplicate so as to feed at opposite sides the comb A.

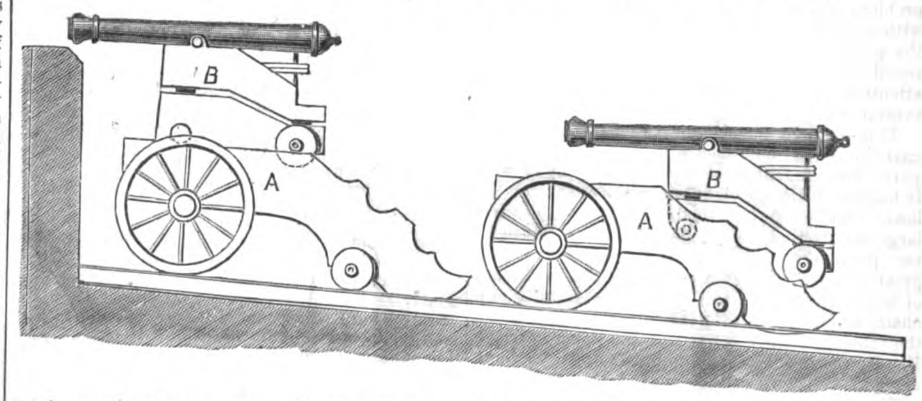
The operation of the machine is as follows:— The wool or other fibre to be combed as it is laid on the combs (at points coinciding with the line of their centres) is pressed down into the teeth by the dabbing brushes, and a continuous rotary motion being imparted to the combs in the direction of the arrows the adjacent teeth of the combs A and D laden with fibre will gradually recede, each set of teeth retaining a portion of the fibre supplied thereto. Those fibres which are carried round by the large comb A will be taken up by the drawing-off rollers O and delivered to a pair of condensing rollers P which serve to condense into one roping all the combed fibres taken up by the several sets of drawing-off rollers. In like manner the fibres carried round by the combs D are removed from the comb teeth by their respective drawing-off rollers I and led to the condensing rollers P. Before, however, this stripping of the combs D commences the inverted combs G will in their rotation have come down over and in front of the comb teeth carrying the fibres, and thus the fibres when seized by the rollers I will be drawn through the combs G, the teeth of which will intercept the noils and the burrs or other extraneous matters contained in the fibres, and thus ensure the delivery of cleaned fibres to the rollers.

NOBLE LIFEBOAT SERVICES DURING THE RECENT GALES.

The following is a list of the great services rendered to shipwrecked crews by the lifeboats of the National Institution during the heavy gales of the past and present months:—French lugger "Isabelle," of Dinan, four men saved by the Padstow lifeboat; screw steamer "Hellenis," of Dublin, officers and crew, consisting of twenty-one persons, rescued by the Arklow lifeboat; schooner "Prudence," of Watchet, crew of three men saved by the Burnham lifeboat; schooner "Lady Anne," of West Hartlepool, crew of five men and vessel assisted by the Margate lifeboat; ship "Electric Spark," of Boston, U.S., twenty-one of the crew and the master's wife saved by the Wexford large lifeboat; yacht "Emetic," of Dunmore East, three men and vessel saved by the Dungarvan lifeboat; barque "Empress," of Prince Edward's Island, eighteen persons saved by the New Brighton tubular lifeboat; Dutch schooner, crew of three men and vessel assisted by the Burnham lifeboat; steamer "Viking," of Dundee, seven of crew rescued by the Fraserburg lifeboat; smack "Active," of Selsey, vessel saved by the Worthing lifeboat; the crew of two men of a small sloop rescued by the Castletown lifeboat; brig 'Phillis and Mary," of Blyth, vessel and crew of eight men assisted by the Cadgwith lifeboat; boat of the "Brave Chilion" saved by the Worthing lifeboat; smack "John James," of Chester, two men and vessel saved by the Aberdovey lifeboat; billyboy "Swan," of Hull, six persons rescued by the Sutton lifeboat; schooner "Gipsy King," of Glasgow, one man saved by the Moelfre lifeboat; schooner "Elephant," of Ulverstone, one man rescued by the New Brighton tubular lifeboat; brig "John and Mary," of Shields, nine men saved by the Blakeney lifeboat; brig "Ravensworth," of Hartlepool, six men saved by the same lifeboat; ship "Frank Shaw," of Shields, thirteen men rescued by the Broadstairs lifeboat, and one man by the Ramsgate lifeboat; brigantine "Gleaner," of Carnarvon, three men rescued by the Porthdinllaen lifeboat; schooner "Trusty," of Boston, crew of three men saved by the Sheringham lifeboat; steam whaler "Diana," of Hull, thirty-one men saved by the Donna Nook lifeboat; schooner "Commodore," of Waterford, crew of five men and vessel rescued by the Ilfracombe lifeboat; and sloop "Ann Elizabeth," of Barnstaple, crew of four men and vessel saved by the same boat.

This long list makes a total of 181 lives rescued by the lifeboats of the Institution during the late storms, in addition to 9 vessels saved from destruction. In the same period the crews of the lifeboats of the following stations either assembled or put off 31 times in reply to signals of distress from vessels not ultimately requiring their services:—Appledore, Southwold, Courtmacsherry, Wicklow, Courtown, Lowestoft, Pakefield, Rhyl, Lizard, Eastbourne, St. Justinian, Ilfracombe, Cahore, Withernsea, Ramsgate, North Deal, Hasborough, Peterhead, Sutton, Saltburn, Skegness, North Berwick, Newbiggin, Cromer, Broughty Ferry, Donna Nook, and Hunstanton. It often happened that on these occasions the lifeboat crews had incurred much risk and exposure throughout stormy days and nights. It should be remembered that nearly every life that has been saved by lifeboats during the recent storms was rescued under dangerous circumstances; and it will be thus seen what great benefit has been conferred by the Lifeboat Institution, not only on the poor men themselves and on their country, but also on their wives and children, who would otherwise be widows and orphans. During the storms of the present year the Institution has contributed, by lifeboats and shoreboats, to the saving of 781 lives from various wrecks. The Society has now 210 lifeboats under its management; and it is gratifying to know that nearly every large place, like Liverpool, Ramsgate, Scarborough, Dublin Bay, Montrose, and other important stations, is now supplied with lifeboats. It is therefore only at small fishing villages that lifeboats are now mostly needed, where, on account of the poverty of the localities, the whole expense, amounting altogether to £650, of the first establishment of the station has to be provided by the Institution, in addition to an outlay of £50 a year to keep up the station in a state of permanent efficiency.

THE MONCRIEFF SYSTEM ANTICIPATED.



THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

THE first locomotive, the "Sundusky," was turned out at these works, at Paterson, New Jersey, in June, 1837 (then under the firm of Rogers, Ketchum, and Grosvenor), after sixteen months of labour. In this engine were first introduced several improvements, among which we may mention the cone in the smoke-pipe, which was curled over at its base, the cone being perforated with small holes in order to distribute the force of the blast equally over the surface of the wire bonnet. The driving wheels, which were of cast iron with wrought-iron tyres, were cast with hollow spokes, rim and hub, excepting the spokes opposite to the crank, which were cast solid in order to counterbalance the cranks. The engine was also provided with double eccentrics and hooks on the outside of the frame, and altogether was a very neat and tastefully finished locomotive. Mr. Rogers was the first to use expansion braces; he was also among the first, if not the first, to build 10-wheel engines; and also to appreciate and adopt the link motion at a time when it was pronounced by many to be a humbug. It has always been a special feature in the Rogers engines to give ample boiler, with large steam room, and they have always been noted for their durability and economy of fuel.

In 1856, at the death of Mr. Rogers, these works had turned out about 800 engines, when the works passed into the hands of an incorporated company under its present name, and W. S. Hudson, Esq., was chosen superintendent, and under whose management the works continue at the present time. The works have been enlarged, and other extensive additions are still in progress to keep pace with the demand for engines. Mr. Hudson has introduced many valuable improvements in locomotives, among which we may mention the application of cross equalising levers to four and six wheel engines, so as to make them equivalent in action to a "three-legged stool" or tripod; also a system of equalising levers between driving and truck wheels, which has been successfully applied to engines with six drivers and one pair of truck wheels, also to engines with four driving wheels, and a single radiating truck at each end, for which Mr. Hudson has procured a patent. Several of these engines have been built, and are in successful operation. We wish to call special attention to this engine, as filling all the requirements of an engine which will run equally well either end first. We will quote what Mr. Hudson says about it:—

"The locomotive is on eight wheels, four driving and four truck wheels. The truck wheels are arranged in two radiating trucks, one at each end of the locomotive; each truck is connected by a combination of levers with each pair of driving wheels. The front truck and driving wheels are equivalent in action to a centre-bearing truck, and the rear truck and driving wheels to a side-bearing truck. With this arrangement all the wheels accommodate themselves to the vertical inequalities of the track without changing the distribution of the weight, and without interfering with the radiating of the front and rear truck wheels of the engine. The fixed wheel base may be made very short, so that the engine will pass readily and easily around curves of very small radius without that jumping motion which is inseparable from the ordinary four wheel switching engine, and without danger of getting off the track. The wear of the driving wheel flanges will also be much lessened, and the danger of running off on that account will be very much diminished. For these reasons, the engine is especially adapted to switching, construction, and branch traffic, running, as it does, equally well either end first. The locomotive is very easy on the track, the distribution of the weight and the accommodation to all inequalities of the rail, whether vertical or lateral, being perfect."

Mr. Buckhout, in his report on the New York City Central Underground Railway, recommends the adoption of this style of engine, with some modifications as to condensing the steam, &c., as being better calculated to supply the want for motive power than any of the plans which had been brought to his notice, and in his report, pages 19 and 20, describes the general design, and comments as follows:—"Gauge, 4ft. 8½in. Fuel, anthracite coal or coke. Cylinder, 14in. by 22in., four 56in. driving wheels, steel tyres, all flanged. Two single-axle radiating trucks, one at each end, wheels 30in. diameter. Furnace of steel; 126 2in. flues, 10ft. 5in. long. Tank on each side of engine to contain 1,500 gallons. The engine also to be supplied with a blower or steam jet. The engine to be so arranged as to throw the exhaust steam into the tanks so as to condense it or throw it up the chimney for the purpose of blast for raising steam, and so that the engineer can make the change instantly as required. This engine will take 80 tons in addition to its own weight (68,000lb. in running order), with 1,500 gallons of water in the tank, and 600lb. of coal, up grades of 1 in 39, or 38ft. per mile, with a pressure of steam as low as 80lb. per inch (if the steam should get so low), cutting off at 60 per cent. admission, it being intended to carry a maximum of 130lb. per inch. About 1,400 gallons of water will be required for the condensation of the steam for the distance of two miles, consequently it would require changing every four miles, if the steam were condensed for half that distance. The tanks to have a discharge valve, by which the water can be let out quickly when it requires changing. The fixed wheel base to be 6ft. 9in., and the whole base, including the radiating trucks at each end, to be about 21ft. 9in. With this arrangement the truck wheels will not require to radiate over 3¼in. from a straight line, on curves of 200ft. radius, which is much within the limits of its capability. With equalising levers, as applied to this description of engine by Mr. Hudson, two-thirds or more of the weight can be carried on the drivers, and the arrangement is such as to accommodate itself to all the vertical and lateral undulations of the track without varying the distribution of the weight on the wheels; it is also arranged so as to be equivalent in action to a four wheel centre-bearing truck at one end, and to a four wheel side-bearing truck at the other end. In addition to these properties the engine can be run either end foremost with great facility and equal safety: a feature not embraced in any four driving wheel single truck engine. It has therefore special advantages in saving the time usually occupied in turning an engine round so as to run truck foremost. It has another advantage. The trucks do not deviate from the centre line of engine nearly as much as a four driving and four wheel swing truck engine does on the same curve, being some 50 per cent. in favour of the double truck."

The Rogers Locomotive Works are adding facilities to enable them to turn out 15 to 20 locomotives per month: they are now producing 10 or 12 locomotives per month. They have furnished a large number for the Union and Central Pacific roads, and are still building for those lines. Two of their engines, the "Success, No. 156," and the "Excelsior, No. 157," were built for the Central Pacific, to make the first through trip from the Atlantic to the Pacific shores, and their whistles have already been heard sounding through the Sierra Nevada mountains. These works have also furnished many for South America, to climb over the Andes mountains, over grades of 264ft. per mile. The good working qualities of the Rogers engines are well understood and appreciated by the engineers, with whom they are great favourites; they are tasteful in design, and in finish and ornamentation second to none others. These works are using steel largely in their engines, both for tyres, axles, boilers, slides, crank pins, and for many other parts.—"American Railway Times."

Correspondence.

ENGLISH AND CONTINENTAL INTERCOMMUNICATION.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Permit me to draw your attention to the enclosed list, which I have compiled from the most accurate data, as to the relative rise and progress of ideas by engineers and others for practically connecting England with the European and Asiatic continents, as it no doubt existed in olden times, the entrance or disjointure having been effected from time to time by volcanic or oceanic storms. This will probably prove an interesting rider to Mr. Nursey's paper upon the subject, the first part of which appeared in your last issue.

Permit me also, with reference to that portion of that paper in which my tunnel scheme is described, to remark that the statement conveys the idea that my project arose in 1868. It will, however, be found referred to in the "Mining Journal" for 1856, and also in the "Times" and "La Presse." At that time, I laid my plans before the Civil Engineers' Institute, and was complimented then and there by opinions "that my ideas and plans were very good—but premature by thirteen or fourteen years."—I am, Sir, yours, &c.,

W. AUSTIN, C.E.

8, Culmore-terrace, Carlton-road, Old Kent-road, October 25.

RELATIVE PROGRESS OF DESIGNS FOR CROSSING THE CHANNEL—ENGLAND TO FRANCE.

1. M. Mathieu, 1801, proposed submarine tunnel—no detail or estimate.
2. MM. Franchot and Mottray, in 1803-4, cast-iron tunnel on bed—no detail or estimate.
3. M. de la Haye, Liverpool, 1845—55, iron submerged tunnel—£10,000,000.
4. M. Victor Horeau, 1851, submerged iron tube and double rails—£87,400,000.
5. M. Payerne, 1855, concrete tunnel on sea bed—no estimate.
6. M. Faure, 1855, submarine under-Channel bed—£4,000,000.
7. Mr. James Wytson, 1855, iron floating tube (subaqueous)—£15,000,000.
8. Mr. Nicholl, 1856, iron tube (subaqueous)—no estimate.
9. M. Vacherot, 1855-6, iron and concrete lined tube—no estimate.
10. Mr. W. Austin, C.E., 1856, triple arch oval masonry submarine tunnel, with three double lines of railway, subsequently corrected to circular or ring masonry, &c.—£16,000,000 original *calculus*; £21,000,000 revised estimate.
11. Messrs. Turner, Dublin, 1856, semi-circular submerged iron tunnel, brick cased—no estimate.
12. M. Thomé de Gamond, 1857, tunnel and thirteen islands—£6,800,000.
13. Mr. J. F. Smith, 1861, floating iron tube, submerged and moored—£10,000,000.
14. Mr. Chalmers, 1861, iron drift or tunnel, submerged, lined with concrete—£12,000,000.
15. Mr. Remington, 1863-4, an oval submarine brick-lined tunnel, being almost a fac-simile of one-third of the original oval masonry tunnel of Mr. Austin—£7,000,000.
16. Mr. Hawkshaw, 1864-5, a single arch submarine brick-lined tunnel, with two railways only, and including a subway double drift—£10,000,000.
17. Mr. Bateman, 1869, an iron pneumatic-worked tube of 13ft. clear diameter, with only one pair of railway lines to and from for all traffic—£8,000,000.
18. Mr. C. Marsden, 1869, iron tube or drift on sea bed—£12,260,000.

P.S.—Bridges and ferries being only temporary and non-reliable in event of hurricanes, silting and shifting of harbours, &c., I have not in any way given attention to these.

THE MONCRIEFF SYSTEM ANTICIPATED.

SIR,—Referring to your recent description of Captain Moncrieff's system of mounting heavy guns, permit me to submit to your notice an account of a gun which is intended to answer the same purpose, and which embodies similar principles to those of Captain Moncrieff. It is described and illustrated in a French work published at Milan, in the year 1811, by an anonymous author, General Comte C—. The title is "Essais sur quelques Parties de l'Artillerie et des Fortifications." The first part relates to a description of

a gun carriage for position and siege, to fire without embrasure. The author there states that the problem of finding a gun carriage in order to fire without embrasure, that is to say, which elevates the piece when one wishes to fire, and which the recoil lowers after its discharge, had engaged his attention since 1792, and had also occupied that of several others.

This carriage consists of two parts, the lower carriage A and the upper one B; the upper supports the gun, and is connected to it by a bolt. It has four little wheels between the cheeks of the lower carriage A, two small ones before, and two large ones behind, which are intended to wheel in two parallel grooves. On the axle tree of the great wheels of the lower carriage A is fixed a drum of iron, having fillets to receive the extremity of a chain, which appears similar to that of a watch; the other extremity is fixed to the upper carriage B. By the recoil of the gun, the upper carriage descends as shown in the annexed sketch.

The Republican Italian Government of the year 1805 ordered that this invention should be tried, and it appeared to give some satisfaction after much trouble and alteration. The other trial was by an order of the French Republic in 1803, with a 24-pounder French gun. The results were favourable. The platform had 5deg. elevation, or 1in. to a yard. After the recoil, the distance of the mouth of the piece from the crest of the parapet was 3¾ metres or 12ft. 3in. English. It appears to me that an enfilading battery will destroy Captain Moncrieff's guns, except there are traverses on the parapets. If they are used in the face of a bastion, there must be a traverse at the salient angle. A shell, loaded as described in Marten's patent with molten iron, will, on striking the piece, be likely to cover the carriage and burn the platform, if of wood, and therefore be rendered entirely useless. Molten iron might be used with effect in destroying the gabions, hurdles, fascines, and sandbags of the batteries, parallels, and approaches at a siege.—I am, Sir, yours, &c.,

London, October 25. R. G. Clark.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

Received.—C. M. and Co.—W. R.—F. H. L.—T. T. R.—H. S.—M. and C.—E. M.—G. W. H.—C. D. A.—H. C. S.—J. B. W.—R. M.—G. W.—H. B. T.—F. F. G.—W. S.—E. J.—S. E.—G. W. H.—J. E.—J. G. S.—J. F.—C. H. N.—R. B.—J. N.—T. W.—H. J. G.—A. W. T.—F. S.—E. J. L.—B. B.—E. A.—C. E.—D. G.—F. R. S.—W. B. R.

Meetings for the Week.

Mon.—Royal Institute of British Architects.—Ordinary General Meeting. Sir William Tite, M.P., President, will deliver an "Opening Address," at 8 p.m.

Society of Engineers.—Discussion on paper read by Mr. Perry F. Nursey on "English and Continental Intercommunication;" should time permit, a paper will be read by Mr. Charles J. Light on "The Need for further Experiments on the Strength of Materials," at 7.30 p.m.

Thurs.—Special General Meeting, at 6 p.m.

Sat.—London Association of Foremen Engineers.—A paper will be read on "The Warsop Aero-Steam Engine," at 8 p.m.

Naval, Military, and Gunnery Items.

John Kitts, 107 years of age, has presented to the Baltimore city council a claim for services rendered the city in the wars of the Revolution of 1812.

"E.B." has, through Mr. Mark Whitwell, of Bristol' sent a "thank-offering, for mercies received," of £100 to the National Lifeboat Institution. "E. B." may possibly have been saved from a watery grave by one of the lifeboats of the Institution during the storms of the past week.

The West India and Pacific Steamship Company have entered into a contract with the Post Office for a monthly service of mails between Liverpool and Port au Prince, Mexico, Venezuela, and Santa Martha. The basis of the payment is to be 2s. 6d. per ounce for letters, 3d. per lb. for newspapers, and 5d. per lb. for books, patterns, &c.

The "Polynia" has arrived in Dundee with only two fish (26 tuns) from Cumberland Gulf. The other Dundee vessels were at Cape Kater on September 11 without any fish. The season had been bad for fishing on account of the strong winds, which kept the ice north until the fishing time was past. The "Polynia" was alone all season.

According to the last return of the "Bureau Veritas" of Paris, the number of vessels reported to be totally wrecked during the months of August and September last, was 381, of which number 164 were English, 49 French, 23 North German, 22 Norwegian, 19 American, 13 Dutch, 9 Italian, 8 Swedish, 7 Danish, 6 Russian, and 61 sailing under various other flags.

H.M.S. "Devastation," which has recently been laid down at Portsmouth, is to be built with two turrets on the "breastwork monitor system." She will be propelled by double screws with separate engines, and her armament will consist of four 30-ton guns, two on each turret. She will be unlike the "Monarch" or "Captain," inasmuch as she will have no masts or forecastle, although having all round fire.

Three iron steam vessels have just been commenced at the works of Messrs. Maudslay, East Greenwich. A co-operative company, at Millwall, have received orders to build a wooden vessel and a composite vessel. A vessel has just been commenced at Messrs. Rennie's yard. It is stated that Messrs. Dudgeon, at Millwall, have several orders in hand, and there are other indications that an improvement is about to take place with regard to shipbuilding on the Thames.

The annual prize of honour at Brussels was shot for on Tuesday week. It consists of a silver cup of the value of 5,000f., given by the English National Rifle Association, remaining for a year in the possession of the winner, and five guineas, added by Captain Styan, of the Queen's Westminster Rifles. The competitors are limited to the three men in each corps who made the highest scores at the butts of their respective bodies in the Belgian National Guard. The winner was M. André, of the Charleroi Infantry.

The "Cumbrae," screw, lately built and engined by Messrs. W. Simon and Co., Renfrew, has made a satisfactory trial trip, having attained a speed of about 12¼ nautical miles per hour. The "Cumbrae" is the property of the Clyde Shipping Company, and will form one of their South of Ireland steamers. The dimensions of the "Cumbrae" are as follows:—Length, 207ft.; breadth, 27ft.; depth, 15ft.; burden, 620 tons. She is propelled by a pair of direct-acting inverted surface condensing engines of 130-horse power, nominal.

The iron ramrod did not supersede the wooden one until 1742, when it was introduced into the Prussian army by Prince Leopold, of Anhalt-Dessau. The bayonet was preceded by various contrivances, such as an axe attached to the barrel, then a dagger, etc., stuck into the latter. But, as this was an impediment to firing, a ring was added, about 1691, to the bayonet, whereby the blade, instead of covering the muzzle, came to be flush with its rim. This, however, was still inconvenient for loading, so that at length the bayonet was provided with a neck, as it now is. This was about 1705.

Rear-Admiral Arthur Farquhar will hoist his flag on board the "Black Prince" on the 1st of November, have it saluted, and then proceed on leave. As we stated last week, Captain F. A. Hume and Commander C. G. Fane have been selected to serve under Admiral Farquhar, and Lieutenants A. T. Dale, C. Caffin, and A. J. Leith, and the Rev. H. Alexander, from the "Asia," will also be appointed to the "Revenge," which ship will be ready about the 15th of November to go to sea. Lieutenant Rickman will be flag lieutenant to Admiral Farquhar.

A new iron drawbridge is being erected over the canal at the Royal Arsenal by Sir William Armstrong, at a cost of £3,000. Its object is to connect by a nearer route the landing pier and the North Kent line, avoiding the long and unpleasant curve through the practice range, and saving a distance of about a mile. The bridge will be 121ft. in length and the greater part will swing on a pivot by hydraulic power, so as to admit of vessels passing up and down the canal. Men are now engaged screwing in the iron piles, the canal having been drained to facilitate the operations.

At the last quarterly general court of the Governors of the Marine Society, the committee reported that 92 poor and destitute boys had been admitted into the training-ship "Warspite," off Charlton, during the last quarter; 43 had been sent into the Royal Navy, and 45 to the merchant service. A complement of 160 had been kept on board. Seven young men, who had served their apprenticeship with credit, after passing out of the society ship, were rewarded with medals. The attention of the benevolent was earnestly called to the amount of good this society—the parent of all training-ship institutions—is effecting.

The scientific departments at the Royal Arsenal have under investigation the merits of a 37-barrelled rifle, said to be an improvement upon Montigny's mitrailleuse, which has been already adopted to some extent by the French government. This consists of 37 rifle barrels bound together by hoops, the charges for the whole being contained in a movable breech-piece, and the barrels can be discharged singly or together by a turn of the hand. The "machine" has been found to make a good diagram at the targets, almost too good if it is intended to supersede grape shot. The rifling and the bullets are Metford's, and the charge 15 grains.

Some interesting experiments have taken place at Perm, Russia, with a new 20-inch gun, cast in the foundry of that town. The trials made with this gun, under the direction of Major General Pestitch, commandant of the Cronstadt artillery, are described in the official reports as having been very successful, and more satisfactory in their results than had been the case with American guns of the same calibre. The gun was fired 314 times; the projectile weighs 10 cwt., and the charge of powder required for each shot was 130lb. The weight of the gun is about 50 tons, the recoil 7ft., the initial velocity of the projectile 1,120ft. per second, and the percussion force, at a distance of 50ft., about 10,000 tons. The official papers say this is "the most powerful gun in Europe."

A French writer calculated that, at the commencement of 1867, there existed in the world 2,814 lighthouses, or phares, of more or less importance, viz., 1,785 on the coasts of Europe, 674 on those of America, 162 in Asia, 100 in Oceania, and 93 in Africa. As regards Europe, the best lighted coasts are those of Belgium, France following immediately afterwards. Then come, in the order in which their names are given, Holland, England, Spain, Prussia, Italy, Sweden and Norway, Portugal, Denmark, Austria, Turkey, Greece, and finally Russia. Besides Europe, the best lighted coasts are those of the United States, which have one light for every 20 miles, whilst the Brazilian coast has only one light for every 87 miles. Of the 2,814 in existence at the commencement of 1867, about 2,300 had been established since 1830, while the power of the greater part of those existing prior to 1830 has been increased.

The Director-General of the Ordnance and the Committee of Inventions at Woolwich have under trial a bottle cartridge designed by Colonel Boxer. It is intended, if successful, to supersede the ordinary cartridge in use for small-bore breech-loading rifles, which cartridge, being several inches in length, is very liable to injury. The main principle of the invention is to enlarge the chamber of the rifle without interfering with the diameter of the barrel. The cartridge is, therefore, in the shape of a bottle, the apex or neck containing the bullet, while the base consists of the powder, which, being concentrated more than in the elongated cartridge, is theoretically supposed to possess the property of more rapid ignition and consequent increase of force. All the advantages which attach to a "low trajectory" are, therefore, claimed for the invention, which is not so new as is generally supposed, having been introduced some years since in America. We have had by us for the last five years copper-cased bottle-shaped cartridges for the Spencer repeating rifle.

Miscellanea.

The net profit derived from the Prussian state railways for the year will be about 2,364,722 thalers.

Mr. Daniel A. Lange, director and representative in this country of the Suez Canal Company, will leave London on November 1 for the ceremony of the inauguration of the Suez Canal.

We regret to learn that Mr. George Peabody is lying dangerously ill at 80, Eaton-square. He was in a state of unconsciousness from Tuesday afternoon until Wednesday morning. In the afternoon, we are informed, he rallied slightly, but is still in a critical state.

The Tram-Railway Company have completed their organization, and are now taking into consideration applications from different parts of the country where tramways are required and where the best local support seems likely to be given. A few of the most promising will, it is said, after due inquiry, be proceeded with at once.

On Saturday Lord Ravensworth laid the foundation stone of a building to be used as the Mechanics' Institute at Walker, near Newcastle. The building will be of brick, with stone dressings, and will contain a public hall, a reading room, library, smoking room, class-room, ante-rooms, and a room for the local board. The estimated cost of the building is £3,000.

The number of visitors to the South Kensington Museum during the week ending October 23, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,265; Meyrick and other galleries, 1,423; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 5 p.m., 1,917; Meyrick and other galleries, 126; total, 14,731. Average of corresponding week in former years, 9,931. Total from opening of Museum, 8,901,179.

A definite concession has been granted for Roumelian railways, to connect the Bosphorus with the Sclave and European lines, and open direct communication between Thrace and Macedonia and the ports of Salonica, Enos, and Constantinople. The length of the lines will be 2,000 kilometres. Baron Kirsch and the concessionnaires are to form a company with a capital of 50,000,000f., which will undertake to finish the whole network of railway in seven years.

The Duke of Argyle received at the India Office on Wednesday, the 27th inst., a deputation of the Council of the Institution of Civil Engineers, on the subject of a notification lately issued by the Public Works Department of the government of India. The deputation consisted of Mr. Charles Hutton Gregory, President; Mr. Bidder and Mr. Fowler, Past-Presidents; Mr. Cubitt and Mr. Hawksley, Vice-Presidents; Mr. Abernethy, Mr. Bramwell, Mr. Hemans, Mr. Murray, and Mr. Stephenson, Members of Council; Mr. Manby, Honorary Secretary; and Mr. Forrest, the Secretary.

The immense wealth of the Thames goldfields, in the Northern Island of New Zealand, has given a great stimulus to gold prospecting in other districts of that colony. Thus, in Taranaki, Napier, and Wellington prospecting parties are at work, and substantial success is confidently anticipated. Although gold-bearing quartz has not yet been discovered in the province of Canterbury, the existence of extensive reefs on Banks's Peninsula has been clearly proved, and these will be shortly tested. Prospecting parties are out in the southern, western, and northern parts of the province, and a thorough exploration, at any rate, will be the result.

The Americans say that they had Lieutenant Saxby's storm. The night of October 4 will not soon be forgotten. Two residents of Newcastle, New Hampshire, report that they were on the beach at 10 p.m. when the tidal wave, 18ft. high, rolled in. As they saw it coming, they fled, but one fell among the rocks, and clung to them, the wave going over him. It ran 125ft. above high water mark. In three minutes afterwards there was no trace of it. The tide in the Bay of Fundy, and at and near St. John, New Brunswick, rose to a height never before known. Thousands of cattle and sheep were drowned, bridges were swept away, and miles of railroad track destroyed.

On the night of October 17 and the morning o the following day a snow storm of extraordinary violence swept across Stiria and the adjacent districts. A great deal of injury has been done to the gardens and vineyards, as the vintage is not yet finished; indeed, in some places it has hardly commenced. At Laibach the heat of the 17th was intense, and yet on the following morning at 8 o'clock the snow began to fall. In the night a violent thunderstorm had broken over the district. At Gratz it snowed the whole night and forenoon so heavily that the whole ground was completely covered, and the branches of the fruit trees, still in full leaf, were broken by the weight of the snow.

The inhabitants of Ealing have at last succeeded in obtaining sufficient funds for the erection of a public clock and chimes, which has been placed in the tower of one of the most beautiful churches in the place. The work has been most successfully carried out by the well-known makers, Messrs. Gillett and Brand, of Horology Works, Croydon, who were the manufacturers of the great clock at the International Exhibition, and also the celebrated Boston chimes. Amongst the many great improvements introduced in this new clock is a gravity escapement, the invention of Mr. E. B. Denison, Q.C. There are three faces to the clock, which is illuminated at night by means of gas. The size of the clock may be estimated when it is said that the weights weigh about half a ton.

It is said that the proposal to construct special carriages for native females on the East India Railway has been approved of by the Viceroy. The carriages will be reserved for respectable native women, and are to be "first-class," but with lower fares than those of the ordinary first-class vehicles. It has also been recommended that there should be a European female guard and a European female ticket-collector for the passengers by these carriages. Also that the railway company should see that every station is supplied with a sufficient number of palkees and bearers to convey these ladies on their arrival to their final destinations. An extra quarter of an hour may, it is also said, be allowed to the trains to which the carriages may be attached both at the starting and halting stations.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—998, 1011, 1024, 1027, 1042, 1061

Buildings and Building Materials—993, 1003, 1016, 1026, 1037, 1044

Chemistry and Photography—1046, 1059, 1060, 1070, 1071

Cultivation of the Soil, including agricultural implements and machines—1073

Electrical Apparatus—None

Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—1007, 1022, 1030, 1033, 1072

Food and Beverages, including the apparatus for preparing food for men and animals—987, 996, 1008, 1028 1040

Furniture and Apparel, including household utensils time-keepers, jewellery, musical instruments, &c.—983, 989, 990, 991, 992, 1005, 1006, 1010, 1019, 1036, 1047, 1049, 1052, 1056, 1057, 1067

General Machinery—995, 999, 1023, 1041, 1045, 1054

Lighting, Heating, and Ventilating—947, 1002, 1018, 1021, 1029

Metals, including apparatus for their manufacture—1068

Miscellaneous—907, 981, 982, 988, 997, 1000, 1001, 1025, 1032, 1035, 1038, 1048, 1053, 1058, 1064, 1066, 1069

Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—986, 1009, 1012, 1013, 1014, 1015, 1031, 1034, 1050, 1065

Ships and Boats, including their fittings—1003, 1039

Steam Engines—985, 994, 998

Warfare—984, 1017, 1020, 1043, 1055, 1062, 1063

907 J. R. Baillie, Walthamstow. *Coal waggons.* Dated March 25, 1869.

This consists in the adaptation and application to such waggons of doors or flaps working on a shaft or pivot and moved thereon as required by means of a worm toothed quadrant and worm turned by a winch, or by other means. The door or flap has its pivot nearer to one side than the other of the opening in the bottom or side of the waggon, thereby giving more weight on one side of the pivot than on the other, in order that the flap or door may have a tendency to fall open to its full extent when not controlled by the mechanical means employed for the purpose.—Patent completed.

947 C. Weekes, Great George-street, S.W. *Combustion of wood.* Dated March 30, 1869.

This consists, first, in passing a wire or small piece of wood through holes at or about the centres of any convenient number of sticks or pieces of wood of equal or unequal section such as are commonly sold in bundles for firewood, cut into suitable lengths. Second, in turning the ends of such pieces (thus fixed upon the wire or other centre) so as to produce an arrangement similar to that known as a "chevaux-de-frise," in which state the wood is placed in the grate or fire place, where it is intended for combustion. Pieces of coal or other fuel are then to be placed in the spaces round the ends of the wood, and a light applied at the bottom, sides, or front.—Patent abandoned.

981 T. Lippiatt, Orange, New Jersey, U.S. *Engraving and chasing.* Dated March 31, 1869.

The main bed of the machine supports the heads and extends forwards in the form of slides for receiving the main sliding rest or bed plate which carries the parts operating upon the tool. This plate may be moved nearer to or further from the mandrel as required by the article operated upon, and for this purpose a screw is employed. The mandrel carries a face plate. Upon this face plate the article to be engraved is attached, or in place of a face plate a chuck or other holder may be substituted.—Patent completed.

982 J. C. Lee, Ashton, Chester. *Collecting excreta.* Dated April 1, 1869.

The inventor employs boxes, cases, or receptacles, preferably formed of metal, and fitted with lids, doors, or covers so fitted or arranged as that when the receptacles are closed by means of the lids, doors, or covers, the receptacles may be airtight or nearly so. For the purpose of making the joint between each receptacle and its lid or cover airtight, caoutchouc or any other suitable elastic material may be employed, or a channel may be formed in or on the receptacle, which is to be filled or nearly filled with water, or with a deodorising fluid or material, or with any suitable substance or fluid, into which a flanch formed on the lid or cover dips sufficiently to seal the receptacle, that is to say, to prevent wholly or partially the emission of noxious emanations from within the receptacle.—Patent completed.

983 C. Lange, Strand, W.C. *Clock and watch winding.* Dated April 1, 1869.

The wheel which is geared into and worked by the pinion on which the knob at the pendant is fixed, and which the inventor calls the first wheel, is fixed on to one end of an axle, while the other end of this axle is formed square for the purpose of winding by a key fitted thereto. This first wheel gears into a second wheel, and the two are kept in constant connection and gear by means of a piece of steel or other metal fitted under or over them, and on which the centre or stud carrying the second wheel is fixed. This piece of steel has its turning centre in common with the first wheel, and has an arm to be acted upon for the purpose of setting the hands. On the barrel arbor is fitted a third wheel, and the second wheel is kept in gear with it by the pressure of a spring. By turning the knob at the pendant, or a key fitted on the above-named square one way, the watch is wound up; by turning it the reverse way, the piece of steel on which the stud of the second wheel is fixed moves concentrically with the first wheel, and the second wheel is lifted out of gear with the third wheel.—Patent completed.

984 H. Carter and G. H. Edwards, Bow. *Breech-loaders.* Dated April 1, 1869.

In order to adapt the Chassepot rifle for the Boxer or Daw central-fire cartridge, the inventors first alter the bore of the breech and of the barrel, in so far as the reception of the cartridge is concerned. They take an exact model of the original form of breech, in rear of the rifling, that is to say, so much of the bore and cavity of the breech behind it as is necessary to constitute the receptacle or space for the cartridge when the arm is loaded, and from this model they form a corresponding metallic plug or stopper of similar shape and dimensions. This they subject to a red heat, and insert it firmly into the breech and rear of the cavity or shoe, close to the breech, so as to close or plug the same. They then bore or drill through the body or sides of the barrel, two apertures a short distance apart, and at right angles to each other, passing completely through the sides of the barrel and plug, and they then insert two screws (forming screw rivets by hammering), which serve to secure the plug in position.—Patent abandoned.

985 G. Holcroft and W. N. Dack, Manchester. *Steam engines.* Dated April 1, 1869.

This consists, first, in the application of a balance valve with the back plate placed on a plate or facing behind the ordinary slide valve. Second, in connecting the differential stop to the eccentric rod or its equivalent. Third, in making the governor rod in two parts, each with a head acted upon by springs contained in a box. Fourth, in working the valves of certain ordinary steam engines by applying a catch to the slide worked to and fro by the eccentric.—Patent completed.

986 J. Beckett and A. W. Field, Llandudno. *Railway brake.* Dated April 1, 1869.

To apply this invention to (say) an ordinary railway carriage, the hooks on the outer ends of the drawbacks are each constructed to receive and carry an antifriction roller or wheel, which when the apparatus is in the act of being thrown out of gear travels upon a double cam placed between the front and back drawbars of the carriage, and with a notch therein or ratchet tooth formed thereon at a point slightly in front of the frame of the carriage (when drawn out by the power required to move the vehicle), when applied to the drawhook on the front or back of the carriage, as the case may be. Each drawbar is provided with a lateral stud springing at right angles therefrom or with the requisite projections fashioned to joint a link-rod thereto.—Patent abandoned.

987 E. O'Connell, Greenwich. *Infant feeders.* Dated April 1, 1869.

The inventor provides a cap or cover for the neck of the bottle made of porcelain or other suitable material which is not of a corrosive or deleterious nature, and having a central aperture for the elastic or feeding tube to pass through. Near to or surrounding this aperture he makes one or more holes for the admission of atmospheric air to the inside of the bottle, by the aid of which hole or holes the fluid or other nourishment in the bottle is easily obtained by suction.—Patent completed.

988 J. B. Rowcliffe, Manchester. *Wire cloth for paper machines.* Dated April 1, 1869.

This consists in weaving wire cloth of a twilled, fancy, or basket pattern in an ordinary wire loom to which two, three, or more tiggers or healds are applied for raising and lowering the warp in the succession required by the particular pattern to be produced. In weaving twills, the inventor reverses the direction of the twill or diagonal in the warp at intervals as often as may be required to keep the wire cloth even on the rollers of the paper making machine.—Patent completed.

989 C. D. Norton, Old-street-road. *Revolving heels and tips.* Dated April 1, 1869.

The inventor makes a disc of metal having a rabbet on its inside lower edge, the purpose of which is to permit a reefer, made of a circular piece of metal of a correspond-

ing size, to pass the upper orifice of the disc and bear upon the rabbet for the purpose of attaching the disc to its base upon the boot or shoe. Being thus placed, and the keeper having screw holes perforating its surface it is firmly attached to the boot or shoe by means of screws or nails driven through the holes into that part of the heel formed upon the sole of the boot, at the same time permitting the revolving part of the heel to be easily turned by the hand at the pleasure of the wearer.—Patent completed.

990 T. HIGGINS, Warrington Gardens, W. *Hats.* (A communication.) Dated April 1, 1869.

This consists in constructing hats with a clip or holder on their interior to carry a small hat brush. For this purpose the inventor employs a small spring clip of metal secured to a card, which is glued or fastened in the crown of the hat. The jaws of the clip are formed to embrace the brush, and nip against the sides of its back or handle.—Patent abandoned.

991 J. CAPLIN, Pentonville-road. *Umbrellas and parasols.* Dated April 1, 1869.

Instead of affixing the notch to a piece of tubing or runner cylindrical throughout its entire length, with the edge of the notch projecting considerably beyond it, the inventor forms that part of the tubing or runner situate immediately under the notch with a swell, the larger diameter of which is greater than that of the notch.—Patent completed.

992 W. GIBSON, Birmingham. *Cramp keys.* Dated April 1, 1869.

The inventor makes the cramp key or implement of the same general form as that in ordinary use, that is to say, the implement consists essentially of a cramp and screw with the following additions or modifications. Instead of making the thumb bit or thumb plate of the screw of the ordinary form, the inventor makes the thumb bit in the shape of a square hollow key, at right angles to the axis of the screw, the key serving to screw and unscrew such parts as have square heads which will engage in the hollow key.—Patent abandoned.

993 G. H. WILSON and G. E. PULLEN, Commercial-road. *Window sashes.* Dated April 1, 1869.

This apparatus is constructed in order to be placed on either end of top bar of front or lower sash. It consists of two racks, of a box with two bolts, which take into these racks, of a locking spring, of an adjusting spring, of a lever or arm, and of a drop bolt.—Patent abandoned.

994 W. ALLAN, Sunderland. *Marine steam engines.* Dated April 1, 1869.

The inventor places the condenser below the crank shaft, and makes it to form part of the bed plate. The two ends of the bed plate rest on and are secured to beams or girders which run athwartship, whilst the casing of the condenser is carried down between these beams or girders until it rests on the centre keelson. The tubes of the condenser are placed athwartship, so that the condenser doors or covers by which the tubes are got at are at the two sides of the condenser. The end bearings of the crank shaft can either be carried in separate castings, which castings contain the air and circulating pump chambers, and may be bolted or otherwise secured to the sides of the condenser casing, or the whole bed plate may be in one casting.—Patent completed.

995 W. BAYNE and O. E. M'GREGOR, Wolverhampton. *Carpenters' planes.* Dated April 1, 1869.

The inventor makes the face of the head of the plane movable, so that it can be pushed nearer to the back edge of the mouth or withdrawn from it, according to the extent to which it is worn or the nature of the work to be done. A portion of the head of the plane, carrying with it the whole of the head face about half an inch deep, is advanced and withdrawn by means of a screw which enters the remaining portion of the head. The head face is kept true with the tail face by sliding in a dovetailed groove and by a stud in the movable portion of the head which enters a hole to correspond in the fixed portion thereof.—Patent completed.

996 G. H. SMITH, Colchester. *Cooking indicators.* Dated April 2, 1869.

For cooking eggs the inventor constructs a pan with a perforated bottom working on a hinge, so as to open and shut with a clasp, and to the top of the pan he fixes a whistle or other alarum capable of being operated upon by the pressure of steam. This alarum has a piece of wire gauze placed over its mouth to prevent priming or choking.—Patent completed.

997 J. BATH, King William-street, E.C. *Printing and copying machine.* Dated April 2, 1869.

In a suitable framing the inventor arranges the following parts:—At the front part of the framing he arranges a set of keys horizontally, somewhat similar to the keyboard of a musical stringed instrument, say forty-eight keys for example. Each of these keys corresponds to a letter of the alphabet, beginning at the left hand of the keyboard. The first key corresponds to the capital A, the second key to a small a, and so on in regular order of succession throughout the entire number of keys, every other key corresponding to a capital letter, and the other keys to small letters. In connection with the aforesaid keys the inventor employs a series of levers, all radiating from the key board or converging to a centre at any given distance from the key board. Each of the levers is mounted on an independent fulcrum suitably placed, and a spring is adapted to each for keeping them raised when out of use, and to the converging ends of each of the aforesaid levers the inventor affixes large and small letters, or characters or types in accordance with the letters on the keys. The types occupy a very small space when arranged side by side, say about 2in. for the forty-eight letters. In a line with the key board, or thereabout, he adaps a flat table or tray fitted with a pad covering its surface, upon which is to be placed the blank sheet of paper that is to be printed upon, and upon this blank sheet he places and secures in position a sheet of black, blue, or other coloured transfer capable of giving off the colouring matter with which it is prepared upon pressure being exerted upon any part of its surface.—Patent abandoned.

998 H. A. FLETCHER, Whitehaven. *Steam generators.* Dated April 2, 1869.

This consists in attaching round the sides of the firebox or tube a series of conical water pockets or thimbles, closed at their inner converging ends and opening at their outer or expanded ends, through apertures made in the firebox into the water space surrounding the same.—Patent completed.

999 W. MARSTON, Loughborough. *Bolts.* Dated April 2, 1869.

This consists in the first place in forming that end of the bolt which usually slides into a staple or hole, or past a stop or check plate of a circular or inclined shape upon one side thereof, and, second, in forming a circular or inclined shaped stud on a plate, in which a number of holes have been made, through which screws are passed to secure the plate to the sill or shelf.—Patent abandoned.

1000 F. SCHAFER, Golden-square. *Covers and clips for bottles.* Dated April 2, 1869.

A ring and a cup or cone of indiarubber, sponge, or porous material is fitted between rings secured to the top of a vessel or wine cooler. The cup has a series of radial cuts in it. When a bottle is inserted into the vessel it extends the opening in the rubber ring and forces down the flaps of the cone, thus preventing any escape of cooling properties. As the bottle is lifted, the sponge removes the water from the outside, and the flaps pass under the bottle to remove any drops which escape the ring. A ring of sponge is also placed on the outer rings, on which the bottom of the bottle can be drawn. A spring clip is placed over the neck of the bottle to prevent soiling the hands. It is composed of a ring and a series of tongues.—Patent completed.

1001 J. CRUTTENDEN and T. WELLS, Maidstone. *Mechanism for ballot voting.* Dated April 2, 1869.

This relates to certain arrangements and combinations of apparatus for receiving and registering votes by ballot, whereby only the number of balls corresponding to the number of persons to be elected may be employed. The apparatus consists of one set or sets of revolving doors or turnstiles, through which the voter passes into a portable chamber to record his vote, and then passes through another set or sets of revolving doors or turnstiles out of the chamber. These doors are connected by mechanism, either under the flooring or enclosed in suitable casing above, or by both means, so that the opening of one entrance door secures the closing of the exit door, and when the voter has passed into the chamber, the door by which he entered also becomes secured, and prevents his return except by the exit door. This is accomplished by fitting to the axles on which the doors revolve a plate or disc. Each of these plates or discs has studs or projections on it (preferably on the periphery), which come against the end of a swivel plate forked at each end and placed under the floor or cased above or both. As the entrance door is rotated, the forked end prevents its being opened beyond the required distance. At the same time, the stud on the opposite side of the disc pushes the corresponding end of the plate to one side by acting on the other end of the fork, the swivel plate moving on its centre. This movement causes the fork on the other end of the plate to engage and hold fast the disc of the other or exit door.—Patent completed.

1002 W. Y. CRAIG, Harecastle, Stoke-on-Trent, and S. P. BIDDER, jun., Mitcham. *Safety lamps.* Dated April 2, 1869.

This consists in securing the wire gauze or other casing of the lamp by means of a bolt, catch, pawl, or other similar fastening of iron or steel situated inside the lamp and held in its place by means of a spring. This bolt or catch, on the application of a magnet to the outside of the lamp, will be withdrawn by the attractive power of the magnet, so as to allow of the wire gauze or other casing being removed.—Patent completed.

1003 D. OSBORN, Great Berkhampstead. *Building with concrete.* Dated April 2, 1869.

To avoid the necessity of having to wait until the concrete is set before the building can be continued (after a height of wall equal to the depth of a panel has been set up), the inventor so constructs and arranges the fastenings which secure the panels to the uprights that he can set one panel above the other and secure it in position as shown, without first removing the lower panel. Also to prevent the necessity for pulling down from time to time (during the process of building) all the uprights or vertical supports, the inventor makes them of a moderate length, and adds length to length, relying on the attaching of the panels thereto to secure these lengths of uprights in position. The junctions of the panels and the vertical supports are arranged at different levels so as to break joint with one another.—Patent completed.

1004 S. K. HOXSIE, Philadelphia, U.S. *Boat elevators.* Dated April 2, 1869.

This consists in the combination and arrangement of an elevated platform with reservoirs and altitudinally movable tanks, which receive a supply of water therefrom, which causes them to descend. The tanks are connected with the platform by means of chains or wire ropes, which are supported by means of sheaves, which are elevated in order to raise a boat or other vessel. The latter is supported by the platform when at a proper height and angle for discharging its contents into another vessel or receptacles.—Patent completed.

1005 G. H. ELLIS, New Barnet. *Cleaning boots.* Dated April 3, 1869.

The inventor provides a neat base and pedestal or pillar suitable for standing upon a table, and into this pillar he disposes a vertical shaft having a pulley keyed thereon, with a groove which receives a cord or belt of indiarubber. He then places a horizontal shaft in a suitable bearing through the centre of the pillar, with a driving wheel and handle at the end made to act against the pulley and to drive it noiselessly by friction. Upon the other end of this shaft he disposes a brush, slightly concave upon its surface, and having a sponge or other pad fixed thereto, to receive and apply blacking to a boot held against it. This brush and pad are arranged to be easily taken on and off the shaft.—Patent abandoned.

1006 M. WOLFSKY, Pilgrim-street, E.C. *Locks for bags.* Dated April 3, 1869.

The plate is provided with a long slot down the centre, and is attached to the metal frame which is to be fixed to the bag or other receptacle. The plate has a key bolt working in the slot on its under side in connection with a catch bolt against which it works.—Patent completed.

1007 R. ALLAN, Kelvindale. *Paper machinery.* Dated April 3, 1869.

This consists essentially in dispensing with the woollen or felt jacket which is at present employed on the lower couch roll of paper making machinery, thus using the upper couch roll only covered. The rolls or rollers are preferably ground together, so as to ensure a practically perfect contact or complete joint throughout their length.—Patent completed.

1008 D. NICOLL, Caledonian-road. *Safe for food.* Dated April 3, 1869.

In constructing this safe the inventor prefers to line it with prepared bitumenised paper slabs or boards, whereby it is rendered perfectly air, gas, and water-tight. These chambers may also be made with enamelled sheet iron or any other clean and impervious substance. The opening or door is made to close up to an indiarubber washer. The exhauster, which is placed under the safe, is composed of a board having the same dimensions as the bottom of the safe. To the edges of this the inventor nails or attaches a piece of indiarubber or elastic cloth having a depth equal to the height of the preserving chamber or cupboard, and also nailed or otherwise fastened round the edges of the floor of the safe, and in this floor he has an opening communicating with the gas bag or exhauster.—Patent abandoned.

1009 E. WILSON, Peckham. *Velocipedes.* Dated April 3, 1869.

On the main or driving axle of the velocipede the inventor fixes by keys or other fastenings two ratchet wheels, and side by side therewith, but loose on the axle, are two pulleys. Each of these pulleys carries a pawl or catch, which is formed and arranged to take into the teeth of the adjacent ratchet wheel. Over each of the pulleys an endless belt, strap, or band is passed, which also proceeds over a small pulley at the front of the vehicle. To these straps are attached the stirrups in which the feet of the operator are inserted to propel the velocipede.—Patent abandoned.

1010 W. H. DOUGLAS, Stourbridge. *Jet ornaments.* Dated April 3, 1869.

This consists in ornamenting articles made of jet and vulcanite by sinking the surface to be ornamented and securing the gold leaf and enamel (such as lavender and white) thereto as required.—Patent abandoned.

1011 J. HOWDEN, Glasgow. *Preventing escape of heat from boilers, &c.* Dated April 3, 1869.

This consists in applying the plaster of Paris by surrounding the vessel or surface to be protected in some cases wholly or in part by an envelope of sheet iron, lead, wood, or other suitable material, placing the envelope at a distance apart from the surface equal to the thickness required for the non-conducting material. The plaster of Paris is then made up in its liquid state and run or poured into the space between the envelope and surface of the vessel until the space is filled. The plaster of Paris in a few minutes solidifies without the application of heat, and the envelope may either remain permanently or be removed after the space is filled.—Patent completed.

1012 U. SCOTT, North-street, Fitzroy-square. *Railway and other carriages.* Dated April 3, 1869.

First, the improvements consist in a new method of opening and closing the covered heads of carriages and the covered trucks for railways. Second, in making railway doors to slide in slots made in the pulleys of the carriage. Third, in making carriage locks. Fourth, in making lamp sockets for candles for keeping the candle in position.—Patent completed.

1013 W. E. BROAD, Wychdon. *Railway wheels.* Dated April 3, 1869.

This consists in an arrangement of a loose sheath or elongated bearing and axle whereby each wheel is allowed to rotate independently of its fellow.—Patent abandoned.

1014 G. F. GRIFFIN, Great George-street, Westminster. *Permanent way.* Dated April 3, 1869.

When using wooden sleepers the inventor makes them with one or more deep grooves cut longitudinally to receive the rails, and with suitable holes to receive bolts, which he terms Griffin's regulating bolts. In some cases he fastens thin hoop or angle iron upon the face or upper side on either side of the longitudinal groove or grooves and recesses, thin iron supports in the grooves at the joints and in other places.—Patent completed.

1015 D. J. HOARE, Princes-terrace, Bayswater. *Atmospheric railways.* Dated April 3, 1869.

The inventor employs a slot along the top of the tube, as has before been done, and forms the tube with a vertical flange on each side of the slot. In order to close over the slot airtight he employs a continuous length of vulcanised india-rubber, strengthened if desired with canvas or other material, and on the upper surface of the strip of india-rubber he fixes plates of metal in short lengths. A recess or groove is also made along the top of the inner side of each of the vertical flanges at the sides of the slot, which recess is deep enough for the india-rubber band and the metal plate fixed above it to lie in, so that the top of the metal plates may be level with or below the top of the flanges, whilst the band of india-rubber rests at its sides on the bottom of the recess. A thin band of iron or other metal not quite the width of the open part of the slot may run along under or over the india-rubber to take the strain or drag off it. To raise the band to allow air to pass into the tube immediately behind the piston, the inventor passes the band over a pulley, and to again close down the valve in rear of the piston he employs another pulley connected to or carried by the carriage. By this means a free supply of air is admitted directly on to the back of the piston, and the tube in rear of the piston is filled with air. Afterwards the valve is pressed down on to its seat, and so a perfectly airtight joint may be secured.—Patent completed.

1016 S. SHARROCK, Liverpool. *Roofs.* Dated April 3, 1869.

The beams rest upon the columns, and, supporting the roof, serve also as gutters. The covering for the roof is of corrugated iron, and forms an arch. It is fixed to angle irons on the upper flanges of the sides of the beams, which are suitably stiffened. The tie rods pass from the spring of the arch on one side to a corresponding point on the other side. They are attached to angle irons fixed to the sides of the beams, and bars connect the corrugated covering with the tie rods. Two, three, or more of these bars may be employed in connection with each tie rod.—Patent completed.

1017 F. BOYD, Boston, U.S.A. *Breech-loaders.* (A communication.) Dated April 3, 1869.

The patentee claims, first, a breech-piece having lips upon its upper part in combination with clamps attached to the barrels, and projecting backwards over the breech-piece. Second, two clamps, whether attached to the

barrels or breechpiece, in combination with two cam projections, on which they clamp, and with two barrels arranged to turn upon a suitable spindle, the whole arranged so that the barrels can be thrown to either the right or to the left. Third, the plate or washer attached to the spindle in combination with the raised or cam-shaped surfaces of the bearing plate. And, fourth, the barrels with metal plates at their rear ends in combination with the clamps when the latter are inserted and suitably secured in grooves in the former.—Patent completed.

1018 F. W. H. MEDHURST, Chancery-lane. *Lamps.* (A communication.) Dated April 3, 1869.

The inventor encloses the wick in a tube of suitable length, the lower end of which screws into the usual reservoir containing the liquid to be consumed, and into which the lower end of the wick is immersed. The upper end of the wick is flush with the top of the tube, which is enclosed in a second tube capable of sliding thereon. The upper end of this outer tube rises above the wick tube, and at its upper end is placed a plug or nipple of copper or other suitable material, which may be solid, but is preferably made hollow and closed at the top, the plug being filled with cotton.—Patent completed.

1019 J. G. TONGUE, Southampton-buildings, Chancery-lane. *Parasols.* (A communication.) Dated April 3, 1869.

The stick of the parasol or umbrella is of solid steel, and tempered so as to be strong and light. The stopping springs or catches are not set into a groove in the stick, and new arrangements of sliders are employed so formed that the lining of a parasol can be attached thereto without the stopping catches or springs being cramped in their action.—Patent abandoned.

1020 G. A. ERMEN, Eccles. *Breech-loaders and cartridges.* Dated April 5, 1869.

This consists in constructing the cartridge chamber of a box slightly tapered and of larger diameter than the remaining bore of the gun barrel. The difference in their diameters at their point of junction forms an angular shoulder of about 45deg., and against this the front part of the cartridge abuts when inserted therein preparatory to firing. A second improvement relating to the breech mechanism consists of a sliding wedged-shape block inserted in a slot formed by two plates or arms projecting from the rear of the gun barrel, their extremities being connected to the gun stock.—Patent completed.

1021 W. JOHNSON, Swansea. *Compressing combustible substances.* Dated April 5, 1869.

The machinery consists of a double-acting steam cylinder placed horizontally on a firm bed. The piston rod, which projects on both sides, carries at either end a plunger fitting and working accurately in a long bottomless tube, the upper part or cover of which is made moveable, and is so fitted that, by means of a self-adjusting weighted lever, the outer or delivery aperture of the tube can be either reduced or enlarged so as to regulate the resisting power of the tube to the compressing power of the plunger.—Patent completed.

1022 J. WOODS, J. HAMPSON, and I. and G. FISH, Preston. *Looms.* Dated April 5, 1869.

The troughs are bolted to the brackets, which are made to slide on to a rod, and may be set to any distance and position by set pins or screws. This rod is supported in its position by the brackets, which are bolted to springs which have steady pins against which to bear. On the rods, near the centre or in any convenient position, is fixed a fulcrum cranked bracket, set and regulated or altered by a set pin.—Patent completed.

1023 J. U. ASKHAM, Sheffield. *Anvils.* Dated April 5, 1869.

The inventor first prepares a model of the size and shape of the anvil to be produced. He then places it in a box formed of two or more parts, and covers it with composition. He then fills up the box with sand in the ordinary manner. After the model is removed and the sand perfectly dry (this being done in the usual way), he first pours in through a suitable opening the molten steel to form the face or table; then through the same or other convenient aperture (after the steel on the table is sufficiently cool) he pours in a very mild molten steel, which flows over the table and gives the requisite toughness and solidity to the steel "beck." After a proper time has elapsed, the inventor then pours in through another opening formed for the purpose the iron or metal, which also runs upon the steel and forms the lower part or butt of the anvil, and a perfect amalgamation takes place between the iron and steel. The casting being complete, it is then finished in the ordinary manner for castings.—Patent completed.

1024 J. FLETCHER, Heywood. *Firebars for furnaces.* Dated April 5, 1869.

The inventor prefers to use one central raised bar of the form of an ordinary ridging tile of an inverted V shape, perforated on both its sloping sides, either with or without a similar bar at each side of the furnace perforated on the inner sloping side only, or, if preferred, the transverse section of the central perforated firebar may be a semicircle, and that of the side bars a quadrant or arc of 90deg.—Patent completed.

1025 F. COMMASI, Rue du Colysee, Paris. *Motive power from flow of sea.* Dated April 5, 1869.

The apparatus employed for this purpose consists of a combination of reservoirs, culverts or conducting passages, and machinery, the action of which varies according as the tide is ebbing or flowing, and the description of which cannot here be attempted.—Patent completed.

1026 W. G. WHITE, Laurence Pountney-lane, E.C. *Safes.* Dated April 5, 1869.

In constructing the outer shell of a safe or strong room, the inventor forms it of a single piece of iron or steel, rolled or otherwise, made into a continuous hoop or circle or other convenient form of any required thickness and size in a similar manner to that in which the tyres of railway wheels are formed. This piece of iron is then, by means of hydraulic or other pressure, caused to take the required shape, and so form a depository or safe with the top, bottom, and two sides in one piece without any seam or joint, and the back end or part is closed by means of a piece of iron or steel riveted or otherwise attached to the back by means of angle iron or steel, or else to the edges of the body of the safe, which may be turned or flanged over for the purpose.—Patent completed.

1027 W. JONES and T. SHEFFIELD, Manchester. *Steam boilers.* Dated April 5, 1869.

This consists in constructing and arranging within the shell of a boiler a continuous spiral or curvilinear or other formed pipe that will be contained within a space of the boiler covered by the water. One end of this pipe has an opening in the back plate of a furnace, which may be contained within the boiler. The heat of the furnace and products of combustion enter the opening in the back plate formed by one end of the pipe, from whence they pass in a course through such pipe until what remains of the heat thus circulated through the water space of the boiler becomes finally ejected at the opposite extremity.—Patent abandoned.

1028 J. WINTER, jun., Wardour-street, Soho. *Filling and corking bottles.* Dated April 5, 1869.

The bottle or jar holder is formed hollow and steam-tight, with hollow recesses therein, say six, for example, of the same diameter and depth as the bodies of the bottles or jars which they are intended to receive. On the axis of this holder the inventor fixes a steam chamber open at the bottom and permanently closed at its top and sides, its ends being closed by spring doors, which open to allow the necks of the bottles to enter the steam chamber at one end and to pass out at the other end. These doors close immediately after each bottle or jar has entered and passed out of the steam chamber.—Patent abandoned.

1029 C. CAIRNS, New York, U.S.A. *Heating by steam.* Dated April 5, 1869.

This consists in applying a pump, or two or more pumps working one into the other, or separately, and introduced between the generation of the steam and the article to be heated, so that these pumps shall force the steam into a smaller space, and thereby increase the pressure and correspondingly elevate the temperature.—Patent completed.

1030 J. W. DRUMMOND, Schenectady, U.S.A. *Looms.* Dated April 5, 1869.

This relates to the weaving of fabrics by one or more continuously moving shuttles, which travel in one direction in a raceway along one side of the breast beam, having a long vertical mortice or slot down through which the woven fabric passes. Then the shuttle is carried in a semi-circular raceway around the end of that opening and back on the other side and around the semi-circular raceway at the other end, and so on. The fabric is woven double of two separate breadths, or in the form of a flat bag. The two pieces of fabric pass down through the mortice or slot, and the warps are led into the loom horizontally from opposite sides of the breast beam. The warps go through sectional reeds and through treadles arranged to be raised and lowered by slide motion, or by cams so as to weave plain twilled or other fabrics.—Patent abandoned.

1031 J. GREENSLADE, Steeple, Essex. *Traction engines.* Dated April 5, 1869.

These improvements are designed for rendering traction engines, more especially those travelling on common roads, well suited for ascending or descending steep inclines by mounting the boiler together with the engine so that it may be maintained in a horizontal position and thus keep the water always at the same level whatever may be the inclination of the framing, whereby the priming of the engine is prevented as well as injury to the fire box and tubes from excessive heat, such as is the case when the boiler is fixed to the framing in the usual manner.—Patent completed.

1032 J. STERRIKER, Great Driffield. *Expressing oils.* Dated April 5, 1869.

This refers to Letters Patent dated April 1, 1867. The inventor employs pressing plates having grooved surfaces and pressing boxes such as those described in the specification of the above-mentioned patent, and in order to provide for the plates being firmly held rotatively to each other during the pressing operation, and for obviating the tendency to lateral and longitudinal movement, he connects the plates by a special form of metallic hinge made by preference wholly or partly of steel.—Patent completed.

1033 G. T. BOUSFIELD, Brixton. *Manufacture of paper.* (A communication.) Dated April 6, 1869.

To prepare a composite sizing suitable for sizing fine writing paper, the following materials are used in the following proportions, viz.:—Sago flour, 700lb.; glue, 300lb.; nitric acid (commercial), 15lb.; aqua ammonia (commercial), 10lb.; carbolic acid (crystallised), 3oz.—Patent abandoned.

1034 G. T. BOUSFIELD, Brixton. *Shafts of carriages.* (A communication.) Dated April 6, 1869.

Tubes of metal, either rolled, drawn, or cast, are employed in the construction of shafts, poles, perches, and similar parts of carriages, and such shafts and other parts may be curved or made to any shape desired. The interior of the tubular shafts or other such like parts of carriages may be filled in with resin or with other light material, which may be run in a liquid state into the shaft, and which will afterwards solidify by cooling.—Patent abandoned.

1035 F. F. VILLIPIGUE, Northumberland-street, W.C. *Piercing rock.* Dated April 6, 1869.

These perforators or piercing machines are based upon the principle of a constant equilibrium between the motive force and the resistance offered, that is to say, that a self-acting and incessant equilibrium is established between the resisting forces and a regular and constant motive force applied by means of the handle or crank of the machine.—Patent abandoned.

1036 A. HELWIG, Old Kent-road. *Sewing machines.* Dated April 6, 1869.

This consists chiefly in giving to the needle of a single-thread machine a lateral to-and-fro motion transversely to the direction of the sewing, so that the needle descends alternately on the inside and outside of the edge of the hole. Also in the peculiar means employed for effecting this transverse to-and-fro movement of the needle, and in the combination of such means with the mechanism for giving to the needle the ordinary vertical reciprocating motion whereby the thread is carried through the work.—Patent completed.

1037 J. M. JOHNSON, Maida-hill. *Lavatories.* Dated April 6, 1869.

A shelf or slab, holding one or more basins or vessels placed in one or more rows, is mounted in a stand or framework in such a manner that it is supported in a state of rest when the washing, drinking, or other operation for which the apparatus is intended is going on; and it is capable of being tilted or swung in such a manner as to discharge the contents of all the vessels which it carries simultaneously.—Patent abandoned.

1038 E. O'BRIEN, Liverpool. *Beam balance.* Dated April 6, 1869.

This consists of a balance beam with arms of equal length, to one end of which is suspended the usual scale for carrying the ordinary weights, or a rod on which the weights are suspended, and on the other a box scale, divided into two equal parts by a vertical diaphragm. The bottom of each compartment is hopper shaped, having, by preference, three inclined sides and one vertical side, which latter is formed by the side of the diaphragm which divides the scale into two chambers.—Patent abandoned.

1039 R. B. HOOPER and T. and H. R. NICKSON, Liverpool. *Sheathing ships.* Dated April 6 1869.

This consists in fastening a wood sheathing to the sides and bottoms of iron and other ships or vessels, for the purpose of attaching copper, yellow metal, zinc, or other sheathing thereto, in such a manner as to prevent the latter from, by any possibility, coming into contact or connection with the hull of the vessel, or the bolts which fasten the wood sheathing to which it is attached. The invention also relates to a peculiar form of rivet or bolt used for the purpose of attaching the wood sheathing to the hulls of vessels.—Patent completed.

1040 A. V. NEWTON, Chancery-lane. *Baking oven.* (A communication.) Dated April 6, 1869.

The inventor claims the rotating disc or hearth mounted and operated in the peculiar manner described. Also the crown plate, in combination with the firegrates, covers, flues, regulating damper, flue or chimney, and ash boxes, the whole constructed and arranged substantially as set forth in his specification.—Patent completed.

1041 A. K. B. GRANVILLE, Sandford-on-Thames. *Beating engines.* Dated April 6, 1869.

The inventor substitutes a second roller for the stationary plate. This roller revolves whilst at work, and the reduction of the rag or material is effected by the opposing blades of the two rollers. He sets the cutting blades spirally around the roller, by which means the action of the machine is improved.—Patent abandoned.

1042 W. GOODREDS, Tipton. *Puddling furnace doors.* Dated April 7, 1869.

This consists substantially in introducing and preserving a current of water through the furnace door. The inlet of the water is at the top of the door, from whence it is carried round the stopper hole to the outlet. The water may be carried by any convenient means, but by preference gas tubing of a suitable size and kind is employed.—Patent completed.

1043 J. MASON, Birmingham. *Breech-loaders.* Dated April 7, 1869.

The breech block, according to this invention, is caused to work upon a pin and open in a lateral direction. There is affixed to the pin a short lever, which acts upon a prong which is immediately connected with the extractor, and forms part of it.—Patent abandoned.

1044 W. T. RICKARD, Crown-court, Threadneedle-street. *Cements.* Dated April 7, 1869.

Instead of using drying oil or oils, silicate of potash or soda, or other alkaline silicate, is employed, in combination with the usual solid ingredients. The aqueous portion of the silicate combines with these ingredients, which have a chemical affinity for water, and thereby solidifies them.—Patent abandoned.

1045 R. NORFOLK, Beverley. *Casting screw threads.* Dated April 7, 1869.

The inventor prefers to make use of a core box of the shape required to form one half of the screw. The core-box consists of a bed piece in which a loose rim fits. A screw thread corresponding to that to be produced on the casting is cut on a piece of brass or other metal forming the centre of the core-box, and the sand is rammed in the space between the screw-piece and the loose rim. The parts of the core-box are secured together by pins and cotters or other equivalents, and when the core is removed from the core-box it is dried previously to being placed in the moulding box.—Patent completed.

1046 D. S. CHASE, Belfast. *Combustion of gas.* Dated April 7, 1869.

This consists in the use of a thin vertical bar or plate of solid or hollow steel or other metallic substance placed on edge across the upper surface of the burner and at right angles to a line intersecting the perforations of the burner. The vertical bar or plate may be made to rise above the burner in a rectangular, circular, semicircular, tapering, or other form, and it may be perforated.—Patent completed.

1047 E. COLLARD, Southampton-row, W.C. *Dress improvers.* (A communication.) Dated April 7, 1869.

The object is to improve ladies' dresses by a bustle (or dress improver) which can be expanded or made narrower according to the size required by means of steel springs or whalebones fastened at the right and left angles, an opening being left in the centre of the tube in which the springs are moving.—Patent abandoned.

1048 W. E. GEDGE, Wellington-street, Strand, W.C. *Aerospires.* (A communication.) Dated April 7, 1869.

This apparatus is usually composed of two tubes joined at a right angle and communicating with each other by the opening. In the thickness of one of the pipes, which is horizontal, and towards the joint, is a third conduit placed horizontally, shaped like a truncated cone, and the large opening of which is set and riveted to the edge of one end of the horizontal tube. The opposite opening is of about one third the diameter of the other. Another tube fitting to the lower part of the second tube supports the pivot and permits the rest of the apparatus to revolve on its axis as a weathercock, or to stop according to the direction given to it by the crest, that is to say, always presenting to the wind the large opening of the conical tube.—Patent completed.

1049 H. B. BARLOW, Manchester. *Expanding caskets.* (A communication.) Dated April 7, 1869.

To the base plate are attached two side compartments, between which is a drawer opening from both sides and secured by a spring and pin. Above these are four small inner compartments hinged to the partition which supports an upper central compartment to which two other side compartments are hinged. There are also two more side compartments hinged outside the four small inner compartments. The whole is surmounted by a cover which can be closed so as to secure all the compartments by one lock and key or a padlock.—Patent abandoned.

1050 W. R. LAKE, Southampton-buildings. *Permanent way.* (A communication.) Dated April 7, 1869.
The inventor prefers to use a rail whose upper flange or bearing surface is of the ordinary width or nearly so, while its lower flange is considerably smaller than the upper flange, being only of such dimensions as are necessary to give the required strength to the rail, whereas the metal in the flange of an ordinary double-headed rail is much more than is required merely for the purpose of strength.—Patent abandoned.

1051 J. and J. MENZIES, Perth, N.B. *Shuttles.* Dated April 7, 1869.
This relates to side tipped shuttles, and consists in so constructing their ends that they are prevented from splitting. This is effected by forming recesses in that part of the ends of the shuttles wherein the tip and driving pin are fixed. The recesses may be of various forms, and surrounding the shanks or stems of the tips and driving plates by which these are inserted into and retained in the shuttle. Into the recess a loop of wire is placed so as to fill them, thereby strengthening the shuttle against splitting. In pirn shuttles, whether side tipped or centre tipped, the part whereon the skewer or tongue is fixed is also strengthened by inserting a ring or loop of wire into a recess formed in the wood surrounding it.—Patent completed.

1052 J. H. TEALE, Leeds. *Putting on boots.* Dated April 7, 1869.
This consists in constructing an apparatus having a metallic or wooden foundation or bottom of any suitable form or dimensions. On this foundation or bottom two upright standards or brackets of metal are fixed, the hinder one of which has a forked lever attached to it for the purpose of holding the boot or shoe in position for putting on or taking off. From these brackets or standards two or more pegs protrude for the purpose of being inserted into the straps at the back and front of the boot or shoe to hold the boot or shoe in a position for being put on or taken off.—Patent abandoned.

1053 B. M'EVOY, Birmingham. *New game.* Dated April 7, 1869.
This new game is played principally by means of an appliance which consists of a frame upon which two arches are supported, and which is fixed into the turf or ground by means of spikes which are attached thereto.—Patent abandoned.

1054 J. ROBBINS and J. ALLBUT, Tipton. *Pumps.* Dated April 7, 1869.
The inventors use two vertical pump cylinders and solid plungers, working through stuffing boxes at the tops thereof. The lower ends of these pump cylinders are connected with the fore ends of two short horizontal cylinders respectively, the axis of the horizontal cylinders being in the same line. Pistons in the horizontal cylinders are connected to the opposite ends of the same piston rod, so that when the piston in one of the horizontal cylinders is making its advance stroke, the piston in the other horizontal cylinder is making its return stroke. The pistons have no valves, and the suction pipes, having valves opening upwards as usual, are connected to the rear ends of the horizontal cylinders respectively.—Patent completed.

1055 W. POWELL, Birmingham. *Breechloaders.* Dated April 7, 1869.
This relates to that class of breechloaders called drop-down guns. Underneath the lever by which the barrels are fastened and unfastened is a forked slide, consisting of three parallel bars, a middle bar, and two outer bars, the three bars being connected together at their rear ends by a cross bar. The ends of the outer bars of the forked slide are turned outwards at right angles, and engage in slots made in the sides of the strikers. The forked slide works in a recess in the rear of the body of the gun, and the top end of the spring, which acts upon the opening and closing lever, engages in a slot in the middle bar of the said forked slide. When the lever is raised to unfasten the barrel it forces the spring and forked slide back, the latter withdrawing the striker into the body of the gun. On shutting down and fastening the barrels, the forked slide advances by the action of the spring, but does not carry the strikers forward with it owing to the length of the slots in the strikers, in which the ends of the outer bars of the said forked slide engage. Thus, the unfastening of the barrels withdraws the strikers and leaves them in position to be driven forward by the hammers for the discharge of the gun.—Patent completed.

1056 W. H. DOUGLAS, High-street, Stourbridge. *Glove fastener.* Dated April 7, 1869.
In the centre of the under side of a stud or button the inventor makes a screw hole for receiving the eye or fastener, which consists of a screw with a small plate, of a circular or other suitable form at the bottom, provided with a boss or projection in the centre, in which is an undercut hollow or sink forming the eye of the fastener. —Patent abandoned.

1057 W. H. DOUGLAS, High-street, Stourbridge. *Sleeve links.* Dated April 7, 1869.
This consists of the ordinary flat button, on the back of which the inventor fixes a plate, furnished with a sort of double hook somewhat in the form of one end of the double hook is attached to the plate and the other end is free. Instead of the double hook forming part of or being attached to a plate, as above described, it may in some cases be fixed direct to the solitaire itself.—Patent abandoned.

1058 G. ASHCROFT, Alexandria, Egypt. *Hydraulic presses.* Dated April 7, 1869.
The inventor constructs a cylinder, and in that cylinder a piston, made to work along its length water-tight under considerable pressure. Attached to this piston is a rod or plunger, which fits the neck of a second smaller cylinder, so placed on a common axis as that the piston with its rod moves up and down through their respective cylinders freely.—Patent abandoned.

1059 W. H. BALMAIN, St. Helens. *Oxidising agents.* Dated April 7, 1869.
The inventor avails himself of the fact that manganic acid, whether in combination with a base in the form of a manganate, or just set free, will rapidly and readily absorb oxygen, whether alone or as it exists in the air, or as it might be mixed with other gases and produce permanganic acid, or a permanganate which will yield up readily to any substance capable of combining with it a portion of its oxygen, and return to the state of manganate, which again on its part is ready to reabsorb oxygen and reproduce permanganate.—Patent abandoned.

1060 L. MOND, Farnworth. *Utilising waste soda.* Dated April 7, 1869.
This relates to the utilisation of the residue which is obtained from soda and potash wastes after these substances have been oxidised and lixiviated for the separation of sulphur and sulphur compounds as now commonly practised. For this purpose it is proposed to use the residue in the manufacture of soda and potash in the process called balling, by substituting it for a portion of the limestone or other such substance usually employed.—Patent completed.

1061 W. E. NEWTON, Chancery-lane. *Steam generators.* (A communication.) Dated April 7, 1869.
The invention consists, first, in arranging the tubes and their square or parallelogrammic heads so that the fire is restrained from passing directly upwards between the tubes, and a more tortuous or effective action of the heated gaseous products of combustion is secured thereon. The heads of the several tubes are also made to break joint, and spaces are left round the margin or margins of the combined heads to facilitate the scraping or cleaning of the exterior surfaces of the tubes. Second, the invention consists in a combination with the tubes (arranged as described with their heads or ends) of return pipes or bends, not only to connect each tube with the one immediately above and below it at both or opposite ends of the boiler, but arranged to occupy an oblique or diagonal position, whereby increased facility is afforded for contraction and expansion without breakage of the joints. Third the invention consists in a combination with a boiler of a lower drum arranged on the outside of end bearing or support to the boiler, and connected with the lower tier of main tubes for the collection of mud or sediment outside of or beyond the fire chamber, whereby facility is afforded for detaching the drum when necessary either for cleaning or repair.—Patent completed.

1062 W. T. ELEY, Gray's Inn-road. *Cartridge cases.* Dated April 7, 1869.
The inventor forms a fold or ridge in the metal for the metallic coil of a cartridge case at a suitable distance from one of the edges. He then coils the metal with a fold or edge lengthwise of the coil, and afterwards turns the folded part or edge over upon the edge of the overlapping part of the coil.—Patent abandoned.

1063 C. E. H. C. HEALEY, Strand. *Cleaning breech-loaders.* Dated April 7, 1869.
The inventor makes use of a brush or scrubber, or jag, or their equivalent, which brush or its equivalent is moved to and fro within the barrel by means of an endless band, cord, chain, or wire passing over pulleys or rollers, or suitable substitutes at the muzzle and breech of the fire-arm to be cleaned, the band, cord, or chain being secured to the brush or jag.—Patent abandoned.

1064 J. W. WARMAN, Farringdon. *Organ key boards.* Dated April 8, 1869.
This consists in giving the key a bayonet-like form, the finger portion being the higher; the thumper bar thus resting on the body portion just behind the finger portion will rise no higher than the latter, and consequently be clear of the pin rail of the next manual above. The keys of the topmost manual of a set may be of the usual straight form.—Patent abandoned.

1065 J. I. STASSEN, Euston-road. *Velocipedes.* Dated April 8, 1869.
The inventor steers the velocipede by the hind or rear wheel or wheels. The front or driving wheel, the shaft of which carries the ordinary cranks, is supported and free to revolve in bearings formed in the apex of a frame, by preference somewhat of a bell crank shape. The upright rods of this frame embrace the wheel and are united at top by a pin and bolts. Through the pin uniting the frame a vertical rod passes, carrying the steering handle. The lower end of this rod is joined to a yoke, to which rods extending to the forked frame carrying the rear wheel are attached.—Patent abandoned.

1066 A. H. BRANDON, Paris. *Composition for joining leather.* (A communication.) Dated April 8, 1869.
This consists in mixing certain gums or resins, more particularly amber, gum, elemi Venice, turpentine, copal mastic, and lac, in various proportions by aid of the sulphide or bisulphide of carbon or other suitable solvent of gutta percha or caoutchouc.—Patent abandoned.

1067 H. PARSLOW, Glasgow. *Shaping apparel.* Dated April 8, 1869.
This relates to the form and arrangement of models or templates, which are so shaped that on applying them to the cloth or fabric from which the article of apparel is to be made, and by drawing the outline formed by the edges of the model upon the cloth or fabric (the body of the person being beforehand measured), the shape of the various parts is at once obtained, which ensures a perfect fit of the article of apparel when the parts of which it is to be composed are put together.—Patent abandoned.

1068 A. STEWART and J. WOTHERSPOON, Coatbridge, N.B. *Cutting metal tubes.* Dated April 8, 1869.
The improved machinery comprises various parts mounted upon a cast-iron bench or bed frame, and is provided with adjustable holds to fix the article to be operated upon. The cutting tools are disposed radially on a revolving head or chuck, being fed inwards automatically in a gradual and continuous manner as the action proceeds. The toolholders are fitted into radial guides upon the chuck face, and are moved inwards or towards the centre by radial screws, carried by the chuck and having bevel pinions on their outer ends in gear with a bevelled ring or wheel carried loosely on the revolving chuck and made to turn at a slightly slower or quicker rate than the chuck by the driving details shown and hereinafter described, or by any other suitable gearing.—Patent completed.

1069 R. W. MUNRO, Clerkenwell-green. *Whist markers.* Dated April 8, 1869.
The whist marker is a suitable dial on which are printed, engraved, or otherwise indicated any given number of figures or signs according to the requirements of the game for which it is to be used, and the marker is so arranged that only one number or other sign shall be caused to appear through a hole formed in a suitable case at any given time.—Patent abandoned.

1070 J. PATTINSON, Newcastle-on-Tyne. *Utilising ammonia wastes.* Dated April 8, 1869.
The inventor reduces the waste or skimmings to powder, and mixes with it sufficient powdered lime or other suitable alkaline earth to decompose the chloride of zinc, oxychloride of zinc, and chloride of ammonium existing in the "skimmings." As the "skimmings" are of variable composition it is necessary first to ascertain the amount of chlorine contained in that to be brought under treatment in order to determine what proportion of lime or other alkaline earth is required for the decomposition of the chlorides and oxychloride. For every 35 parts of chlorine contained therein about 28 parts of unslaked lime or about 37 parts of slaked lime or an equivalent quantity of other alkaline earth should be provided and mixed with the "skimmings." A suitable charge of this mixture is put into a retort or into a furnace and heat applied thereto so as to decompose the chloride of zinc, oxychloride of zinc, and chloride of ammonium before mentioned.—Patent completed.

1071 D. and G. HALLAS, Leeds. *Regulating and purifying gas.* Dated April 8, 1869.
The inventors use a tap or cock of peculiar construction. On the face of the centre part (within which the cock turns) they place an index, marked at given intervals to denote that when the handle of the cock is severally opposite to them, gas for the various number of lights which they denote is being passed through. The rotating part of the cock itself is made hollow, and pierced at its circumference with holes of varying size, so regulated that each is capable of supplying a given number of lights and no more, and the gas is emitted into the supply pipe. —Patent completed.

1072 J. A. CHAUFOURIER, Paris. *Self-feeding cotton gin.* Dated April 8, 1869.
This improved gin is composed of a framing carrying the principal parts, consisting, first, of two ginning rollers of small diameter, between which the lap of cotton passes deprived of the seeds, which are discharged without being crushed. Second, of two drawing rollers placed immediately behind the ginning rollers, and serving to draw out the lap of cotton after it has been deprived of the seeds. Third, of two cleaning rollers with flexible casings, which are kept in constant contact with the drawing rollers for the purpose of cleaning the same, and at the same time preventing the lap of cotton from coiling round said rollers. Fourth, of an endless web travelling over rollers within a receptacle, and furnished with inclined card teeth, by the aid of which the cotton is fed in a continuous manner to the ginning rollers.—Patent completed.

1073 A. FRYER, Manchester. *Producing sugar.* Dated April 8, 1869.
The inventor constructs a truck, which he prefers to make entirely of metal, and which is usually furnished with only two wheels keyed fast upon their common axle. This axle projects through the wheels on each side, and at each end of it is placed a bracket resting in a bearing upon it, and hanging down nearly to the lowest part of the circumference of the wheel. Each of these brackets terminates on the outer side in a flange or step, which he prolongs in such a manner that by slightly inclining the bracket its edge comes in contact with the ground. When in position he is enabled to draw the wheels of the cart containing the canes or beetroot on to these flanges, where, when the brackets are again brought to a vertical position, they rest, and the carts thus freed from the ground and resting on the trucks are drawn along the tramway. Several of these carts are usually formed into a train, the fore part of the one being supported by the hinder part of the adjoining one.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated October 19, 1869.

3042 J. and J. Kippax, Bolton-le-Moors, Lancashire. Improvements in the method of weaving counterpanes or quilts, applicable in part to the weaving of some other goods or articles.

3043 M. Henry, Fleet-street, City. Improvements in the construction of bridges, and in apparatus for the purpose.

3044 A. Forder, Wolverhampton. Improvements in the seats or saddles of velocipedes and manumotive carriages used either on land or water.

3045 A. Evans, Grimsbury, Northamptonshire. An improved method of joining or connecting pipes and tubes.

3046 W. B. Robins, Richmond-terrace, Shepherd's Bush, Middlesex. Improvements in syringes and other apparatus for throwing water, for watering plants, and similar purposes.

3047 A. Clegg, Finsbury-place, Middlesex. Improvements in sewing machines.

3048 J. H. Johnson, Lincoln's Inn-fields. Improvements in heating, and in apparatus employed therein.

3049 F. R. Window, Baker-street, Portman-square, Middlesex. An improved process for producing photographs in pigments.

Dated October 20, 1869.

3050 J. Hudson, Fleetwood, Lancashire. Improvements in machinery for opening and closing the gates of railway crossings.

3051 D. Jackson and J. Riley, Oldham, Lancashire, and G. R. Ray, Dukinfield, Cheshire. Improvements in machinery for cutting, shaping, and dressing stone.

3052 W. R. Thomson, Glasgow. Improvements in locks, latches, or bolts for fastening the doors of railway carriages, which improvements are also applicable to other purposes.

3053 A. Munro, Arbroath, Forfarshire, and W. B. Adamson, Glasgow. Improvements in cutlery, edge tools, agricultural and other implements.

3054 J. Scharr, Leeds. Improvements in the manufacture of liquid soap.

3055 B. Sulman and R. Willis, City-road, Middlesex. A quadrantal-action-lever stamping and cancelling press.

3056 W. Heywood, St. Paul's-street, Huddersfield, and J. Bottomley, Kirkgate, Huddersfield. Improvements in carriages.

3057 J. F. Crease, Eastney, Southampton. An improved method of attaching Roman, Portland, or other like cements to iron or other substances.

3058 A. Brady, Maryland Point, Stratford, Essex. Improvements in purifying iron or any other metal.

3059 W. Firth, Rose Villa, Viewforth, Edinburgh. Improvements in the wheels of traction carriages for use on common roads and tramways.

3060 J. Howard and E. T. Bousfield, Bedford. Improvements in the construction of steam boilers.

3061 W. E. Newton, Chancery-lane. An improved mode of, or process for, preserving animal or vegetable substances from decay.

3062 H. Percival, Sunderland, Durham. Improvements in glass furnaces.

Dated October 21, 1869.

3063 S. H. Musgrave, Camden-road, Camden Town. The manufacture of needle and other cases from opaque glass tubing of various colours, fitted with a peculiar metal spring slide, scoop, and cap in one.

3064 H. Brooks, Cumberland Market, Regent's Park. An improved metallic cap or cover to glass or other bottles or vessels.

3065 J. Becker, Rue de Penthievre, Paris. An improved apparatus for stopping bottles.

3066 G. M. Ashforth, Market Overton, and W. Hardy, Thistleton, Rutlandshire. Improvements in obtaining and applying motive power applicable to working sewing machines and other useful purposes.

3067 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in rotary blowing engines.

3068 G. Clark, Southwell House, Lower Heath, Hampstead. Improvements in hansom cabs.

3069 G. Dauzats, Boulevard Bonne Nouvelle, Paris. Coloured or illustrated dominoes with central number.

3070 J. Buchanan, Gateshead-on-Tyne. Improvements in apparatus for coiling electric telegraph cables or ropes.

3071 F. Jenkin, Fittis Row, Edinburgh. Improvements n bridges.

3072 A. M. Clark, Chancery-lane. Improvements in hinges and hinge guards for railway carrriage and other doors, part of which improvements is applicable for warming and ventilating railway carriages.

Dated October 22, 1869.

3073 R. J. Goodbody, Charleville-square, Tullamore, King's County, and R. E. Donovan, Ashgrove House, Upper Rathmines, Dublin. A new or improved apparatus for roasting tobacco for snuff, also applicable for roasting, baking, burning, or drying coffee, malt, and other granular, pulverous, and vegetable substances.

3074 T. Gibb and C. Gelstharp, Jarrow-on-Tyne, Durham. Improvements in the construction of furnaces for calcining ores and other substances, and in the method of working the same.

3075 H A. Bonneville, Sackville-street, Piccadilly. Improvements in sewing machines.

3076 J. R. Grayson, Princes-square, Bayswater. Improvements in apparatus for clipping or shearing horses and other animals.

3077 C. E. Fuller, Sambrook-court, Basinghall-street, City. Improvements in machines for manufacturing brushes.

3078 J. Rignall, Bury St. Edmunds, Suffolk. Improvements in reaping machines.

3079 W. J. Rivington, Clerkenwell, Middlesex. Improvements in counting and registering apparatus.

Dated October 23, 1869.

3080 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved manufacture of metallic tiles or slates for roofing.

3081 C. A. Ofverberg, Finsbury, Middlesex. Improvements in filters and filtering apparatus.

3082 F. Woodward, Worcester. Improvements in apparatus for signalling and communicating on railway trains.

3083 J. and J. Cash, Coventry. Improvements in boxes or cases for preserving letters, papers, and other documents.

3084 R. Scott and W. M'Ivor, Addiewell, Mid Lothian. A process whereby the sulphuric acid residues produced in the refining of oleaginous and bituminous matters may be utilised and employed for the production of sulphate of soda and sulphide of sodium and black ash.

3085 F. S. Anderson, Cannon-street, City. Improvements in obtaining fuel and light from water.

3086 T. Deichmann, Chester-street, Belgrave-square. Improvements in preserving meat.

3087 T. Hydes and J. and J. E. Bennett, Sheffield. Improvements in propelling ships and other navigable vessels.

3088 A. B. Ibbotson and T. S. Sarney, Sheffield. Improvements in metallic keys or wedges for supporting and securing railway rails in their chairs, and a method of manufacturing such keys or wedges.

3089 T. Bevington and S. Courtauld, Spa-road. Bermondsey, and J. A. Norberg, Almorah-road, Islington. Improvements in machinery for breaking stone and ore, part of which improvements are applicable to hammers and pile-driving machines and other machines in which weights have to be raised and suddenly dropped.

3090 L. Meurin, Mount-street, Berkeley-square. Improvements in clocks and other instruments for measuring time.

Dated October 25, 1869.

3091 P. Walker, Bewsey New Hall, near Warrington, Lancashire. Improvements in means for rendering coal mines less injurious to those employed therein.

3092 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in sewing machine needles.

3093 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the manufacture of dry white lead and white lead pigment from metallic lead.

3094 W. W. Ladelle, Wraysbury, Buckinghamshire. Improvements in bleaching.

3095 J. H. Johnson, Lincoln's Inn-fields. An improved adhesive compound, and its application to stamps, labels, wrappers, envelopes, and other like articles.

3096 G. Ireland, Handsworth, Staffordshire. Improvements in nut-crackers.

3097 J. Edge, Madeley, Salop. Improvements in flat wire rope.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," October 25, 1869.

1818 J. Taylor
1834 J. Lindley
1842 H. Tylor
1860 W. R. Lake
1863 J. Harding
1875 J. Napier
1876 G. Molland
1879 W. R. Lake
1888 J. B. Brooks and G. Picken
1891 S. Nicholls
1893 M. Olsson
1895 A. J. Glas
1898 P. G. B. Westmacott
1902 C. D. Abel
1911 W. R. Lake
1915 W. Spence
1918 A. J. Deblon
1927 J. Macintosh
1936 H. Caro, C. Graebe, and C. Liebermann
2002 W. R. Lake
2007 J. Steward
2026 W. E. Newton
2050 W. E. Newton
2053 W. R. Lake
2133 B. J. B. Mills
2137 J. T. A. Mallet
2215 A. M. Clark
2232 R. Boyd
2238 W. Lincolne and E. Chafer
2280 A. M. Clark
2354 W. R. Lake
2355 W. R. Lake
2458 J. H. Johnson
2564 R. J. Westley
2656 W. T. Lillicrap
2683 M. Grouse
2705 J. H. Johnson
2763 R. C. Wallace and D. Crawford
2806 E. O'Brien
2888 H. Howard-Keeling
2893 T. Adams
2897 S. Farron
2902 H. and A. Holmes
2908 W. H. Horsley
2914 J. C. Ramsden
2922 G. W. Hawksley and M. Wild
2924 T. Rice
2943 E. H. C. Monckton
2944 E. H. C. Monckton
2946 W. C. May
2997 N. Washburn
3025 J. Player
3028 J. M. A. Stroh

LIST OF SEALED PATENTS.

Sealed October 22, 1869.

1265 R. Foster
1270 P. Jensen
1274 J. Cudhird
1280 G. White
1286 J. Smith
1290 S. Oakman
1296 The Hon. R. Flower and M. M. Crowly
1298 J. H. Sams
1324 O. Rose
1332 F. Bujeaud
1337 R. Craig
1458 P. W. Flower, H. Nash, and R. Heathfield
1493 L. A. V. Dubourg
1563 M. Jarvis and E. Millward
1883 S. Holmes
2259 T. Winter
2263 E. Attenborough
2507 T. Whitehead

Sealed October 26, 1869.

921 J. Macintosh
1293 W. R. Lake
1304 O. Moseley
1308 G. Heyes and E. Barlow
1313 E. Cooper
1318 D. Greig, R. Burton, J. Gozney, and T. Atkinson
1322 M. Wilkin and J. Clark
1336 H. J. Seels
1371 A. and E. Fau
1472 C. Ferguson
1500 R. Wilson
1674 C. E. Brooman
1564 T. Herbert and J. C Fowler
1678 W. E. Newton
1944 J. Lomax
1970 W. E. Gedge
1997 S. Brooke
2106 J. Piret
2303 F. Jackson
2333 F. C. Colney
2397 H. Bessemer
2425 J. Lewis
2457 R. F. Fairlie
2527 T. Coley
2536 H. Yates
2570 H. E. Newton

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2410 G. and E. Ashworth
2726 A. V. Newton
2740 G. Haseltine
2754 B. J. B. Mills
2763 J. Storer
2767 G. F. L. Meakin
2796 P. Adie
2856 J. Chubb and W. H. Chalk
3022 T. W. Webley

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2821 J. Clark
2824 J. B. Payne
2842 J. Spence
2877 W. Clark
2853 A. Chaplin and G Russell
2891 J. J. Ridge

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

1994	2912	2918	2924	2932	2938	2946	2952
2394	2914	2920	2928	2936	2940	2950	2954
2706	2916	2922					

LIST OF SPECIFICATIONS PUBLISHED

For the week ending October 23, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
528	0 10	677	0 8	717	1 4	776	0 4	796	0 4	819	0 6
619	2 0	678	0 8	718	1 2	777	0 4	800	0 4	824	0 4
620	0 10	680	0 8	724	1 2	778	1 0	801	0 4	825	0 4
626	2 6	684	1 0	727	0 6	781	0 4	807	0 4	826	0 4
629	2 4	687	0 10	729	1 4	782	0 4	808	0 4	829	0 4
634	0 10	690	0 8	740	1 2	785	0 4	810	0 4	830	0 4
644	0 8	693	0 8	746	0 10	786	0 4	811	0 4	833	0 4
645	0 8	694	0 8	749	0 10	787	0 4	813	0 4	839	0 4
646	0 8	695	0 6	759	0 8	788	0 4	814	0 4	842	0 4
651	0 8	698	1 2	767	0 8	790	0 4	815	0 4	846	0 4
660	0 10	704	0 10	773	0 10	792	0 4	816	0 4	889	2 10
670	0 8	707	0 8	775	0 4	793	0 4	817	0 4	1197	0 10
674	0 8	712	0 10								

Notice.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to Robertson, Brooman, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 5, 1869.

THE NEW BLACKFRIARS BRIDGE.

TO-MORROW will witness the inauguration by Her Majesty of two of the most important metropolitan improvements of the present day. These are the new Bridge at Blackfriars and the Holborn Valley Viaduct. It is our purpose now to describe the former of these works; particulars of the latter will be found in the succeeding article.

Just one hundred years ago—in 1769—the first bridge at Blackfriars was completed, from the designs of Mr. Robert Mylne, the works having been commenced in 1760, and the designs having been selected from twenty others sent in competition to the corporation of the city. As of the past we remember it as the third of our metropolitan bridges—London and Westminster Bridges being respectively the first and second—and a fine piece of masonry it was. The arches were elliptical in shape, and were the first instances in England in which the form of the ellipse was substituted for that of a segment of a circle in a bridge. The total cost of the bridge itself, irrespective of the approaches, was £152,840. The introduction of the ellipse was considered an innovation, and gave rise at the time to a lively controversy, in which Dr. Johnson took an active part in opposition to Mr. Mylne, and in support of his friend Gwyn, who had a competing design. Succeeding engineers, however, have widely endorsed Mylne's principle, and with the utmost success in the construction of bridges with very flat gradients upon arches of very elegant contour. But Mylne's bridge had a radical defect which shortened its existence most materially, and this lay in the foundations, which, giving way, were gradually letting down the whole superstructure. As long as patching, propping, and lightening the roadway could keep the bridge together, it was resorted to, but when it became clearly manifest that there was a beginning of the end, then it was determined to have a new bridge. The old bridge was closed in June, 1864, when the work of demolishing the superstructure was commenced, and was continued for about eighteen months. In January, 1866, the works of the present elegant structure were commenced, from the designs of Mr. Joseph Cubitt, with whom is associated as joint engineer Mr. Henry Carr, Messrs. A. and P. Thorn being the contractors, and their engineer being Mr. F. W. Bryant, the present president of the Society of Engineers. Mr. Penrice has watched the work on behalf of Messrs. Cubitt and Carr.

The work of construction has been longer and more tedious than was anticipated, owing to the unforeseen difficulties encountered in removing the piers and foundations of the old bridge, which were of a very substantial character, although they were not carried sufficiently deep to ensure stability. Upon the works of demolition and reconstruction we need not here dwell, having paid occasional visits to the works, and having given our readers the benefit of our observations from time to time in reports of progress. These reports have also embodied the chief engineering features of the new bridge, so that we need now only describe it in general terms as it stands in its finished state. The structure is a wrought-iron rib bridge, each arch being composed of nine ribs, the contour of the ribs presenting a flat segmental curve. There are five arches, as will be seen from the engraving on page 334 of our present issue, which shows the bridge in elevation Two of the arches are of 155ft. span each, two of 175ft., and one—the centre arch—of 185ft. The height of the centre arch from high water level is 25ft., of the two next side arches 21ft. 6in., and of the two shore arches 17ft. The height of rise in the centre arch is 17ft., and in the others 16ft. and 12ft. respectively. The ribs are placed 9ft. 6in. apart; they are 3ft. 10in. deep at the crown of the arch, and 4ft. 7in. deep at the springing. The ribs are braced together at intervals of 17ft. Over them are laid the bearers, to which are bolted Mallet's buckled plates, upon which is a layer of asphalte 1in. thick. Over this again is a layer of broken stones and asphalte about 10in. deep, upon which is finally laid the granite pitching which forms the roadway. The total length of the bridge is 1,272ft.; its width, including the roadway of 45ft., and two footpaths of 15ft. each, is 75ft. The gradient is 1 in 40, less than half that of the old structure, which was 1 in 22. A row of handsome lamps is placed along each pathway, a little back from the kerb—a plan not adopted on any other of the Thames bridges; and they are so arranged as to facilitate the navigation after dark. The balustrade is Venetian-Gothic in design, which, in fact, is the style of the bridge generally. It is a perforated balustrade, arranged in panels of plain and twisted columns, and presents a very elegant appearance. Over the piers are granite recesses, having seats capable of holding about a dozen persons.

The bridge presents a very elegant appearance from the river, from which point of view its fine arches and piers are seen to excellent effect. Externally the piers are of grey granite; internally they are of brickwork built solid. The foundations of these piers are laid deep in the hard London clay. The method adopted was to sink a number of iron caissons 36ft. in length by 18ft. in breadth, which were forced down through the bed of the river until they became fixed. Four of these caissons placed side by side, with slight intervals between, and having their length lying across the stream, furnished the basis of each pier. At each end of this row of caissons was one of a triangular form, on which was reared the cut-water of the pier. Each pier, with its cut-water, thus required six caissons. These were sunk about 20ft. into the bed of the river, and were afterwards filled with concrete and brickwork, as also the intervening spaces. In addition to these permanent caissons, others of a temporary character were introduced, and the whole process involved the constant employment of divers, as well as of steam engines, the latter to pump out the water from the interior of the caissons. On this solid mass of ironwork, concrete, and brickwork was laid the combined brickwork and granite forming the superstructure of the bridge. Over each of the cut-waters, resting on ornamental Portland stone bases, and from the caps of each of which the arched ribs of the bridge spring, are columns of red polished granite from the Isle of Mull. The shafts of these columns are each 10ft. 6in. in height and 7ft. in diameter, each shaft being surmounted by a Portland stone capital. Each shaft is formed of three pieces of granite, each 3ft. 6in. in height and weighing about 10 tons. The blocks are wrought with mathematical accuracy and their faces polished with the greatest care, presenting a beautiful appearance. The capitals are extremely rich and happy in design, those on the up-river side being carved to represent river birds and plants, while the capitals on the opposite or down-river side are representative of marine life—gulls and seaweed. The treatment is very bold, and reflects credit on the sculptor, Mr. Phillips. The spandrels of the arches are filled in with iron lattice-work, decorated with floral bosses. The external ironwork is painted of a bronze green, relieved by the gilding of the bosses. The parapet of the bridge is also painted bronze green, with appropriate gilding. Rising from each of the abutments is a fine pedestal of granite, with carved cornice in Portland stone. Two of these flank each end of the bridge, and viewed from the roadway they have a fine effect, and when surmounted by statuary—as we presume they will be in course of time—they will present an imposing appearance. The ironwork used in the bridge—between five and six thousand tons in all—has been supplied by Messrs. Lloyds, Fosters, and Co., of Wednesbury, both wrought and cast iron forming excellent examples of the work turned out by that firm. The new bridge with the approaches, will cost altogether about £400,000, or at the rate of about £4 per superficial foot, and is thus one of the cheapest permanent bridges yet built in London. There has been no test used to prove the strength of the bridge, simply because the sectional area of the wrought iron under each part is ten times in excess of what is required for the most trying exigencies of metropolitan traffic.

Whether we regard the design of the structure or its perfect and rapid execution, we can only find room for praise, the greatest credit being due to the engineers and contractors engaged upon the work. It is undoubtedly one of the quickest—if not the quickest built permanent bridge across the Thames. It was not until January, 1866, that the work of construction was really commenced, and in the face of many impediments—want of room not being the least evil which had to be contended with—it has taken less than four years to complete it from first to last. Old Blackfriars was commenced in 1760 and finished, as we have said, in 1769, Vauxhall Bridge was begun in 1811 and finished in 1816, Waterloo Bridge was also begun in 1811 and finished on the 18th of June, 1817, the second anniversary of Waterloo, after which victory the bridge was called; Southwark Bridge took six years to build, Hungerford five years, old Westminster eleven, and new Westminster, from one cause or another, very nearly the same time. London Bridge took seven years before it was completed; so that in the present instance we have no cause to complain either of engineers or contractors. Especial credit is due to Mr. Bryant, who has had the carrying out of the work for the contractors, and who has successfully overcome many difficulties which arose in the course of the construction. The gantry, 80ft. wide, which ranged the whole length of the bridge and carried a double line of rail, and the travellers, some of them lifting 20 tons, were examples of his constructive skill. From first to last the bridge has been a success, and now forms an architectural monument as well as an engineering achievement of which the present generation may be proud.

THE HOLBORN VIADUCT.

THOSE persons who are only occasional visitors to the metropolis, and who may now be visiting it after a lengthy absence, will hardly recognise the spot where once Holborn valley was spread out to view, and where day by day an ever-increasing traffic put horseflesh sadly to the torture and human patience sadly to the rack. The change is great, and stands out as a magnificent improvement upon the system of roadways upon which traffic was conducted of old. The civic authorities have for some time past had in view the bridging over of this gulf, which was accountable for 50 per cent. of the accidents arising from persons being run over in the City during the year. In 1863 they prepared and deposited in Parliament plans for what is known as the Holborn Valley Improvement, and in 1864 the Act was passed. In 1867 additional powers were obtained, providing for the construction of a

street leading from Holborn, viâ part of Shoe-lane, to the foot of Ludgate-hill. The Holborn Valley Improvement, as set forth in the first Act, consists of the viaduct and two approach streets. The viaduct, bearing a roadway and foot pavements on its summit, extends across the Holborn valley from the western end of Newgate-street to the south end of Hatton Garden.

The approach streets afford a means by which vehicles can mount from the bottom of the valley to the summit of either hill. These streets are so arranged that the gradients are slight, bearing no comparison with the steep acclivities of the former Holborn-hill and Skinner-street. The western approach street is 500ft. in length by 60ft. in width, and starts from the top of Holborn-hill at its junction with Hatton Garden, proceeding in a north-easterly direction down the western declivity of the valley into the Farringdon-road. As this approach street descends the hill side obliquely the gradient is reduced to 1 in 45—an arrangement which is facilitated by the raising of a portion of the Farringdon-road, whereby the floor of the valley is elevated. This raising of the ground lessens the elevation of the bridge by which the viaduct crosses Farringdon-street. A little north of this bridge commences Farringdon-road, formerly only 60ft. wide, but now enlarged to the same width as Farringdon-street—namely 96ft. About 400ft. north of the viaduct bridge is the junction between Farringdon-road and the western approach street. At this point the new thoroughfare known as Charterhouse-street forms a continuation of the western approach street, and leads obliquely up the other side of the valley, still in a north-easterly direction, to the northern front of the new Metropolitan Meat Market. The eastern approach street is 50ft. wide, and has a gradient of about 1 in 45. It runs obliquely up the eastern side of the valley, starting from Farringdon-road at a point about 100ft. north of the viaduct bridge, and running parallel with the viaduct for a length of some 400ft. or more, taking, therefore, a south-easterly direction, after which it turns more towards the south, and finishes its entire course of 700ft. by joining the viaduct road at St. Sepulchre's Church.

These approach streets are thus confined to the northern side of the viaduct; the southern side is partially provided for by the Act of 1867. Provision is there made for one such street 50ft. in width and taking the western side of the valley from the south end of Farringdon-street to the top of Holborn-hill, passing at the back of St. Andrew's Church. The central part of Shoe-lane, for a length of 400ft., will be incorporated with this new thoroughfare. An entirely new portion, also about 400ft. long, runs from Holborn, at the back of the church, into this appropriated portion of Shoe-lane, which will be widened to 60ft., involving the pulling down of part of Farringdon Market. From the top of Stonecutter-street the new street will be carried diagonally across Harp-alley, a line of 500ft., terminating at the lower end of Farringdon-street, debouching towards the circus at the foot of Ludgate-hill. Having described the plan of the works generally, we will now proceed to describe the main structural feature of the scheme—the Viaduct. At the junction of the viaduct with Holborn-hill several thoroughfares open into a circus 170ft. in diameter. The thoroughfares radiating thence are the Viaduct-road, Western Charter-house-street, Holborn, and the new street leading down to Shoe-lane and the southern end of Farringdon-street, Hatton Garden, and Bartlett's-buildings. The viaduct is 1,400ft. in length and 80ft. in width, the carriage way being 50ft., and the two pathways 15ft. wide respectively. On the left just through the circus are examples of the buildings it is intended to erect along the viaduct. The first is the new establishment of Messrs. Negretti and Zambra, the opticians, and the next that of Messrs. Fearon and Son, the wine merchants, whose premises and vaults we described a few weeks since. Advancing eastward we pass on the right the church of St. Andrew's, Holborn, which is now approached from the roadway *down* a flight of steps instead of *up*, as formerly. From Hatton Garden to Farringdon-street, the viaduct has an ascending gradient of 1 in 143; from the latter point to St. Sepulchre's Church it descends at the rate of 1 in 153, after which the road is continued on to Newgate-street with a rise of 1 in 696, a very great contrast to the former gradients on this line of route. Not far beyond St. Andrew's Church is the bridge carrying the viaduct over Shoe-lane, whilst a little further eastward is the fine bridge over Farringdon-street. The bridge over Shoe-lane is tasteful and decorative in its style. It consists of one span, the girder and parapet being coloured so as to correspond with the Farringdon-street bridge. The main girders are of wrought iron, with cast-iron cross girders, carrying Mallett's patent buckled plates.

The viaduct crosses Farringdon-street obliquely, so that the bridge has a skew of 36deg. This bridge, which, in an engineering point of view, is the chief feature of the viaduct, is the point at which Mr. Haywood has concentrated his engineering and architectural strength. The bridge, of which we give a perspective elevation at page 335 of our present issue, is divided into a centre and two side spans, supported by twelve columns of polished granite and twelve abutment piers, the four external piers being also of granite, and the remainder of Portland stone. The granite columns stand six on each side of the roadway, dividing it from the pathways, and the abutment piers project from the side walls. The base of each column is of Cornish granite unpolished, the base moulding being of black Guernsey granite polished. The shaft, 4ft. 3in. in diameter, is of polished red Ross of Mull granite, and the capitals are of polished Aberdeen granite, ornamented with bronze leaves. Referring to the four external columns, we have to add to the foregoing that which comes above the capital, consisting of a block of polished Ross of Mull granite, continued up to form a pedestal for a statue. There are thus four statues, which appear as surmounting the parapet of the bridge. The figures face the roadway of the viaduct, and represent Art, Science, Commerce, and Agriculture. The statues are 8ft. high, cast in bronze by Messrs. Elkington, the artists being Messrs. Farmer and Brindley, for Art and Science, and Mr. H. Bursill, for Agriculture and Commerce. The height from the road level in Farringdon-street to the top of the pedestals bearing the statues is 31ft., that on the northern side of the bridge being slightly less owing to a difference of level. The headway under the bridge is 21ft. in the centre, and 16ft. at the sides. The iron girders and parapet of the bridge are painted bronze green, relieved with orange and gold. The spandrels of the arches are of open foliated ironwork, with the City griffin. The City arms appear on the parapet over the centre arch, whilst griffins surmount each of the smaller arches. On the parapet over the centre arch, above the City arms, is a lamp standard with three lights, a lamp standard of one light being fixed over the griffins of the side arches.

At each of the four angles of the bridge is a stone staircase, whereby foot passengers can ascend and descend to and from the viaduct. At each angle, also, a lofty building rises, each of which has a statue carved in stone on the front facing the viaduct roadway. At the south-west angle is Fitz Eylwin—better known as Fitz Alwyn,—the first Mayor of London. At the south-east is Sir Thomas Gresham; at the north-west is Sir William Walworth; and at the north-east the renowned Sir Hugh Myddelton. There is a recess between the windows of the first floor for each statue. The buildings are in the free Italian style, and are wholly of Portland stone. The sculpture is the work of Mr. Bursill. Continuing our course along the viaduct still eastward, we soon come upon the bridge which carries the roadway over the metropolitan extension of the London, Chatham, and Dover Railway, the parapet of which is close and high.

The interior of the whole of this vast pile of masonry, brick and ironwork, is utilised. It consists of extensive series of vaults, which are entered by gateways under the Farringdon-street and Shoe-lane bridges. These vaults are formed by arches springing from east to west. Those in the loftiest parts of the viaduct are the most commodious; but all are spacious, dry, well ventilated, and of a temperature almost uniform. As noticed by us a few weeks since, the whole of these vaults west of Shoe-lane have been taken by Messrs. Fearon for the storage of spirits, which is the first occupation on the route. Houses along the viaduct will be enabled to communicate with these vaults by corridors running across underneath the thoroughfare. Beneath each pathway are smaller vaults which are arranged in tiers, and which will afford cellarage for the adjacent houses. They are formed of arches springing from east to west, and about 10ft. span. Near Farringdon-street these vaults are three tiers in height, but the tiers gradually diminish east and west, as the ground rises according to the old level until, at the ends, they are reduced to one tier. Between these side vaults and the larger central vaults there is on either side a vertical space of about 7ft. wide, extending downward from beneath the carriage-way and footway to the foundations of the viaduct. Each of these spaces is divided into two storeys by an intervening floor of 6in. stone slab. The upper storey is the subway; the lower one is a tunnel for the sewer. In the centre of the viaduct, below all this, is the tube of the Pneumatic Despatch Company, through which the Post Office bags are whisked *en route* between Euston-square and the General Post Office. The great Holborn sewer, measuring 5ft. 6in. by 4ft. 3in., is diverted under Charterhouse-street so as to avoid the viaduct. The house vaults, the subway, and the sewer tunnel are in duplicate, occupying space along the whole length of the viaduct on each side of the great central vaults. The subway and the sewer tunnel are one over the other, beween the outside and the central vaults. Thus the viaduct has two subways and two sewer tunnels. The sewers are for the drainage of the adjacent houses, and also receive the water from the gulleys in the road, the latter discharging into the sewer by means of pipes. The ventilation of the sewer tunnel is provided for by means of pipes leading up the party walls of the houses, and opening above the level of the roofs. The sewer itself is an open one and is paved along both sides.

Turning again to the upper portion of the viaduct we have to notice in conclusion a few details, which although in themselves of secondary importance, yet go very far to complete the perfectness of the entire work. As has already been mentioned, the two sides of the viaduct will in course of time be lined with houses, and will form a street, the appurtenances of which are already supplied. These consist first of lamp-posts, which are of elegant pattern, and are coloured in bronze and gold in harmony with the Farringdon-street Bridge. Each of the lamp pillars is arranged at the base to contain a meter. Half-way up the pillar a disc plate is fixed, through which the gas supply pipe passes, to prevent any gas that may have escaped from the pipes in the subway ascending to the lighted lamps and so causing an explosion. Under the disc the pillar is pierced with

ventilating holes, to allow free vent for the leakage gas. The lamp heads are cylindrical in form. In the centre of the circus at Hatton Garden is a lamp standard of seven lights. A standard of five lights occupies the centre of the junction formed by the eastern approach street and the viaduct near St. Sepulchre's Church. At intervals along the pavement hydrants are inserted, three of which are for watering the roads. The remainder, 100ft. apart, are for the extinction of fires, and have been arranged according to the suggestions of Captain Shaw, the chief of the Fire Brigade. Cast-iron street orderly bins are placed at intervals, each capable of containing a truck load, the rubbish being put in at the top, and taken out at the foot, the whole remaining perfectly closed except when one orifice or the other is required to be opened. Pillar letter boxes are also added and complete the list of useful adjuncts.

Finally, let us say a word respecting those upon whom has devolved the task of designing and carrying out this great work of improvement. Most faithfully and well has the whole scheme been carried out by the executive. Mr. William Haywood, the city engineer and surveyor, deserves the highest credit for the design and arrangement of the whole work, which has been carried out under his superintendence. The excellent manner in which the general contractors, Messrs. Hill, Keddell, and Waldram have done their work is also evident. Although the viaduct has been constructed piecemeal, according as the land could be obtained, the several sections have ultimately been joined together without the slightest deviation in the lines. The work has stood firmly, not a crack or displacement appearing in any part. The Improvement Committee of the Corporation also deserve commendation for the trouble and anxiety so complicated an undertaking must have caused them. The contractors for the ironwork of Farringdon-street bridge are Messrs. Cochrane, Grove, and Co., and for the pipe-laying Messrs. Docwra and Son. The following portions of the work were executed by Messrs. Handyside and Co., of Derby, viz.:—The iron bridge and parapets over Shoe-lane, the iron subway, bridges, and parapets over the London, Chatham, and Dover Railway, the ornamental gates at the four entrances to the subways in the Farringdon-road, the bronze foliage on the capitals of the polished granite columns and abutments supporting the Farringdon-road bridge, and the ornamental lamp pillars on the viaduct and approaches. We congratulate all those who have been engaged in the work upon having brought so important an undertaking to a successful issue.

THE NEW ZEALAND MEDAL.

As considerable anxiety is naturally felt, in military and naval circles especially, in regard to the proposed distribution of medals to the officers and men who have shared in the various contests with the Maories during the past twelve or fifteen years, it may be as well to state that the dies for striking them are in course of preparation at the Mint. Some time, however, must elapse before the medals are struck, for the ordinary coinage has to be simultaneously carried on at that establishment, and medal making is at all times a tedious operation. For the sake of gratifying the curiosity of the public in general, and of the expectant warriors in particular, we shall describe the designs which ornament the metallic decorations. The obverse of the New Zealand medal bears as its principal device a bust of Her Majesty, and this covers the greater portion of the field. The royal head, which is cut in very bold relief, is completely draped at the back, the veil falling in ample folds to the shoulder. The face of the Queen may be considered as a successful portrait if a margin be allowed for a pardonable amount of flattery on the part of the artist who delineated it, and, as on the English coinage generally, it is turned towards the left. A supposed tiara of gold, in which diamonds and other precious stones are, imaginarily, set, and which as a whole is excellently engraved, rests gracefully on her Majesty's head, whilst strings of pearls and gems encircle the neck and rest upon an elaborately chased robe covering the breast.

The inscription on the obverse is lengthy, but the merit of originality can scarcely be claimed for its composition, as it is identical with that on the common British penny, viz.:—"VICTORIA D : G : BRITT : REG : F : D :" On the reverse, the victor's wreath of laurel—depicted with minute regard to the natural characteristics of the evergreen plant, and of skilful workmanship—forms the main feature. In the field, and within the wreath, the date appears. This, however, will vary on different medals, so as to identify their recipients with the campaigns of particular years. Above the wreath the words "New Zealand," in thin thread-like letters, but distinct and clear withal, are placed, and underneath appears the Latin motto *Virtutis honor* (which may be translated "honour to valour") in similar characters. The name, with rank or title of the owner, where either exists, will be indented on the edge, as in the case of the Crimean medals, with which, so far as diameter and weight are concerned, the new medals will be uniform. The material is to be silver, of a higher standard than that of the current coin of the realm, but not of virgin purity. The designs for both obverse and reverse are the work of the Messrs. Wyon, of Regent-street, who also prepared the matrices and puncheons from which the dies are produced. It is somewhat remarkable that these latter operations—artistic and manipulative—should not all have been performed within the Mint, which has its engraver, Mr. Minton, and its medallist, Mr. L. C. Wyon, and who are both men of talent.

RECENT LEGISLATION ON TURKISH MINES.

No sooner do men become thoroughly acquainted with the superficial character and contents of any district or country than they seek to penetrate beneath the crust and explore those hidden treasures which Nature for the most part conceals in her subterranean stores. In exactly the same degree and proportion in which these explorations are carried on, so does a nation rise to commercial prosperity and welfare. But for its mines, more especially its black diamonds, England would have been the most insignificant little island on the face of the globe! Its prosperity has been mainly due to its hidden wealth. On many portions of the earth mining industry is unknown, on many others still in its very infancy. This occurs even in countries which are ranked among the "Great Powers." The vast extent of Russia has been, in a subterranean sense, scarcely explored at all, and Turkey has done little or nothing in the working of her mines, which are unquestionably of great value and national importance. Many years ago this might have been put down to ignorance of their existence. It is true that some would be inclined to term it very culpable ignorance, but yet the excuse, however poor, could be alleged. Now matters are changed. Recent geological investigations, together with the information acquired by the introduction of railways, which has necessitated a more complete examination of the country than had been previously undertaken, have demonstrated that in both these countries there is an enormous amount of latent mineral resources. In the latter country especially there are numerous extensive metallic veins to be met with at the foot of the mountains of Epirus, and in the district contiguous to the great Balkan range of hills. The neighbourhood of Mount Pelion is rich in the galena or argentiferous lead ore of Thessaly, and copper veins abound near the shores of the fatal Bosphorus. Lethargic as Orientals invariably are when contrasted with their Western brethren, yet the mines in Asiatic Turkey are sufficiently valuable to induce the State to work them. From the silver mines the annual production is over seventy tons, while in the same locality a copper mine yields annually a thousand tons, and one of lead gives a couple of hundred. In addition to these may be mentioned the results of private enterprise and investment of capital. Copper mines, near Trebizonde, famous for its bees and their poisoned honey, and those at Fokat, yield on the average 700 tons per annum. A large proportion of this mineral wealth is exported, a great quantity of it finding its way to France. Besides metals, coal has been discovered in Asia Minor, at Smyrna, Aidin, and in the African possessions at Tripoli.

However little interest a government may display in the discovering or exploring of a nation's resources and natural wealth it nevertheless wakes up very quickly to their value and importance directly they have been discovered, with a great disregard to the agency by which the discovery has been brought about. One of the first steps to be taken in order to benefit commercially by the export of minerals is obviously to provide ports and harbours where the means of transport can proceed with safety and facility, and the intercommunication with other nations be conducted with mutual advantage and success. Turkey in this respect is not badly provided. Even if she has not the ports, at any rate she has the seaboard, which is the first essential. Her frontiers extend to the Danube. She touches both the Bosphorus and the Mediterranean, and her advantageous contiguity to these seas will be considerably enhanced when the railways in the interior part of the country are farther and more fully developed. About eight years ago, the government of the Sublime Porte, observing what a brilliant future in mining industry was open to the nation, determined to legislate in the matter and introduce those general principles which regulate similar branches of labour and enterprise in all civilised countries. With this object in view a commission was created and charged with the regulation, surveillance, and responsibility in all affairs of mining administration. By one of the enactments the power was given to any landowner to search as much as he liked, and in any manner he pleased, for suspected minerals on his lands; but he was forbidden to make over this search or the operations connected with it to another party without the especial sanction of the executive. Since the promulgation of this edict it has been rescinded, and the proprietor may call in anyone to assist his operations that he desires. In case a proprietor owns lands in which there are minerals, and refuses to allow them to be worked, the government reserves to itself the right to enter upon that land and work the mines in spite of the owner. It also can grant a concession to a third party to work mines whenever the owner of the soil is unwilling to do so himself, provided the concessionaire commences operations within six months after the granting of the concession, and pursues them vigorously and continually. Any infringement of these conditions is followed by the revoking of the concession. All the shackles that formerly hindered the development of the mineral resources of the country are removed by these regulations, but a still more important enactment was made in the year 1867. It ran as follows:—"Every Turkish subject, or foreigner being a subject of one of the powers signing the protocol promulgated in 1867 by the government of his Imperial Majesty who may ask for permission to own and work mines, may

obtain it on condition of conforming to the present and future laws of the country." This wise and politic arrangement will doubtless exercise a very great influence upon the future industrial aspect of Turkey. It must be borne in mind that this country is only just aroused to a sense of the importance and value of an intimate communication with her Western neighbours. The more she facilitates this intercommunication, the better for herself.

It must not be supposed that with the permission to own and work the mines, the jurisdiction of the government terminates. On the contrary, it extends to many minute details belonging to the subsequent methods and plan of operations adopted for opening up the mines. In the first place, the method of working is prescribed, and none other allowed to be used. This is decidedly an unwise regulation, and will tend very much to deter English capitalists from entering upon such speculations. Probably, so far as the Turks themselves are concerned, who like to have the way of doing work shown to them, it will do well enough, but everyone of our contractors, from the largest down to the smallest "ganger," likes to do his work his own way. It is his business to make the job pay, and he is not likely to allow of any interference with respect to the *modus operandi* he is to employ. So long as he does the work to the satisfaction of those who are concerned in it, it is nobody's business how he does it. That's his look out. A uniform arrangement has been adopted respecting the payment to be made by the concessionaire. Directly the firman for the concession has been granted, he pays down a sum of from £5 to £50 according to the assumed value of the property. The second payment is, in fact, a rent, and is paid annually, and is a fixed sum of three-halfpence per acre. This is paid to the proprietor of the land, or to the government if the property be on Crown land. The third payment is also an annual one, and is proportional to the produce of the mine. It varies from 1 to 50 per cent., and is collected by the State. A glance is sufficient to point out that these monetary arrangements are based upon a foundation nearly similar to that which prevails in France. There are special engineers appointed by the State to supervise the working arrangements in the mines. If, on the one hand, this savours a little of the interference of red tapeism, on the other it relieves the concessionaire of a large proportion of anxiety and responsibility on the score of accidents and misadventures.

THE MOUNT ST. GOTHARD RAILWAY.

WHATEVER local or even national interest may be excited on the score of a main line of intercommunication in a country comparatively so limited in extent as our own, it is a mere trifle to that created by a proposed new continental railway. In the latter case our parishes become provinces, and our counties separate kingdoms and nations. The traversing the barriers that Nature has in her inscrutable wisdom placed between different races is the important point in every scheme for uniting them in a closer bond of intimacy—important in a double sense, not only because it generally constitutes the great physical difficulty to be overcome, but also because the route selected will bestow more direct advantages upon the countries in which its termini are situated than upon others more remote from its course. It will be readily apparent that so soon as a line is projected to cross any of the great mountain ranges dividing the various portions of a continent, the interest of every separate State is at once involved. Contention becomes the order of the day, and each loudly proclaims its own right to the boon, while it shuts its ears to the petition of its neighbours. The two rival schemes at present in which the passage of the Alps is concerned are those *viâ* St. Gothard and *viâ* the Simplon. Locally considered, so far as we may regard Switzerland, Baden, and the shortest route to Milan, the former line is to be preferred to the other. If, however, we remove the Swiss interest in this route, there is very little to be said for it, as it presents no similar advantages for France, Belgium, or for the through traffic from England. On the contrary, the object of its promoters appears to be to divert the traffic altogether from the French companies, and, in fact, create a monopoly for themselves. A glance at the map, showing the course of the St. Gothard line, will at once demonstrate that it is not so well adapted to unite and benefit the great railway systems of the continent as its rival. In reality it consists of a couple of main lines. One commences near the Lake of Lucerne, and terminates at Bellinzona, a distance of eighty miles. The latter starts from the last-mentioned place and finishes at Chiasso, and is about thirty-five miles in length. Its connection with Milan is effected by a junction at Bellinzona with the main lines of Lombardy, which are continued to the ports of Trieste and Brindisi. The immediate effect of the new route would be to bring into closer *rapport* the north of Italy with Belgium, the southern parts of Germany, and a small portion of the coast of France, and it is asserted will rob the Mont Cenis line of its present traffic. This is a mistake, as it will not in any degree affect that route.

If a line from north to south be drawn passing by St. Gothard, it will cut Holland at its narrowest part, and traverse Rhenish Prussia, Bavaria, Switzerland, and Lombardy. This is not the most advantageous course for the proposed project, as will be seen by inclining the line to the east so as to cross the Alps, not at St. Gothard, but at Splugen. Starting from this point, and drawing a line parallel to the former, it will carry us into the States of Hanover, Germany, pass through Milan, and form the shortest route from the North Sea to the shores of the Adriatic. In close connection with our subject is a question which yet remains to be decided. It is whether Trieste or Brindisi is to be the great emporium for international merchandise. Some give the preference to the former, but we select the latter as the best adapted for the purpose. There is not the slightest doubt that one, or perhaps both, are destined to become gigantic cities of commerce. Brindisi has a magnificent and easily accessible geographical position. It is close to Alexandria, and has railway communication with nearly every part of the continent. Our French neighbours put forward Marseilles as a competing port with both Brindisi and Trieste, but it is not far enough away from home to act as a receiving port for large cargoes. It would, in the event of it rivalling either of them, be in the interest of the Swiss to pierce the Alps at the Simplon Pass instead of at St. Gothard. A conference is being held at Berne to investigate the merits of the two routes, and in a short time it may be expected that the matter will be decided.

TELEGRAPHIC NOTES.

THE first general meeting of the shareholders in the Falmouth, Gibraltar, and Malta Telegraph Company in connection with the Anglo-Mediterranean and British Indian Submarine Telegraph Company was held on Tuesday afternoon, at the City Terminus Tavern, Mr. John Pender in the chair. The report stated that the whole of the shares had been allotted, and the allotment money paid. The order for the cables had been given to the Telegraph Construction Company, and £80,000 paid on account. The laying of the cable of the British Indian Company would be finished in March next, and the Falmouth Company's cable would be laid in April or May, so that the whole line of submarine communication between England and India would be thus completed. The Chairman congratulated the shareholders upon the opportune time in which the company had been brought out, thus enabling the directors to make terms with the Government before the telegraph system had passed into its hands. Arrangements had been made with the Postmaster-General with reference to the transmission of their messages between London and Falmouth, and the directors had also obtained the promise of special wires for their traffic, with other accommodation at the metropolitan terminus, and the same facilities as those accorded to other telegraph companies. It was intended that their tariff of charges should be as low as possible, in order that the advantages of telegraphy should be brought within the reach of the poorer classes.

Mr. John Pender, who has taken a leading part in the establishment of submarine telegraphy with India, and is chairman of the British Indian and the Falmouth, Gibraltar, and Malta Telegraph Companies, proceeds to Egypt to represent these companies and the Anglo-Mediterranean and the Telegraph Construction and Maintenance Companies at the opening of the Suez Canal.

The number of messages which passed over the French Atlantic Telegraph during the week ended October 30 was 1,042, the cable charge thereon being £2,592, showing an increase of £956 on the preceding week.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

NEW WAY OF BRONZING—AMMONIA POWDER—TO MAKE ANILINE COLOURS SOLUBLE IN WATER.

A NEW way of giving the appearance of bronze, applicable to small articles of copper, has been introduced by M. Zalewsky. He simply dips them in melted sulphur, with which some lampblack is mixed. The effect, of course, will be to produce a layer of sulphide of copper. What the lampblack can do we have no idea. According to M. Zalewsky, the coating of sulphide of copper will take a good polish. The great trouble in the process, which otherwise looks reasonable enough, will be to remove the layer of sulphur from the casting or whatever may have been dipped.

Some time ago we noticed the announcement of a new explosive called "ammonia powder." Further information, now to hand, tells us that, in the manufacture of this powder, nitrate of ammonia is substituted for the nitrate of potash used in ordinary gunpowder. There can be no doubt that a powder of this composition must have a far greater explosive force than common powder, since the nitrate of ammonia on ignition will be entirely converted into gas. The chief objection to the use of nitrate of ammonia will be its very deliquescent nature, which will make it extremely difficult to obey the injunction "keep your powder dry."

The aniline colours, insoluble in water, may, according to Dr. Zinsmann, who publishes the process, be made to dissolve in that menstruum in the following way:—A solution of gelatine in acetic acid of about the consistence of syrup is first made, and the aniline colour in fine powder is gradually added, stirring all the time so as to obtain a homogeneous paste. The mixture is then to be heated over a water bath to the temperature of boiling water, and kept at that heat for some time. Colours in this state, if a very clear gelatine is employed, will be applicable to many decorative purposes. Bookbinders, paperstainers, and printers will find them useful. They may also, we read, be used to colour confectionery and soaps. Before they are used for confectionery, it will be well to make sure that no arsenic is present

IN the "Times" obituary column of the 27th inst. were recorded the deaths of nine persons whose united ages amounted to 759 years, giving an average of 84 years and 4 months to each. Of the number four were ladies, whose ages were 80, 87, 88, and 95; and five gentlemen, aged 80, 81, 82, and two 83.

PREVENTING BOILER INCRUSTATION.

EVERY steam user who has been troubled with scale in his boilers—and very few have not—has doubtless tried to effect its cure by means of one or other of the various boiler compositions before the public. Some may have succeeded; some, to our knowledge, certainly have not. This may have been owing to various circumstances; amongst others, that of using the proffered remedy without ascertaining its chemical fitness for the water in which it was to be used. It has been too much the custom to assume that a given boiler composition will prove perfectly effectual in every kind of water. This mistake has only been found out after fruitless efforts to remedy the evil, but which, by a discriminate selection, might have been cured. Steam users, however, who have hitherto been unsuccessful in preventing scale will be glad to learn that a very perfect remedy is now being brought before the public by Mr. Smith, of 204, High Holborn, London. This preparation is a powder composed of several ingredients which are very certain in their action in preventing scale and perfectly harmless in their effect upon the metal plates. It is now more than a year since Mr. Smith first brought out this preparation. During that time it has been used by a number of firms whose testimony to its merits we have seen. We select, from a number of testimonials, two from parties whose names are well known to our readers. The first is from Messrs. Merryweather and Sons, the steam fire engine manufacturers, who, under date of January 21, 1869, write:—"We have used your boiler composition in our steam boilers, and find it to surpass, in our estimation, all others that have hitherto been used by us. We find that half the stated quantity is quite sufficient to keep our boilers free from deposit."

The second testimonial, which is dated March 16, 1869, is from Mr. Field, the inventor of the boiler bearing his name, and is as follows:—"I am tired of trying various preparations supposed to prevent incrustation in steam boilers. As regards your own composition, I have as yet only given it a partial trial in the case of a large Cornish boiler, in which the incrustation was very stony. I examined this boiler after six weeks' use of your preparation, and found that the greater part of the incrustation had been dissolved or reduced to a state of powder. On washing some of the plates, the iron is plainly visible, and I am of opinion that the whole of the scale will be removed in course of time. I have not seen so marked an action with any other composition, and am much pleased with it, especially as I have looked for action on the iron, and found none whatever." Another firm writes that "it does not injure the slides or brass fittings of the engine." Upon this latter point—the action of the preparation upon metal,—we recently had a conversation with an eminent analytical chemist. This gentleman assured us that, after some months of varied and searching experiment, he could not detect the slightest signs of injurious action upon any of the metals which he had subjected to its influence under the most trying conditions. These highly favourable results, together with those no less favourable which are vouched for in practical working, lead us to predict that Mr. Smith's composition will come into general use and will prove of the highest value to steam users.

DR. LIVINGSTONE.

THE following letter relating to the illustrious explorer has been received in London:—Zanzibar, Sept. 9.—Dear Sir,—Mr. Henry M. Stanley addressed a letter, dated London, March 8, 1869, to my cousin, who is United States consul at this place, asking him to send you any news he might obtain regarding Dr. Livingstone; but he informs me that, under the consular regulations, he is not allowed to correspond with anyone on matters of importance except through the Department of State. Now, therefore, I, instead of him, have the pleasure to inform you that yesterday letters were received here by the British Consul from Dr. Livingstone, dated August 8, 1868; and, though I have not seen them, I learn from one who has that, at the time of writing, the Doctor was in good health; that for a year previous he had been exploring a section of country to the south of the Tanganyaka Lake, which contained many small lakes, which he claims to be the true sources of the Nile; that he had heard that two sets of supplies had reached Ujiji from Zanzibar for his use, but that he had not yet been there for them; that he would ask that a further supply might be sent there—and among the articles he wished were included nautical almanacs for the years 1869 and 1870—which looked as though he purposed remaining in the country yet a long time. He gave no hint as to his intentions for the future, or when he might be expected to come out; and his letters, written on scraps of paper begged from the Arabs who brought them to the coast, are said to be very meagre in regard to news.—Trusting this may prove of interest, I am, dear Sir, &c., JOHN F. WEBB.

REVOLVER CONTEST.

A COMPETITIVE trial has been carried out at the Arsenal range at Woolwich between the Adams revolver—the weapon in use in the British military service—and Colt's revolver. Both are breech-loading pistols, and the ammunition fired was partly furnished by the respective makers of the competing arms, and partly bought by Mr. C. Healey, of the "Engineer," the contest having arisen, we believe, out of some comments made in that newspaper. For rapidity two sets of 24 rounds were fired from each weapon, the Adams doing it in 1 minute 30 seconds and 1 minute 35 seconds; the Colt in 2 minutes and 2 minutes 10 seconds—superiority for Adams, 38 seconds. For accuracy the pistols were fired from a hand-rest, 24 shots each. The target made at 60 yards by the Adams was 5.45 inches; by the Colt, 8.62 inches. At 30 yards, Adams, 3.37 inches; Colt, 6.75 inches. For accuracy and rapidity combined the results were:—At 60 yards, Adams with 24 rounds, a target of 7.91 inches, in 2 minutes 32 seconds; Colt, a target of 11.70 inches, in 2 minutes 55 seconds; at 30 yards, Adams, a 5.62 inches target, in 2 minutes 5 seconds; Colt, a 5.16 inches target, in 2 minutes 5 seconds. The mean penetration of both weapons at 30 and 60 yards ranges was 3.33 half-inch boards for the Adams, and 2.66 for the Colt. But these last results are too evidently dependent upon the brand of powder used, and the respective degree of hardening of the bullets, to make it necessary to draw any grave distinction upon this point between the pistols themselves. The cartridges used throughout the trials were filled by Messrs. Eley, and have been commented upon for their faultiness of action. As the Adams pistol fires a Boxer cartridge of government dimensions, it is to be regretted the contest was not made with the service ammunition, as it was under the umpireship of the Arsenal Laboratory officials. The victory of the Adams revolver is, however, marked apparently beyond any possible fluctuation incident to ammunition.

THE INSTITUTION OF CIVIL ENGINEERS—PREMIUMS.

THE Council of the Institution of Civil Engineers have awarded the following premiums for papers read during the session 1868-9:—1. A Telford medal and a Telford premium in books (to consist of a complete set of the publications of the Institution) to M. Jules Gaudard, C.E., Lausanne, for his paper "On the Present State of Knowledge as to the Strength and Resistance of Materials." 2. A Telford medal and a Telford premium in books to William Shelford, M. Inst. C.E., for his paper "On the Outfall of the River Humber." *3. A Watt medal and a Telford premium in books to Zerah Colburn, M. Inst. C.E., for his paper "On American Locomotives and Rolling Stock." 4. A Telford medal and a Telford premium in books to Thomas Nesham Kirkham, M. Inst. C.E., for his paper "Experiments on the Standards of Comparison Employed for Testing the Illuminating Power of Coal Gas." 5. A Telford medal and a Telford premium in books to John Ellacot, M. Inst. C.E., for his "Description of the Low Water Basin at Birkenhead." 6. A Telford medal and a Telford premium in books to Professor David Thomas Ansted, F.R.S., for his paper "On the Lagoons and Marshes of Certain Parts of the Shores of the Mediterranean." 7. A Telford premium in books to William Henry Wheeler, M. Inst. C.E., for his "Description of the River Witham and its Estuary, and of the Various Works Carried Out in Connection Therewith for the Drainage of the Fens and the Improvement of the Navigation." 8. A Telford premium in books to James Robert Mosse, M. Inst. C.E., for his paper on "The Mauritius Railways—Midland Line." 9. A Telford premium in books to Imrie Bell, M. Inst. C.E., for his paper "On Sinking Wells for the Foundations of the Piers of the Bridge over the River Jumna, Delhi Railway." 10. A Telford premium in books to John Milroy, Assoc. Inst. C.E., for his "Description of Apparatus for Excavating under Water, and for Sinking Cylinders." 11. A Telford premium in books to Samuel Parker Bidder, jun., Assoc. Inst. C.E., for his paper "On Machines Employed in Working and Breaking Down Coal so as to Avoid the Use of Gunpowder." 12. A Telford premium in books to Charles John Chubb, for his paper "On Coal-Getting Machinery as a Substitute for the Use of Gunpowder." 13. The Manby premium in books to David Marr Henderson, Assoc. Inst. C.E., for his paper "On Lighthouse Apparatus and Lanterns."

The Council have likewise awarded the following prizes to students of the Institution:—1. A Miller prize to Edward Bazalgette, Stud. Inst. C.E., for his paper "On the Use of Concrete in Building Operations." 2. A Miller prize to Frederick Harry Mort, Stud. Inst. C.E., for his paper—"An Inquiry into the Nature and Causes of Some Discrepancies between Theory and Practice." 3. A Miller prize to Tristie James Ellis, Stud. Inst. C.E., for his paper "On the Artistic Design of Bridges." 4. A Miller prize to Thomas Robert Gainsford, Stud. Inst. C.E., for his paper "On the Construction of a Railway Tunnel or Covered Way at Bradford, Yorkshire, among Abandoned Coal and Ironstone Workings." 5. A Miller prize to Charles Henry Grey Jenkinson, Stud. Inst. C.E, for his paper "On Wrought-Iron Girder Bridges." 6. A Miller prize to George Henry Roberts, Stud. Inst. C.E., for his paper "On Reservoir Embankments."

* Has previously received a Telford medal.

THE AMERICAN STEAM BUREAU.

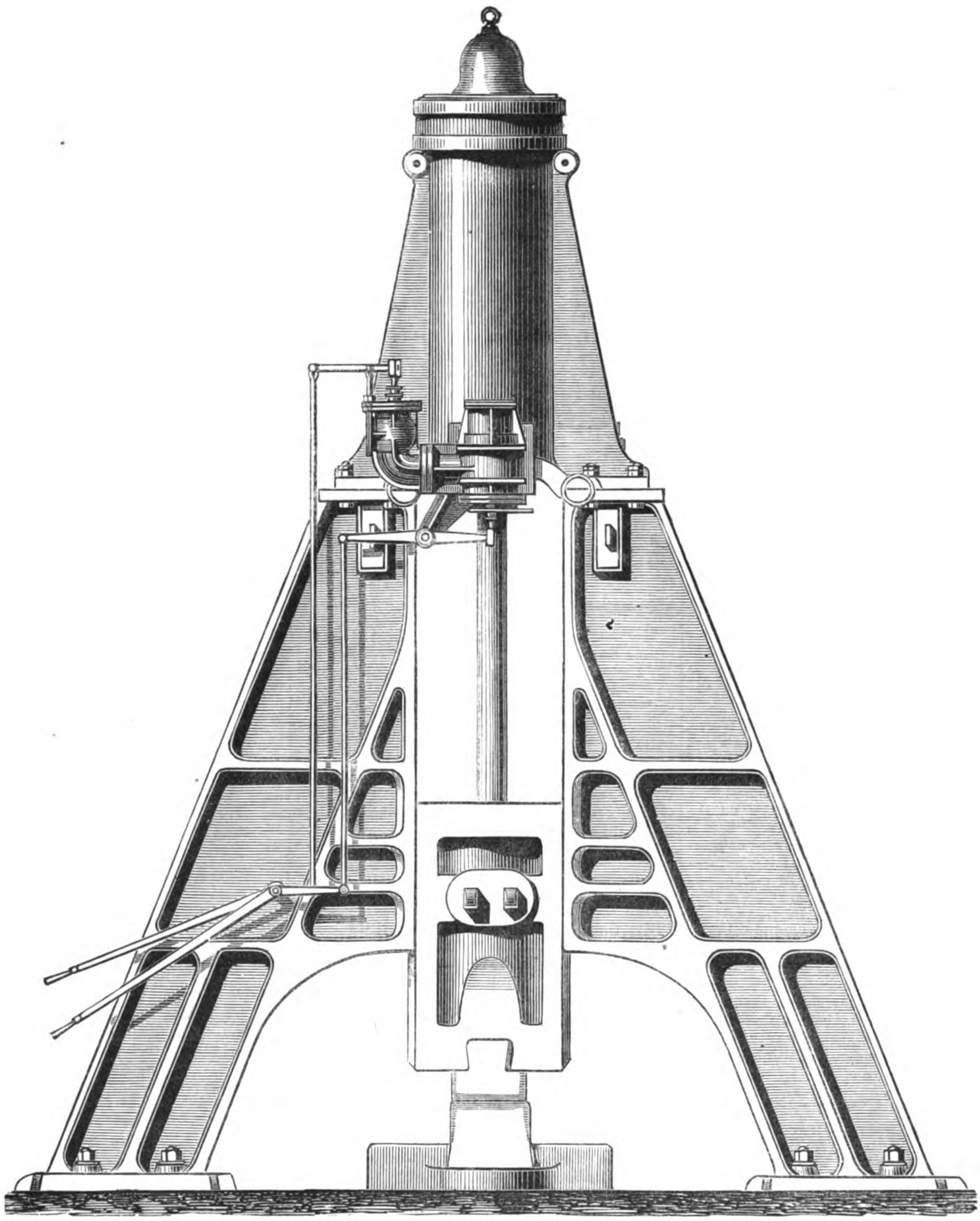
WE understand that the Board of Civilian Engineers, appointed by Secretary Welles in January, 1863, to make a thorough examination of the plans and doings of the Steam Bureau, have lately sent a synopsis of their report to Secretary Robeson, in answer to a request from him. This synopsis is nothing more or less than a condensed statement of the voluminous report they sent into Secretary Welles several years ago. It is astonishing how, in the face of so intelligent and convincing a report, the Department could go on, as it did, repeating and continuing the engineering monstrosities these impartial civilian engineers had so clearly pointed out. Many millions in money, besides the good name and efficiency of the service, would have been saved, had timely heed been given to their recommendations. The report seems to have been pigeon-holed, probably because it did not sustain and defend the projects of Mr. Isherwood, who was then all-powerful in the Department, and who was not prepared to listen to criticism. After going through a most searching investigation of the steam machinery of the navy, and carefully comparing it with the results and proportions of ordinary practice, the Board condemned the Steam Bureau's new-fangled theories and plans, without reserve or qualification. For instance, in referring to one class of screw vessels, they stated "that the power of the machinery for these vessels, by changes in type and detail, could have been increased at least one-third over that attainable by the Bureau's machinery, without adding to the space occupied, decreasing the coal stowage, or equalling the total weight or cost."

Now this is repeating, with the force of an official utterance, what this journal was at the same time carefully asserting in numerous articles. But neither the articles nor the report had the least effect in staying the ruinous course of the Steam Bureau. They were neither answered nor heeded: simply ignored.

An attempt was lately made to defend the abortive steam machinery of the "Wampanoag." What did these engineers say of engines of similar type and design, given them for examination six years ago, and long before the "Wampanoags" were begun? "By the use of properly designed, 'direct-acting' engines (in lieu of the geared engines proposed)," they reported, "an absolute saving of space, weight, and cost could be effected, while the power would be doubled and the speed of the vessel increased by at least three knots an hour." Yet condemned as they thus were in advance, and in terms so strong and definite, four or five "Wampanoags," costing nearly 2,000,000 apiece were built, and now stand as convincing proofs of the soundness of the criticisms and recommendations of this report, and sad evidence of the extraordinary fatuity of the Steam Bureau and the administration which could sustain it. In the lack of an intelligent and determined supervisory power, one self-confident man was enabled, in the face of the protests of the engineering profession, and in opposition to all sound practice, to experiment upon the National Navy, with the Treasury to pay his bills. We do not know how much the present Navy Department will be able to do in the way of remedying the evils entailed upon it, but we hope Congress will give its efforts every assistance.—U.S. "Army and Navy Journal."

EIGHT-TON STEAM HAMMER AT THE LANDORE STEEL WORKS.

BY MESSRS. THWAITES AND CARBUTT.



EIGHT-TON STEAM HAMMER.

THE accompanying engraving represents an elevation of an eight-ton steam hammer which has lately been erected at the Landore Steel Works, by Messrs. Thwaites and Carbutt, of the Vulcan Iron Works, Bradford. The hammer is for the purpose of hammering steel ingots before entering the rolls; this hammer, which is of the single-acting type, has a cylinder 30in. diameter and admits of a stroke of 7ft. The hammer head weighs eight tons. The cylinder is fitted with Messrs. Thwaites and Carbutt's cylindrical equilibrium valve, which is very simple and effective. The standards, which are H section, are made straight in form, and securely bolted to a massive bed-plate, and afford a good base for the hammer to stand upon. The anvil block for this hammer, which is cast in one solid piece, weighs seventy-five tons.

A STEAM FIRE ENGINE FOR VANCOUVER'S ISLAND.

THE important town of Victoria in this colony has a mixed population of English and Americans, the spirit of emulation being such that it possesses two volunteer fire brigades, which work in unison on the occasion of a fire. The American brigade already has a steam fire engine of American make, and the English brigade, to keep up its reputation, resolved also to procure a steam fire engine, and after having the designs of various English and American builders of fire engines submitted, selected a London engine of Messrs. Merryweather and Sons' make, the same as the engine "Le Prince Imperial," which gained the first prize gold medal at the late Paris Exhibition for these makers. The new engine for Victoria has a horizontal steam cylinder 6½in. diameter, and a direct and double-acting pump 5¼in. diameter, with 18in. stroke of steam and water pistons. The engine is made light, and is fitted with a lounge and rope reel, as it is for hand draught; is handsomely finished, and named "Deluge, No. 1." Previous to its shipment, it was thoroughly tested, and found to raise steam from cold water to 100lb. pressure in seven minutes from the time of lighting the fire. When in full work, its delivery of water is at the rate of 300 gallons per minute, projecting a stream to the height of 160ft.

SOCIETY OF ENGINEERS.

AT the ordinary meeting of the Society of Engineers, held on Monday, the 1st inst., in the Lower Hall, Exeter Hall, a discussion took place on a paper read by Mr. Perry F. Nursey, on October 18, "On English and Continental Intercommunication." The following candidates for elec-

tion were balloted for and duly elected, viz.:—As Members: Messrs. John Eunson, jun., engineer to the Northampton Gas Company; E. V. O. Haldane, late assistant-engineer, Hyderabad, Deccan; John Green Hall, city surveyor, Canterbury; Mathew J. Jennings, C.E., Durham Lodge, New Cross, Wm. Roebuck, Ellington-street, Arundel-square; Thomas Small, M.E., Gloucester; Robert P. Spice, consulting engineer, 21, Parliament-street; Thomas Warden, M.E., Birmingham; Thomas Wilkins, M.E., Orchard Works, Ipswich. As a Foreign Member: Lieutenant John Grierson, Bombay Staff Corps, lat. R.A. As an Associate: Samuel Cutter, jun., Providence Ironworks, Millwall.

MAKING FOUNDATIONS IN MARSHES.

A NEW process of making foundations for bridges in marshy soils has been recently used on a branch line of the Charentes Railway Company, in France. This line crosses a peat valley to the junction of two small rivers; the thickness of peat was so great that any attempt to reach the solid ground would have been very expensive. In order to obtain cheaply a good support for the bridge, two large masses of ballast accurately rammed were made on each bank of the river, and a third one on the peninsula between the two. The slopes of these heaps were pitched with dry stones, for preventing the sand from being washed away by the rain or by the floods in the rivers. Over the ballast a timber platform is laid; this platform carries the girders of the bridge, which has two spans of about 60ft. each. When some sinking down takes place, the girders are easily kept to the proper level by packing the ballast under the timber platform; this packing is made by the plate-layers with their ordinary tools. This simple and cheap process has succeeded quite well. The same difficulty was overcome by a different plan on an ordinary road near Algiers. This road crosses a peaty plain, nearly one mile broad; the floods and elasticity of the ground prevented the formation of an embankment. The road was to be carried over a viaduct across the valley, but the foundations of this viaduct presented serious difficulties, the thickness of peat or of compressible ground being nearly 80ft. It was quite possible to reach the solid ground with cast-iron tubes sunk with compressed air, or with any other system, but neither the implements nor the suitable workmen were available in the colony, and it was a great expense to bring them, and especially the workmen, from France. The use of timber piling was of course out of the question, as timber is very expensive in Algiers, and quickly becomes rotten; but there was a set of boring implements with the men used to work it. The engineers began boring holes 10in. diameter down to the solid ground. These holes, lined with thin plate-iron pipes, were afterwards filled with concrete up to the level of the ground. Each of these concrete columns bears a cast-iron column; these columns are properly braced together and support the girders of the viaduct, which is divided into spans of about 20ft., and is 20ft. high over the ground. This system has succeeded very well, and is to be extended to another large valley.

VARIETIES IN LEPIDOPTERA.*

By Mr. Joseph Sidebotham.

THE questions as to what constitutes a species? where does a species end, and a variety begin? and whether a species be a natural or merely an artificial division? are amongst the most difficult of solution in the whole range of natural history, and just at this time are very prominently before the scientific world. With a view to determine the influence which difference of food and light might have in modifying species, the author gives the following as the result of some experiments which he had made:—I procured about 2,500 larvæ of the tiger moth, in a young state. I divided them into six lots, keeping each in a separate cage, and feeding them differently. One lot was fed on willow, another on butter bur (*Petasites vulgaris*), another on hawthorn, another on plum, one on dock, and one on nettle, grass, bramble, and various other kinds of food. A considerable proportion of each became perfect insects, and I could detect no difference whatever in the colours, from the food they had lived upon. That is to say, the variations in colour and marking were not to be traced in any case to the food. I kept several batches of eggs, and reared the larvæ carefully through the winter, and then again divided them giving each lot a different kind of food. Again the same result. I found that one year the larvæ I had brought from the coast had usually the inferior wings more or less of a yellow shade, instead of the bright scarlet of the Cheshire specimens.

Having for many years continued these experiments without obtaining any marked results, I this year tried another of a different nature. I selected the tortoiseshell butterfly, as one of the least variable species we have, and I procured several broods of young larvæ just emerged from the egg. These I kept in a dark box until I had all ready, and then I divided each brood into three lots, putting one-third into a box in my photographic room, which is lighted with orange-coloured glass, one-third into a box lighted with blue glass, and the ventilators carefully shaded so that only light of a blue colour could reach the larvæ; the remainder were put into an ordinary cage, in the natural light. The latter fed up and came out into butterflies in the usual time. Those in the blue light were not healthy, and, though every care was taken, at least fifty or sixty died before changing, and a considerable number changed into chrysalides, and then died; those that came out into perfect insects were very much smaller than usual. Those lighted by orange-coloured glass fed up very well, but many of the two first lots had come out before one of them changed into chrysalis; scarcely one of them died, and I examined each one before I allowed it to fly, to see what effect had been produced.

Those reared in the blue light differ from the ordinary form in being on an average much smaller; the orange brown is lighter in shade, and the yellow and orange run into each other, instead of being distinct and separate. Those reared in the non-actinic, or yellow light, are also smaller, the orange brown is replaced by a salmon colour, the venation more strongly marked, and the blue dashes at the edge of the wings in the usual form are in these of a dull slatey colour. One evening I found about sixty butterflies out of chrysalis, of those in the photographic room, and taking each one carefully I examined them all and allowed them to fly; shortly afterwards I found the whole of them had settled against the wall of the house, and presented a most remarkable appearance; they remained there more than half-an-hour. The western sun was shining against the wall, and it is not unlikely when being suddenly brought from the red light, where they had spent all their lives, to the bright daylight, they were so dazzled as to act in this peculiar manner.

The results of this experiment do not show any very startling change in colour, such as one would have expected from the known effects of light on plants and from the occasional occurrence of very much more strange varieties one now and then meets with, which cannot have been subject to such severe treatment. Still, when we consider that even this difference is caused in one generation, and in the course of a month, it is a very suggestive fact, and leads one to think that light has certainly as much or more effect on the colours of Lepidoptera than the difference of food, and might in a long series of generations lead to very material changes in both form and colour, and perhaps considerably modify our ideas of what constitutes a species.

* Literary and Philosophical Society.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

ON Monday evening last the open general meeting of the Royal Institute of British Architects for the present Session 1869-70 was held in Conduit-street. The President, Sir William Tite, M.P., delivered an inaugural address, in which he adverted to the increased prosperity of the Institute, both in regard to the number of its members and the state of its finances. He referred to the transactions of the past session, which had been of unusual importance, and to the interesting papers read by Mr. Layard, M.P., late Chief Commissioner of Works, and by Sir M. Digby Wyatt, Professor Donaldson, Canon Burgess, and others. After commenting on the late judicious selection of Professor Lepsius for the award of the Royal gold medal, annually presented by the Institute, with Her Majesty's sanction, to an eminent architect or *savant*, Sir William passed on to describe some of the more important architectural works of the day, especially mentioning the Holborn Valley Viaduct (by Mr. Haywood), Blackfriars Bridge (by Mr. Cubitt), the University of London buildings (by Mr. Pennethorne), and St. Thomas's Hospital (by Mr. Currey) as being eminently creditable to their respective authors. He congratulated the Institute on the care and success with which candidates for certificates of proficiency to act as district surveyors were now examined under the Metropolitan Building Act, and on the scheme of the voluntary architectural examination, which, as recently improved, was likely to encourage and benefit the architectural student, and he dwelt at some length on the great importance of an improved system of professional education. After the transaction of the formal business of the evening, the meeting was adjourned to the 15th inst.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

THE annual dinner of this society took place on Saturday last at the Restaurant, Westminster Chambers, the President, Mr. W. Forsyth Black, presiding. The usual loyal and other toasts were given, and success to the society followed, which was very cordially received. The president proposed the healths of Messrs. Roberts and Dawson, and spoke very highly as to the assistance they had given in working the society up to its present position, and for serving several years in the respective positions of honorary secretary and treasurer. It having been proposed at a previous meeting that the society's thanks should be given them in writing, advantage was taken of this opportunity, and a very nice illuminated engrossment on vellum was handed them by the president, which was acknowledged in a very effective manner. The testimonial is worded to the following effect, although separately:—

"That at a general meeting of the Civil and Mechanical Engineers' Society, held on the 23rd June, 1869, the following resolutions were unanimously adopted:

"To Frederick Hebberd Roberts, Esq., C.E., and George J. Crosbie Dawson, Esq., C.E.

"That the society accepts with much regret the resignation by Messrs. Roberts and Dawson of their respective offices of honorary secretary and honorary treasurer, and desires to express its high appreciation of the very efficient manner in which they have discharged the duties of their offices for the long period of nine years.

"That the society further wishes to convey to Messrs. Roberts and Dawson its best thanks for their zealous efforts to increase its numbers and extend its influence."

(Signed) W. Forsyth Black, President.
Arthur C. Pain, Hon. Treasurer.
William Meakin, Hon. Secretary.

The next meeting of the society is announced to be held on Wednesday, the 10th inst., at 7.30 p.m., at the society's temporary room at the Whittington Club, when some of the topics referred to by the president in his address to the members will form a subject for discussion.

TREATING WASTE LIQUORS.

AN improved method of treating the acid solution resulting from the operation of manufacturing tinned plates, and which has been saturated or partially saturated with iron from the plates or articles which have been dipped or steeped therein, has been patented by Mr. J. J. Vaughan, of Mitre Lane, Kensal Green. He subjects it either in an undiluted state or diluted below the crystallising point, or the residue or mother liquor remaining after the crystals of sulphate of iron have been deposited from the solution, to the following treatment:—A quantity of crude magnesite is pulverised and placed in the receptacle containing the liquor, which is allowed to filter through it, by which means the free sulphuric acid is neutralised. The filtrate is then treated with a further quantity of pulverised magnesite and subjected to heat, whereby the sulphuric acid of the copperas or sulphate of iron contained in the liquor is expelled therefrom and absorbed by the magnesia, the iron being left in the form of oxide. This process may be varied by treating the filtrate with calcined magnesite or magnesia so as to throw down the iron, the supernatant liquor being cleansed and boiled down, and the precipitated oxide of iron treated as may be required by drying or roasting to render it appli-

THE NEW BLACKFRIARS BRIDGE.

ENGINEERS, MESSRS. CUBITT AND CARR. (See page 327.)

cable for polishing, the manufacture of colours, and other useful purposes.

Another mode of treatment which may be adopted is to calcine the magnesia and to mix the before-mentioned solution with it, and then calcine or roast it after such mixing. The soluble sulphate of magnesia should be lixiviated and dried or crystallised, and the insoluble residue or oxide of iron dried and treated for the purposes to which the same is applicable. In the case of the acid residues resulting from the refining of petroleum and paraffin oil and other analogous materials Mr. Vaughan washes out or separates the acid as far as possible, and combines the same with raw or calcined magnesia, or the tarry "magma" is mixed with magnesia or its carbonate and roasted in a furnace with access of air. The resulting mass may either be purified or used in its crude state as an artificial manure.

MANUFACTURE OF IRON AND STEEL BY THE NITRATE PROCESS.

MR. J. P. BUDD, of Ystalyfera, near Swansea, has recently patented an invention which has for its object to subject molten cast iron to the action of nitrate of soda and soft hematite iron ore or other oxide of iron previous to its being subjected to the puddling process. For this purpose he runs the molten cast iron into shallow pans capable of holding from 3in. to 5in. in depth of melted metal and lined with a paste composed of the above-mentioned materials. When the fluid metal is poured into the pans a violent ebullition takes place and a large proportion of the silica, together with some of the carbon, phosphorus, and sulphur contained in the iron, is carried off in the slag, so that when the slabs of purified metal are subsequently worked in the puddling furnace the puddling operations are effected much more rapidly than with ordinary pig iron, as when puddling ordinary pig iron in a puddling furnace but a very small proportion of carbon is separated from the iron before the greater proportion of the silica is eliminated. Cast iron if of a suitable quality for steel making may advantageously be acted on by a paste containing nitrate of soda or hematite ore, or both combined, in shallow pans, as above described, previously to being decarbonised to convert it into steel.

When the object is to produce bars of wrought iron which are to be rolled into black plate or thin sheet iron to be afterwards converted into tin plate Mr. Budd lines the shallow pans into which the cast iron is run with a composition composed of hematite iron ore and nitrate of soda. He mixes together a quantity of hematite iron ore, containing if possible no phosphorus or sulphur and only a moderate quantity of silica, and mixes therewith half by bulk or two-fifths by weight of nitrate of soda, or 30lb. of hematite ore to 20lb. of nitrate of soda. Having well mixed these together mechanically the mixture is passed through a pair of clay rolls, by which the grit is reduced and it becomes more plastic. A paste is then formed of the mixture which requires about three-tenths of its weight of water to be added; it is then sufficiently liquid to be filled into a bucket. A series of shallow moulds of cast iron are then placed as near as convenient to the tapping hole of the blast furnace from which the fluid cast iron is to be obtained. Those found convenient are of the following dimensions:—Length, 7ft. 9in. at top tapering to 7ft. 4½in. at bottom; width, 2ft. 2in. at top tapering to 1ft. 9½in. at bottom; depth, 4in. The use of the bevelling or tapering in the mould is that the plate of cast iron shall be more easily removed from it. These moulds hold about 13cwt. of cast iron when filled about 3½in. deep. Into these moulds molten cast iron is run every 4 hours or oftener, care being taken to fill them often enough that they shall retain their heat or drying power between the casts.

As the casts from the furnace must thus be frequent the iron is potted from the furnace, that is, the operator takes out what iron he requires from an opening into the furnace at the upper part of the tapping hole without emptying the whole of the iron in the half. Whilst the moulds are hot from the previous cast he pours into each of them a bucket full or about 64lb. of the refining mixture before described and spreads it evenly over the bottom and sides. The water evaporates and the mixture lies at the bottom as an adhering paste. The workman then proceeds to run the molten iron from the furnace until he has filled the moulds about 3¼in. A great ebullition takes place, fumes in large quantity are evolved, jets of flame burn from the surface of the metal for a considerable time, a quantity of scoria is thrown up violently to the surface and separates from the plate of iron that fills the mould, and when cold can be stripped therefrom. The weight of the scoria so thrown up is from 30lb. to 40lb. from each plate of metal weighing about 13cwt. The iron contained in the hematite ore used in the paste is converted into cast iron and adheres to the bottom of the plate. The refined iron when broken presents a honeycomb or cellular appearance throughout and resembles overblown refined metal, and a large proportion of the silica will have been removed from it. The iron thus refined is ready for the puddling process.

As advanced refined metal Mr. Budd finds it advantageous to use some pig iron with the iron refined as above in puddling; about one-third of pig iron answers best. Cast iron thus refined, even if it be what is commercially known as cinder pig, which is produced when iron scoria are largely used as material in the blast furnace, will make excellent puddle bars and work to a good yield. The process of puddling is shortened, and the sides and the bottom of the furnace are less acted on than with unrefined iron. The quantity and proportions of the refining paste which we have given are suitable for the quality of cast iron known as white iron. When grey or carburetted iron is used the quantity of nitrate of soda to be used with the hematite ore should be increased; about 30lb. of nitrate of soda (instead of 20lb. as in the composition first mentioned) being used with 30lb. of hematite ore.

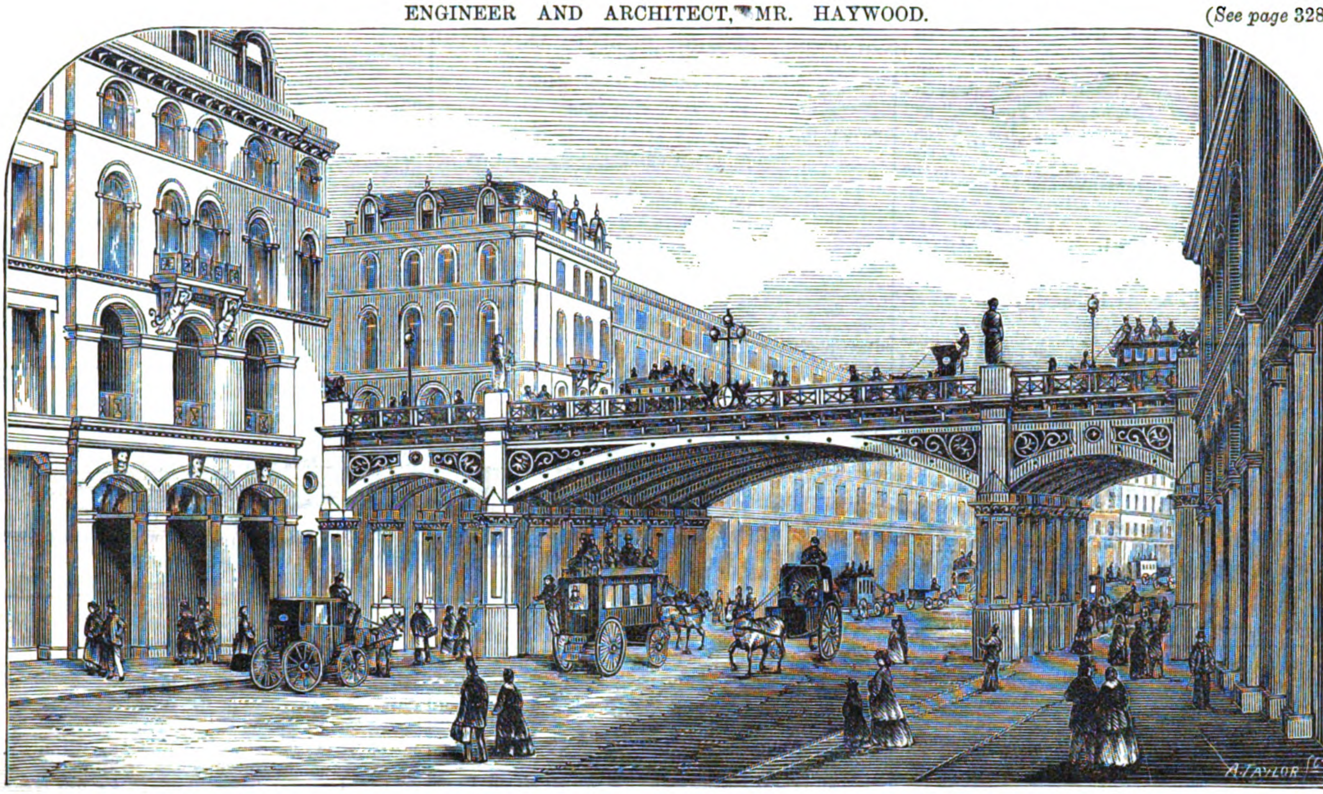
When the malleable iron sought to be made in the puddling furnace is not to be of the quality suitable for tin bars and similar purposes, but is required to be a softer working quality suitable for rails and merchant bars, Mr. Budd does not use nitrate of soda in the refining paste, but makes it of hematite ore alone. When used alone a great ebullition takes place when the molten iron runs over it, the oxide of iron in the hematite is reduced, jets of white flame burn on the surface for a considerable time, and a large proportion of the silica is separated from the iron. The refined iron in this state is much preferred by the puddlers, as it lessens and helps their work. In place of hematite ore other oxide of iron which can similarly be formed into a paste may be employed in place thereof, as, for example, the refuse of iron pyrites from which the sulphur has been extracted for the manufacture of sulphuric acid, and from which the copper and other metals contained in it have been extracted. Oxide of manganese, iron scale, or other substances capable of yielding oxygen when exposed to heat may be incorporated with the paste.

MESSRS. T. WINGATE and Co., of Whiteinch, have launched a composite screw of 620 tons, fitted with a pair of improved compound surface-condensing engines of 100-horse power. The steamer, which has been named the "Wilhelmine Emma," has been built to the order of Messrs. Miller Brothers, and she will proceed at once to Japan. The construction of the vessel is somewhat novel, the bottom being composite, with flush iron topsides, so as to combine in the highest degree the strength and stiffness of an iron vessel with the anti-fouling properties of a composite.

THE HOLBORN VIADUCT BRIDGE.

ENGINEER AND ARCHITECT, MR. HAYWOOD.

(See page 328.)

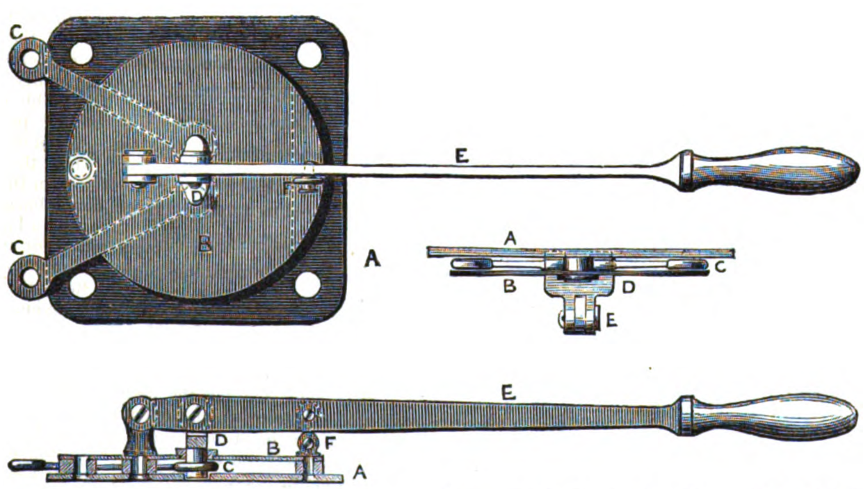


LAUNCHING LEVER.

A VERY ingenious instrument, for facilitating launches by dispensing with the mallet and chisel operation has been designed by Mr. W. B. Robinson, the master shipwright and engineer of Portsmouth Dockyard. This apparatus is seen in plan and section in the accompanying engraving. A is a back plate of wrought iron having four holes by which the instrument is secured to the rail of the launching stage; B is a guard plate to keep the links C C from lifting; C C are links to which the ends of the launching lines are attached; D is a fork slip bolt to hold the links C C until the vessel is ready for launching; E is a lever for lifting the fork slip bolt D; and F a hook to keep the lever E from being lifted by accident. By lifting the lever E, the links C C with the launching lines attached are released, and the weights fall on the dog shores. This ingenious contrivance, which is in. in length, was successfully introduced by Mr. Robinson, at the launch of H.M.S. "Dido," which took place at Portsmouth, on Saturday week. The "Dido" is an unarmoured 6-gun screw sloop of 1,268 tons burden and 380-horse power. She is built on the same lines as the "Danae," which was launched May 21, 1867. The "Dido" is a wooden-built vessel with rolled iron beams, and strengthening iron deck plating next to the waterways, and mid-deck stringer plating. Her principal dimensions are as follows:—Length between perpendiculars, 212ft.; breadth, 36ft.; depth in hold, 19ft. 4in.

LAUNCHING LEVER.

BY MR. W. B. ROBINSON.



TESTS OF BESSEMER RAILS.

THE best class of foreign rail manufacturers bear willing witness to the good character of the Bessemer steel rails made in the United States, especially those made by first-class houses like the Pennsylvania Steel Company, the Cleveland Iron and Steel Company, and the Freedom Iron and Steel Company at Troy. We believe that this favourable opinion is due to our home productions, as the managers of these prominent manufacturing houses omit no effort and spare no pains or expense to produce just such an article as will do the very best service in the track. The method of testing these rails is thus described by a circular issued by Messrs. John A. Griswold and Co., of Troy, and as efficient tests are made by the other establishments which we have named:—

1st. A test ingot from each five-ton ladleful of liquid steel is hammered into a bar, and tested for malleability and hardness, and especially for toughness, by bending it double cold. In case any test bar falls below the standard established as suitable for rails, all the ingots cast from that ladleful of steel are laid aside for other uses.

2nd. All the ingots, and each rail rolled from them, are stamped with the number of the charge or ladleful. A piece is cut from one rail in each charge, and tested by placing it on iron supports a foot apart, and dropping a weight of five tons upon the middle of it from a height proportioned to the pattern of rail. A blow equivalent to a ton weight falling ten or fifteen feet is considered a severe test. We use a five-ton weight falling from a less height, believing that it more nearly represents in kind (although it of course exaggerates in severity) the test of actual service in the track.

In case a test rail does not stand the blow deemed proper and agreed upon, the whole of the rails made from that charge or ladleful of steel are marked No. 2, and sold for use in sidings, where their possible breaking would do no great harm, and where their greater hardness and resistance to wear would be specially valuable. In addition to this double test, the rails are rigidly inspected for surface imperfections.

They further express the opinion that these tests render it practically impossible that rails of inferior quality should be sent out, and furthermore, they invite railway companies to send inspectors to their works to witness the tests mentioned, and other tests and inspections agreed upon. It is by the continuance of such rigorous tests and by proper quantities in case of breakage, that our manufacturers will command the confidence of railway managers, and command the respect of their foreign rivals and competitors. What is needed is a good article of rails, and railway managers may rest assured they will never get this unless they are willing to pay a fair price, and we beg to assure them that they are making a great mistake by buying cheap steel rails. Let them require a three years' guaranty, and they will find that the price will go up immediately. Every ton of cheap foreign-made steel rails that is purchased is a fraud upon the honest manufacturer, both home and foreign, while such purchases are a constant source of danger and expense to the railways. Managers had far better continue the use of iron rails than buy an inferior quality of steel. Let them rest assured that it is not economical or safe to buy either cheap iron rails or cheap steel rails.—"American Railway Times."

THE AMERICAN IRONCLAD FLEET.

THE ironclad fleet of the United States, although somewhat diminished in numbers since the close of the rebellion, still presents a formidable bomb-proof flotilla for coast defence, though somewhat rusty with age and hard knocks. Several of our best ironclads, says the "New York Tribune," are fully manned and equipped, and could be ready at a moment's warning, while the entire lot could be sent along the coast inside of a fortnight, should such a necessity arise. To give our readers some idea of the numerical strength of our walls of iron, we append a list of the present position of the ironclads. Those with a star prefixed carry four guns, those

with a dagger only one. The remainder carry two guns each, excepting the "Roanoke," which has six. At League Island are lying the †"Achilles," "Ætna," "Argos," "Atlas," "Charybdis," "Erebus," "Goliath," †"Gorgon," †"Hydra," "Jason," "Lehigh," "Medusa," *"Miantonomah," †"Nemesis," "Niobe," "Spitfire," "Tartar," and "Puritan,"—17, and one hulk. At New Orleans, the "Ajax," *"Cyclops," "Neptune," *"Samson," *"Tornado," and "Vesuvius"—6. At Mound City, the "Circe," "Fury," "Harpy," "Hecate," "Iris," "Minerva," "Tempest," and "Vixen"—8. At Washington, the 'Castor," *"Hero," "Montauk," and †"Orion"—4. At San Francisco, ready for action, the *"Monadnock," and "Comanche,"—2. At the Naval Academy, the *"Amphitrite"—1. In the North Atlantic Squadron, the "Centaur" and "Dictator"—2. At Boston, the "Terror," ready for sea, and the "Eolus" and *"Stromboli"—3. At Philadelphia, the "Passaic" and "Scylla," ready for sea—2. The following vessels are in process of construction: "Thunderer," at Portsmouth; *"Colossus," at New York; *"Hecla," at Philadelphia; *"Herculese," at Boston; and the "Niagara" is being converted into a broadside vessel at Boston—5. The "Roanoke," with her three turrets, is in ordinary at the Brooklyn Navy-yard—1. Total, 50. The torpedo boat "Spuyten Duyvil," is at the Brooklyn Navy Yard, and is a most terrible engine of warfare, not so much to look at as to encounter. It is not to be expected that a majority of these vessels could fight in a seaway; but as they were originally designed for coast defence, it is probable they would be assigned to such duty.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, November 4.)

CHEMICALS.—In chemicals there has been a fair amount of business transacted, and, still excepting the alkali trade, a more generally cheerful feeling is exhibited amongst the producers, and prices are tending upwards. In the mineral market some derangement has been occasioned by the late stormy weather, though not to any material extent affecting prices. Metals continue very inactive, and there has been but little doing. As anticipated, an amicable arrangement has been concluded with the ironworkers in South Staffordshire, and this source of uncertainty being removed, it is hoped that no check will be experienced to the late increasing business. Soda: prices remain the same for soda ash, at £7 to £7 5s. for 48. Caustic: rather more inquired for at £13 12s. 6d. Crystals inactive, at £4. Bi-carbonate is again in little request at £9 10s. Nitrate of soda: some sales at 16s. 6d. to 17s. Potash: a large amount of muriate on contract has changed hands, and business has been done at £7 5s. to £7 7s. 6d., for 80. Saltpetre: Bengal, 22s. 3d. to 23s. 6d.; English refined, 27s. Alum: there has been a considerable home demand for this article, which, coupled with some large foreign orders, tends to stiffen prices, though it is still held at £6 5s. for loose lump, and £7 in export barrels. Ammonia: sulphate continues to command high prices, and meets with ready sales, at from £15 for inferior to £17 10s. for 24. Copperas: in green and rusty sales are limited, at 52s. For dry there is an increasing demand, at £2 10s. Chloride of iron steady, at 52s. Pyrites: maintain late quotations, 7d. to 8d. per unit. Calcined still inquired for, at 44s. 6d. to 44s. R.C. Lime: phosphate meets with a rather better market, at 52s. 6d. for 65. Bleaching powder in more request at £8 5s. to £8 10s. for 35. Disinfectants are receiving increased attention, at 5s. 3d. per cwt. Manganese: very quiet at 95s. for 70. Acids: in tartaric a fair business, at 1s. 1½d. foreign; English ground, 1s. 2½d.; citric little doing, at 2s. 5d; oxalic at 7½d.

METALS.—Iron: Scotch pigs steady, at 53s. 6d. to 53s. 7d. Cleveland firm, at 44s. for forge to 49s. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire, £6 15s. to £7; Gas tubes at 60 to 70 off list; Boiler tubes, 40 to 45. Copper: is rather firmer. English ingot £71 10s. to £73; Chili Slab £67 10s. to £68 10s. Tin: very quiet. English £122 to £123; Straits £124. Lead is selling freely, and prices are firmer. P.G. best English soft pig lead, £18 15s. Spelter: dull. English £20 10s. to £21. Silesian, special brands, £20 5s. to £20 10s.; Hard spelter, for export, £16 5s. to £16 10s.

LIEUT.-GENERAL PHILIP SANDILANDS died at Hythe, Kent, on Saturday last, in his 80th year. The deceased officer entered the Royal Regiment of Artillery October 4, 1806, and became lieutenant February 1, 1808. He served with the expedition to Walcheren, also in the campaign of 1815, and was engaged on the 17th June with the Horse Artillery in covering the retiring movement from Quatre Bras, and on the 18th of June he was present at the battle of Waterloo.

Legal Intelligence.

COURT OF CHANCERY, WESTMINSTER.

NOVEMBER 2.

(Before the LORD CHANCELLOR.)

PARKES v. STEVENS.

THIS being the first day of Michaelmas Term, his Lordship, according to custom, took his seat at Westminster.

The above case was a motion for a new trial of certain issues tried before Vice-Chancellor James, affecting the validity of a patent taken out by the plaintiff for gas lanterns of a spherical form, such as are suitable for suspension in railway stations and other public places. The great object of the improvements effected by the plaintiff was to produce a glazed lamp, the frame of which should throw little or no shadow, and yet possess the requisite strength, and also facilities for lighting and cleansing the lamp. The latter object the plaintiff had effected by forming the upper half of each lamp of six panes of glass, each section forming the section of a sphere, and by making the door of the lamp of one of the six panes, which opened by sliding on a frame within the next pane, and not outwards on a hinge in the usual manner. The defendant had copied the plaintiff's lamps in those which he had erected in New Palace-yard, and the plaintiff had consequently filed this bill to restrain the defendant from infringing his patent, but his Honour decided that the sliding door was not sufficiently claimed by the specification of the plaintiff's patent and also could not be a valid subject of a patent. From this decision the plaintiff appealed.

On the appeal being resumed on Wednesday morning, the appellant having been heard, his Lordship directed the case to stand over till next motion day, when he would decide whether or not to call on counsel for the respondent.

Mr. Webster, Q.C., Mr. E. E. Kay, Q.C., and Mr. Everitt are for the appellant Parkes; and Mr. Amphlett, Q.C., and Mr. Bagshawe for the respondent Stevens.

Correspondence.

PUBLIC WORKS, INDIA, AND CIVIL ENGINEERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

THE Secretary of the Institution of Civil Engineers presents his compliments to the Editor of the MECHANICS' MAGAZINE, and will feel obliged by the publication of the enclosed documents relating to a branch of the public service in India.

I.

Extract from the minutes of the Council of THE INSTITUTION OF CIVIL ENGINEERS.
THURSDAY, OCTOBER 21st, 1869.

"The Council proceeded to take into consideration the following extract from 'The Gazette of India,' September 4, 1869:

PUBLIC WORKS DEPARTMENT.

NOTIFICATIONS.
ESTABLISHMENT.
Simla, the 31st of August, 1869.

No. 242.—Whereas the Governor-General in Council is given to understand, that in the civil engineering profession in England, it is a recognised practice for civil engineers employed by public companies and otherwise, to receive, in addition to the salaries paid them by their employers, commission on contracts given out, or stores and materials ordered or inspected by them, and other like pecuniary considerations for services done, or intended to be done, which are considered legitimate sources of emolument; and whereas a considerable number of civil engineers, who have practised in England, have lately been employed by the government of India, and the number of such engineers is likely to increase;

1. It is hereby notified for general information that every person in the service of the government in the Public Works Department in any part of British India, whether civil or military, must consider his salary or pay, as regulated by the rules of the department for the time being, or defined in any agreement with the Secretary of State for India in Council, and whether it is drawn wholly or in part in the Public Works Department, or the Military Department, to be his sole legal remuneration; and that the receipt of commission, or any other consideration whatever, directly or directly, on account of any in business or transaction in which he shall be concerned in behalf of the government, whether in India or elsewhere, is prohibited.

2. Every officer of the government is bound to report to his departmental superior every infringement of the above rule which may come to his knowledge.

(Signed) R. STRACHEY, Colonel, R.E.,
Offg. Secretary to the Govt. of India.

"It was resolved unanimously:

"1. That this Council, on behalf of the Institution of Civil Engineers, incorporated by Royal Charter, and representing the profession generally, emphatically deny that, 'in England, it is a recognised practice for civil engineers employed by public companies and otherwise, to receive, in addition to the salaries paid them by their employers, commission on contracts given out, or stores and materials ordered or inspected by them, and other like pecuniary considerations for services done, or intended to be done, which are considered legitimate sources of emolument.'

"2. That the Council assert that any civil engineer detected in such practices would be held by the profession to be guilty of disgraceful conduct, which would disqualify him from being a member of this Institution.

"3. That it is deeply to be regretted that so grave a charge should have been received and published by the government of India without proper inquiry; as such inquiry would have shown that the charge was absolutely untrue.

"4. That such an imputation, stamped as it is with high authority, is calculated to do grievous wrong to an honourable profession, and has created a deep and general feeling of indignation.

"5. That the Council appeal with confidence to the government of India to cause the scandalous statement contained in the preamble of the notification No. 242 to be withdrawn.

"6. That the Council request the President, on behalf of the Institution, as representing the profession, to transmit copies of these resolutions to the Secretary of State for India, and to the Governor General of India."

Signed on behalf of the Council,
CHARLES HUTTON GREGORY,
President.

A true extract.
JAMES FORREST,
Secretary.

October 23rd, 1869.

II.

THE INSTITUTION OF CIVIL ENGINEERS.
Established 1818.—Incorporated by Royal Charter 1828.
25, Great George-street, Westminster, S.W.,
October 23rd, 1869.

My Lord Duke,—I have the honour to lay before your Grace the enclosed extract from the minutes of the council of the Institution of Civil Engineers, in reference to the notification No. 242, published in "The Gazette of India," in which it is implied that professional dishonesty is a practice which is recognised as legitimate by the civil engineers of this country.

I hope that our profession is sufficiently known to your Grace to render any official contradiction unnecessary to exonerate us in your opinion from such a charge. But the public at large can hardly suppose that such a statement could have emanated from the government of India without satisfactory proofs of its truth; and I cannot exaggerate the feeling of indignation which has been aroused by the notification among civil engineers of this country, and those engaged in India.

I have been requested by the Council to ask your Grace to be so good as to give us an audience upon this subject at your earliest convenience. Meanwhile, I beg to assure your Grace that we feel the utmost confidence that we shall not look to you in vain for such measures of justice as may authoritatively clear our profession from the disgraceful imputation which has been authoritatively fixed upon us.

I have the honour to be,
My Lord Duke,
Your Grace's most obedient servant,
CHARLES HUTTON GREGORY,
President.

To His Grace the DUKE OF ARGYLL, K.T.,
&c., &c., &c.,
Secretary of State for India.

III.

THE INSTITUTION OF CIVIL ENGINEERS.
Established 1818.—Incorporated by Royal Charter 1828.
25, Great George-street, Westminster, S.W.,
October 27th, 1869.

My Lord Duke,—Having reference to the inter-

view your Grace was this day pleased to accord to the deputation of the Institution of Civil Engineers, I am desired by the Council of the Institution to state in writing for your Grace's more specific information :—

1. That the profession does not recognise the acceptance by civil engineers of commissions, or other payments, except openly and directly from their immediate employers.

2. That the profession distinctly discountenances, repudiates, and condemns the practice implied in the notification No. 242, recently issued by the Public Works Department of the Government of India.

3. That it is a rule of the Institution not to receive into membership any person tainted, or believed to be tainted, by any of the improper and corrupt practices alleged in such notification.

4. That if it be possible to cite instances of misconduct by persons calling themselves civil engineers, yet that any such instances are entirely exceptional, and amount to flagrant departures from the well understood and well recognised practice of the profession, and, therefore, cannot justify the broad accusation contained in the notification in question.

I have the honour to be,
My Lord Duke,
Your Grace's most obedient servant,
CHARLES HUTTON GREGORY,
President.

To his Grace the DUKE OF ARGYLL, K.T.,
&c., &c., &c.,
Secretary of State for India.

IV.

THE INSTITUTION OF CIVIL ENGINEERS.

Established 1818.—Incorporated by Royal Charter 1828.

25, Great George-street, Westminster, S.W.,
October 28th, 1869.

My Lord,—I have been requested by the Council the Institution of Civil Engineers to transmit to your Excellency the enclosed copies of an extract from the minutes of the Council, and of two letters written by me on their behalf to the Secretary of State for India.

I beg to request your Excellency's serious consideration of a question vitally affecting the honour of our profession, in the assurance that you will be anxious to do us the justice which we respectively ask from the government of India.

I have the honour to be,
My Lord,
Your Excellency's most obedient servant,
CHARLES HUTTON GREGORY,
President.

To His Excellency
THE EARL OF MAYO, G.M.S.I., K.P.,
&c., &c., &c.,
Governor-General of India.

V.

INDIA OFFICE.

October 29th, 1869.

Sir,—I am directed by the Duke of Argyll to acknowledge receipt of your letters of 23rd and 27th inst., protesting on behalf of the Institution of Civil Engineers against an imputation considered to have been made against the British Engineering Profession in a notification of the government of India, wherein it is assumed to be a "recognised practice" in England "for civil engineers employed by public companies and otherwise to receive, in addition to the salaries paid them by their employers, commission on contracts given out, or stores and materials ordered or inspected by them, and other like pecuniary considerations for services done, or intended to be done, which are considered legitimate sources of emolument."

In reply, I am directed to state that the Duke of Argyll will immediately communicate with the Governor-General of India on the subject to which these letters relate, desiring to be informed of the circumstances which led to the issue of the notification in question.

His Grace considers it almost superfluous for me to add that he regards with implicit confidence the indignant repudiation by the Institution of any recognition of the practice referred to in the notification.

I am,
Sir,
Your obedient servant,
M. E. GRANT DUFF.

C. H. GREGORY, Esq.

SUN SPOTS.

SIR,—I perceive by a letter in your issue for the 22nd ult. that the writer, Mr. H. Saloway, is of opinion that the spots in the sun are due to the relative positions of the planets. If, as Humboldt remarks, the aurora is an indication of a highly excited state of the earth's crust, rendered visible under favourable circumstances in the upper regions of the atmosphere, it seems to be due to the action of the planets on the fluid interior of the globe. This is the more likely if we consider their attraction to be equivalent to a resisting medium, which by diminishing the velocity of the earth, must also cause it to part with a portion of its internal heat, as well as alter the plane and axis of its orbit. The periodic time of Jupiter, the largest of the planets, coincides with the period of those spots, say ten 1-10th years. Venus likewise, by her proximity to the earth, causes considerable alteration. When Venus was in aphelion and distant 45deg. from Jupiter, and the sun in square to Saturn, on March 8 and 9, I find there were several consecutive displays of the aurora, which is generally found to occur on the appearance of those spots. Again, on April 17, a display took place, the sun being in conjunction with Jupiter and Venus not far from the latter planet, and in trine to Saturn and Mars. Again, on May 16, Venus being close to the sun and in square to Mars and near her greatest illumination, a similar display occurred. Lastly, in September, from the 5th to the 10th, several displays took place, Venus being 144deg. from Jupiter, and the latter stationary towards the latter day; the same planet being also in square to Uranus. This, I think, proves that these planets exercise some influence on the sun in connection with the earth; and the nearer they are to the equator the greater this influence, whence the greater frequency of the phenomenon in the spring and autumn; the attraction of those planets being at this time exercised on the protuberant matter at the equator.

Another matter, which seems to deserve attention in connection with this subject, is that the readings of the meteorological instruments in such seasons are higher than the average. The mean height of the barometer, thermometer, dew point, relative humidity, mean range, and mean velocity of the wind are higher during such seasons than usual. This was so in the autumn of 1849. The mean of the eight weeks, from March 17 to May 18, was as follows:—Barometer: mean height, 29·989in.; mean temperature, 48·2deg.; dew point, 39·7deg.; relative humidity, ·8deg.; amount of cloud, 7·2deg. Thermometer: minimum, 41·9deg. (mean); maximum do., 58·6deg.; mean velocity hourly, thirteen miles; amount of rain, 2·846in. These figures are higher than usual considering the very wet autumn and mild winter which preceded this spring, when from analogy we should expect a very cold spring, as was the case in 1769. These spots would, therefore, seem to exercise a favourable influence on the weather, rather than otherwise. In 1867, I find that those spots were at a minimum, and the winter of that year was in marked contrast to that of 1869, being marked by excessively cold weather and a comparatively low barometer, the minimum of the thermometer being in January 1deg. against 32·9deg. in the present year; and otherwise distinguished by comparatively low readings of the instruments. The mean readings of this year, as contrasted with the above, were—barometer, 29·911deg.; thermometer: maximum, 67·6deg.; minimum, 31·8deg.; mean, 48·7deg.; mean daily range, 14·8deg.; rain, 22·472in.; number of rainy days, 164.

I would also refer to the same cause the sudden variations of temperature which we have experienced this year, rather than to the motion of the earth through regions of space of different temperature.—I am, Sir, yours, &c.,

DANIEL P. BROWNE, M.A.

Cork, October 27.

THE MONCRIEFF SYSTEM.

SIR,—In your publication of the 29th ult, I see a letter accompanied by a drawing entitled "The Moncrieff System Anticipated." Now, I cannot but think that this title is both very unjust to Captain Moncrieff and exceedingly misleading to the public. The invention described in the letter only very partially accomplishes the ends attained by the Moncrieff carriage. The gun is lowered below the parapet by the discharge, but there is no provision to store up and utilise the force of the recoil to raise it again, and this is a most important and essential feature of the Moncrieff carriage. The mechanical principle by which Captain Moncrieff attains his object, viz., a moving fulcrum, does not seem remotely hinted at. In fact, the carriage described by your correspondent seems no more worthy of being called an anticipation of the Moncrieff carriage than the Æolopile of Hero of Alexandria can be called an anticipation of Watts' condensing steam engine.

The carriage is but a mechanical appliance that makes the system proposed by Captain Moncrieff and partially explained in your columns possible. No system appears suggested by the inventors of this self-lowering but not self-raising carriage. It is specially unfair to speak of the whole system with its manifold applications suggested by Captain Moncrieff, and made possible by him, as only coextensive with the invention of a gun carriage.

Moncrieff batteries, where each gun is in a pit or semicircular excavation, are peculiarly sheltered from enfilade, except at the moment of exposure, which would rarely give the enemy time to lay his guns. The shells loaded with molten iron should at least find their way into the pit before they could burst and set fire to the platform, and to accomplish this would be no easy task.—I am, Sir, yours, &c.,

JAMES WHITE, M.A.

November 3.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—E. J.—F. C.—H. E. E.—D. P. B.—H. S.—J. W. W.—M. P.—J. F.—I. C. E.—T. and F.—W. M.—H. L.—S. A.—R. T.—H. R. G.—E. B.—J. H. P.—S. S.—J. W.—C. O. E.—P. M.—J. T. B.—H. R.—E. C. L.—G. W.—F. R.—H. and Co.—E. and B.—G. S. and Co.—E. F.—G. M.—W. T. E.—G. G. S.—W. M.—G. W. H.

Meetings for the Week.

TUES.—Institution of Civil Engineers.—Discussion upon Mr. Ellacott's paper on "Description of the Low Water Basin at Birkenhead"; and on "The Present State of Knowledge as to the Strength and Resistance of Materials," by M. Jules Gaudard, C.E., at 8 p.m.

Naval, Military, and Gunnery Items.

A MUSEUM of books, portraits, and relics, commemorating the great siege, has just been opened at Sebastopol by General von Todleben.

THE mechanics in the smithery at Chatham Dockyard have commenced forging the stem and preparing the other ironwork for the iron-clad steam ram "Rupert," which is ordered to be constructed there.

THE official Norwegian paper just received contains the announcement that his Majesty the King of Norway and Sweden has been pleased to appoint Sir William Mitchell a Knight Commander of the Royal order of St. Olaf, in recognition of the services he has rendered to merchant shipping generally.

AT a meeting of the Liverpool Local Marine Board yesterday week, a telescope was presented to Mr. J. P. Anderson, late chief mate of the ship "Adept," in acknowledgment of his rescue of the crew of the water-logged ship, "Americana," in September, 1868. The captain of the "Adept" was ill at the time.

MESSRS. W. HAMILTON and Co. have launched from their yard at Port Glasgow a wooden paddle ship built for the Imperial Ottoman Government. The steamer, which has been named the "Amelia," is the fourth which Messrs. Hamilton have built for the Turkish Government, and a sister ship is now in course of construction in their yard.

THE United States War and Navy Departments have combined in the adoption of a uniform system

of signals to be used in the military and naval branches of service. Commander S. P. Lee, of the navy, and General Myer, of the army, will have charge of the respective branches, with the necessary corps of assistants. The work of reorganization is to begin at once.

A TERRIBLE accident occurred on Wednesday afternoon at Sheerness. One of H.M. gun vessels, the "Thistle," was undergoing some preliminary trials, when, from some cause at present unknown, a boiler burst, killing some seven men and seriously injuring fifteen others, several of whom are not expected to recover. After the catastrophe, the ship was brought to anchorage off the Mouse Light, her buoyancy being uninjured.

THE inhabitants of Deptford are taking action, through their respective vestries, for getting the abolished dockyard utilised, either as a metropolitan fish market in lieu of Billingsgate, or as a foreign cattle receiving and slaughtering yard and dead meat market. By the advice of Sir David Salomons, Bart., M.P. for the borough, a memorial has been drawn up, and is in course of signature, for presentation to the Lord Mayor, Aldermen, and Commonalty of the City of London.

SOME time since we described at length the four-rayed iron vessel of very light draught, which had been proposed by Captain Moody for a stable platform for floating forts and for floating telegraph and store stations. Determined to show the practical value of his system, the inventor has commenced building at his own cost a vessel 39ft. from ray to ray; and he intends to test in every way its asserted qualifications, as well as the capabilities of such craft under canvas and under steam. The builders are Messrs. Lewis and Stockwell, and it is expected the vessel will be finished in about six or eight weeks.

THE following contributions in aid of the funds of the Merchant Seamen's Orphan Asylum were received from the passengers, officers, and crews of merchant vessels, per favour of the captains, during the month of October:—"Lady Jocelyn," £10 10s. 1d.; "Rutlandshire," 2s.; "Pera," screw steamer, £2 5s. 11d.: "Sir Jamsetjee Family," £2 2s.; "Harkaway," 2s.; "Delhi," screw steamer, 7s. 10d.; "Nyanza," screw steamer, £1 11s. 6d.; "Simla," screw steamer, £4 12s.; "Taitsing," £1 6s. 10d.; "Fire Queen," £2 10s. 4d.; "Eliza Shaw," 4s. 4d.; "Syria," screw steamer, £22 4d.; "Tanjore," screw steamer, 4s. 4d; "Sumatra," screw steamer, £4 3s. 3d.; "Pride of the Ocean," £1 10s.; "Brinkburn," £2 3s. 9d.; "Cospatrick," £2 4s. 2d.

WE read that a new machine has been set to work at Naples, on a man-of-war, the "Calatifimi," which is called the Nausismografo. The inventor of this engine is M. F. E. Paroone, first machinist of the royal Italian navy. It is stated that, with the help of this machine, the damage which the ship has undergone can be found out, as well as the speed and the direction—in one word, all the different movements which a ship has been obliged to undergo, either on account of the winds or through any other reason. With this machine, the commander can from his cabin watch over all the movements of the ship. After a manœuvre or a battle, the manœuvreing of each ship can be found out. Finally, by this extraordinary machine, the journal of the commander is controlled on his return.

IT has come to our knowledge, and, for the sake of the naval service, we regret to add, with every evidence of truth, says the "United Service Gazette," that the command of one of her Majesty's ships on a distant station has been offered to a captain, provided he pays his own passage out to the station to join her! It has also been stated that the officer has accepted the command under the conditions stated, feeling that had he not done so he was likely to look in vain for employment. We most emphatically enter our protest against such a system. The national exchequer must indeed be low if it cannot afford to send an officer to the station on which he is to perform his duty. We hear it also currently reported that the tin mess utensils used in vessels conveying troops are to be purchased "second-hand!" Is the Board of Admiralty about to open an imperial second-hand establishment and naval commission agency? We see evident signs of attempting to conduct the affairs of the navy in a shop-keeping spirit. We warn the Admiralty and their financial secretary against such an attempt.

Miscellanea.

A MONUMENT to the Prussian statesman and patriot, Baron Von Stein, was opened at Herdeck on the 17th ult. It consists of a watch tower 90ft. high on the summit of the Kaisersberg.

THE remains of 6 men and 46 horses, supposed to be those of a missing portion of General Fremont's exploring expedition, 20 years ago, were found recently in the Opal Fork of the Rio Grande.

AT a meeting of the directors of the Edinburgh School of Arts, held on Monday, it was unanimously agreed to allow female students to attend the lectures and classes of the school.

A FINLAND vessel has just conveyed to St. Petersburg two enormous blocks of stone from the banks of Lake Ladoga, each weighing 72,000lb., to be used for the pedestal of the statue of Catherine II.

THE "Courrier du Gard" of the 23rd ult. says:—Yesterday, in the plains of Crau, the direct train from Marseilles was nearly thrown off the rails by the violence of the wind; two first-class carriages had part of their roofs carried away by a furious gust.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending October 30, was 3,605. Total number since the opening of the Museum, free daily (May 12, 1858), 1,674,621.

IT was stated by Sir James Simpson, when receiving the freedom of the City of Edinburgh, that among the manufactories of chloroform in Great Britain, a single one of these located in Edinburgh makes as many as 8,000 doses a day, or between 2,000,000 and 3,000,000 of doses every year.

WE regret to observe the continued indisposition of Mr. Bazalgette, the Chief Engineer to the Metropolitan Board of Works. It is satisfactory, however, to learn that the Board have granted him leave of absence for three months, during which time he will be relieved from all duties.

MESSRS. WEBB AND SON, of Coombs Tannery, near Stowmarket, whose leather bands were favourably noticed by us at the Agricultural Show at Manchester, met with well-merited success at the late Altona Exhibition, where they obtained the only medal given for leather machine bands over twenty-six other competitors.

COAL has been found by Government geologists near the salt works of Iletzkaya Zaschtschita, on the river Ilek, south of Orenburg, and in the peninsula of Mangushlak, on the eastern shores of the Caspian. It is reported to be of good quality, and will supply the steamers on the Caspian, hitherto fed with anthracite from the Don.

MESSRS. SIMPSON, engineers, of Thames Bank, are laying a thorough system of water supply at Buckingham Palace in case of fire. Four large iron cisterns have been placed at different points on the roofs, from which are laid pipes through the corridors and passages with hydrants and hose at intermediate distances, so as to be accessible to all parts of the palace in time of need.

THE number of visitors to the South Kensington Museum during the week ending October 30, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,559; Meyrick and other galleries, 1,502; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,654; Meyrick and other galleries, 88; total, 14,808. Average of corresponding week in former years, 10,711. Total from opening of Museum, 8,915,982.

IT is said that the North-Eastern Railway Company have determined to introduce at once a new improvement in the working of the points on their lines, viz., the wedge process, by which the pointsman, on closing his points with the ordinary handle from his cabin, will introduce a wedge into the points, and thus effectually lock them, and prevent them from jumping as the trains pass, and thus probably prevent accidents such as have more than once occurred.

DEATH, says the "Melbourne Argus," has at length removed from us the founder of the colony, the Hon. John Pascoe Fawkner, M.L.C., the man who, but a little more than thirty-four years ago, sailed up the River Yarra, and commenced a colony, the growth of which has been unexampled in history, and which, in all probability, will never be paralleled. At the age of seventy-six, respected by all who knew him, after a life eventful as a romance, and eminently active and useful, Mr. Fawkner has passed from us; but his name will be treasured as a household word long after the colony he founded has become an important empire.

THE Council of the Society of Arts offers its Silver Medal for the best instrument, to be affixed to a cab or other hackney carriage, for indicating the fare as between the passenger and the driver, whether by registering the distance travelled or otherwise, and which instrument shall also indicate for the convenience of the cab-owner and of the driver, the total distance travelled during the day, and the total amount earned. The instruments competing, with full descriptions of their construction, to be sent to the Society's house before January 1, 1870. Competitors may at their option sign their communications, or may forward with them sealed letters containing the name and address of the writer.

WE have much pleasure in calling attention to a well-arranged tool box which we recently examined at Messrs. Moseley and Son's Plane and Tool Manufactory, 54, Broad-street, Bloomsbury. This box, which is called the "householder's tool box," is of deal, dovetailed, and painted: it measures inside 26½in. long, 11in. wide, and 6in. deep, and is so arranged that any single tool can be got at readily, taken out and put in again, without disturbing the others. The tools comprise a very complete set of all that can be required for general purposes, and their quality is guaranteed by the maker's name, whilst the price is exceedingly moderate. A number of useful practical hints on the use of the various tools accompanies each box.

THE traffic receipts of the railways in the United Kingdom for the week ending October 24 amounted, on 13,569 miles, to £818,110, and for the corresponding week last year, on 13,414 miles, to £793,100, showing an increase of 155 miles and of £25,010 in the receipts. The gross receipts on the 14 principal lines in the United Kingdom amounted for the week, on 9,895 miles, to £684,576, and for the corresponding week last year, on 9,754 miles, to £667,087, showing an increase of 141 miles and of £17,479 in the receipts. The traffic receipts on 52 other lines in the United Kingdom amounted, on 3,674 miles, to £133,544, and for the corresponding week last year, on 3,660 miles, to £126,013, showing an increase of 14 miles, and of £7,531 in the receipts. The total receipts of the past week, as compared with those of the preceding one ended October 17, exhibit a decrease of £26,600.

UNITED STATES' papers publish a paragraph to the effect that the General Land-Office has received returns of the survey of the township and section lines of five townships on the Gila River in Southern Arizona, containing 105,252 acres of agricultural and grazing lands, bearing evidence of having been formerly under a high state of cultivation for centuries, and abounding in ruins of elaborate and sometimes magnificent structures, together with relics of extinct races possessing considerable knowledge of the arts and manufactures—among the most extensive of the ruins being those called Casa Grande, about two miles south-west of the junction of the east and south channels of the Gila River. These townships embrace the growing towns of Adamsville and Florence, on the Fort Yuma and Fort Grant waggon roads, as well as numerous productive farms and pastures well stocked with cattle and sheep.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1075, 1079, 1085, 8104, 1110 1128, 1129, 1134, 1137, 1155

BUILDINGS AND BUILDING MATERIALS—1130, 1153, 1158, 1164

CHEMISTRY AND PHOTOGRAPHY—1147, 1152

CULTIVATION OF THE SOIL, including agricultural implements and machines—1078, 1083, 1103, 1133, 1161, 1174

ELECTRICAL APPARATUS—1076, 1136

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1094, 1095, 1099, 1113, 1145

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1083, 1112, 1121

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1082, 1084, 1090, 1096, 1105, 1108, 1122, 1131, 1141, 1154, 1163, 1165, 1170, 1176

GENERAL MACHINERY—1080, 1087, 1088, 1091, 1119, 1135 1142, 1159, 1160, 1167, 1169

LIGHTING, HEATING, AND VENTILATING—1077, 1102, 1111, 1147

METALS, including apparatus for their manufacture—1100, 1107, 1144, 1149

MISCELLANEOUS—1081, 1089, 1098, 1101, 1106, 1114, 1124, 1138, 1139, 1157, 1168, 1175

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1074, 1086, 1092, 1115, 1116, 1117, 1118, 1120, 1123, 1125, 1126, 1146, 1148, 1156, 1162, 1172

SHIPS AND BOATS, including their fittings—1104

STEAM ENGINES—1097, 1140, 1150, 1151, 1166, 1171

WARFARE—1093, 1127, 1143

1074 W. T. O. PRATT, Newport, Monmouthshire. *Signalling apparatus.* Dated April 8, 1869.

This consists of rods and levers leading from the whistle or other sound-creating instrument on the engine or in connection with it, within the hearing of the driver, and a wire, cord, or other appliance which is screwed or otherwise acted upon by coming in contact with a blade, bar, or lever placed above the rail or rails or in the space between the rails. The blade, bar, or lever is thrown or put into position at a distance by an attendant or by a lever on the rod of the danger signal and worked in conjunction therewith. Weights and springs may be employed in connection with the apparatus to ensure its proper working.—Patent abandoned.

1075 G. D. HUGHES and A. H. SELLERS, Nottingham. *Safety valves.* Dated April 9, 1869.

The inventors make and attach to the boiler, externally or internally, an apparatus consisting of a casting forming a box, chamber, or hollow vessel, containing one or more valves, one of which valves they propose to make of a spherical, conical, or other suitable form, to be fitted into and supported upon a seating of similar form perfectly steam-tight when down upon the face. To this valve they attach a dead weight by means of a rod fixed to the centre of the valve, such dead weight to be so arranged that it will balance the pressure of steam upon the under surface of the valve to the pressure per square inch at which the boiler may safely be worked, or at any other lower pressure that may be required.—Patent completed.

1076 J. ASPINALL, Harrow. *Telegraph cables.* Dated April 9, 1869.

This refers to letters patent granted to C. F. Varley, dated 29th August, 1868 (No. 2,683). The invention consists in serving the ropes or cable as it comes from the spinning machine with a serving of yarn laid on in the opposite direction and with a shorter lay than that of the two strands or ropes and insulated conductor. A further improvement consists in worming the cable with a worming of yarn more elastic than the material of which the strands are composed. These wormings afford support and protection to the insulator, and make a rounder and better cable for manipulation, besides adding strength.—Patent completed.

1077 W. A. HUNTER, Southport. *Lighting street lamps.* Dated April 9, 1869.

This consists in a tube fixed upright or at an angle if required, containing a quantity of matches, and with a swivel plate, into a recess in which the lowest match in the tube drops. This swivel plate is turned partly round by a rack and pinion or other equivalent, and in turning round the match is rubbed against a rough or prepared surface to ignite the match and to bring it near to the burner. The rack or other equivalent for moving the swivel plate is connected to a rod, which is raised by water or other fluid or other power, and this rod, which is carried up inside the lamp-post, is connected by a link to the tap, which turns on or off the gas in such a manner that when the rod is raised the tap is opened, and the gas escaping from the burner comes in contact with and is ignited by the burning match.—Patent completed.

1078 T. CULPIN, Reading. *Reaping and mowing machine.* Dated April 9, 1869.

The beam is formed into a flat tube or hollow bar made of sheet steel or other metal, thereby forming a trussed beam, thus giving greater rigidity thereto with a given quantity of material.—Patent abandoned.

1079 J. A. MILLER, New York, U.S.A. *Steam boilers.* Dated April 9, 1869.

The inventor constructs steam boilers with a number of units or chambers in the form of hollow slabs having flat sides and cylindrical tops and bottoms. The sides of these hollow slabs are held together by tubes either expanded into holes made in the sides of the hollow slabs or secured in them by ferrules, or by welding or otherwise, and the ends of these hollow slabs are closed by plates. Any suitable number of these hollow slabs are set side by side, and both the water and the steam space of each of the hollow slabs is connected with the other. The frame and heat from the furnace is caused to pass round and between the hollow slab, as well as through the short tubes connecting their flat sides. By this means a large heating surface is obtained in a small space, and combustion is more complete, the gases from the furnace being continually mixed.—Patent completed.

1080 J. DENIS, Rue St. Louis, Paris. *Conical cog cutting.* Dated April 9, 1869.

This improved machine fits on to all kinds of lathes without changing their system, all that is necessary being to make the face plate of the lathe to divide at its upper part, and to fit it with a movable index to indicate the required division. The cog-wheel to be divided being turned without displacing it from above the lathe, it is fixed to the face plate, so that it follows all the movements of the latter. The tool which has served to turn the toothing is then removed from the slide; the tool holder is substituted in a vertical position with the tool, which exactly forms the space intended to be left between the cogs placed in the mortice of the vertical shaft of the cutting machine. The index being on the desired division, the band is passed over the shaft pulley to give motion to the shaft, which should make from 2,800 to 3,000 revolutions a minute. The tool is advanced so as to make the tooth at a single pass or traverse. Being on the required division, the tool is made to travel parallelly to the toothing by means of the slide crank. Directly the pass is made, the face plate is turned (as also the cog-wheel to be cut, it being fixed to the face plate) until the desired point is facing the index, and the tool is brought back, making its pass quite as easily as in advancing. In many cases, to shorten the work, the slide screw may be removed, and the tool run by hand.—Patent completed.

1081 R. J. MORISON, Mark-lane, E.C. *Bale presses.* Dated April 9, 1869.

The base of the machine forms the bottom plate of the press, and may be placed or erected either upon the ground or upon a suitable frame. This plate has its upper surface slotted in the usual manner to receive the binding ropes, when the material compressed is to be covered or enclosed. Upon the base plate or upon the ground frame are fixed (one on each side) two vertical guide bars properly bound by means of tie bars. When the press is large two pairs of guide bars may in some cases be found advantageous.—Patent completed.

1082 R. J. COLLS and A. E. BULL, Reading. *Fastenings for boots.* Dated April 9, 1869.

The two edges of the upper which are to be secured or united for the purpose of fastening the boot are each provided with a bead or rounded edge, formed, preferably, by turning the edge of the leather over a gut or other cord. The two beaded edges are held together by a number of X-shaped fastenings of metal or other material, attached at convenient distances apart to a flexible strip prolonged at one or both ends to form a tab, by which the row of fastenings may be slid on or off the beaded edges before mentioned, for the purpose of securing or unfastening the boot, as the case may be.—Patent abandoned.

1083 J. DEWAR, Kirkcaldy. *Food and manure.* Dated April 9, 1869.

The inventor takes dreg and evaporates it by exposing it to the action of heat applied directly or through the medium of hot air until he obtains the residuum therefrom in a dry state. This residuum may be used either broken into pieces or reduced to meal or powder, and may be given for food either alone or mixed with other vegetable matters, and when so treated and used it is found to form a very nutritious article of food.—Patent completed.

1084 C. J. F. CAMPBELL, Camberwell. *Hanging pictures.* Dated April 9, 1869.

To the back of the picture or looking glass frame a metal plate is screwed, which has a projecting tongue with a hole or eye in it. A staple is driven into the wall, and has a circular peg cast on and forming part of it, and fitting the hole or eye in the tongue piece. When the picture is to be hung, the hole in the projecting tongue of the metal plate is passed over the circular peg on the staple.—Patent abandoned.

1085 C. LUNGLEY, Greenwich. *Removing deposit from flues.* Dated April 9, 1869.

This apparatus consists of a pipe to be worked to and fro in the tubes, flues, or passages, by hand or mechanical means. The pipe is supplied with steam, air, or liquid under pressure from a generator or reservoir. The action of the steam, air, or liquid against the soot or deposit in tube or passage causes it to fall away from the sides, and the force of the current drives it out of the tubes or flues. Sometimes the inventor fits a cap over the end of the pipe, and in this case he perforates the pipes with holes either straight or diagonally in any direction, or he perforates the cap, through the holes or perforations in which the steam, air, or liquid is caused to pass and impinge against soot or deposit for the same purpose.—Patent completed.

1086 W. W. HOOPER, Bow, and J. D. HOOPER, Woodford. *Vehicles.* Dated April 9, 1869.

The inventors connect a lever with the axle of the driving wheel or to a wheel so placed that it may be connected with the driving wheel to multiply its revolutions. The lever is made to act on the wheel with which it is connected by means of a pawl furnished with or without lugs, projections, or claws, which are caused to impinge against or grip a flange or ring on the wheel, axle, or spindle, in one course of their stroke, and to escape or be released on their return stroke. Springs are employed in connection with the levers and pawls to ensure their proper working.—Patent completed.

1087 W. E. NEWTON, Chancery-lane. *Obtaining motive power.* (A communication.) Dated April 9, 1869.

The object of this invention is to dispense with the treadle and crank usually employed for driving light machinery, such, for instance, as sewing machines. In such an instance, the sewing machine is secured as usual on an elevated table, and this is mounted on the upper end of a vibrating lever frame, which is capable of rocking on centres below, and is connected with a system of parallel levers, which are also capable of rocking on centres. The seat of the operator is placed on the rocking levers, so that the whole machine may be vibrated or rocked to and fro like an ordinary rocking chair. The sewing machine is worked by the force of a coiled spring contained in a barrel, which is placed under the table, and is connected to the sewing machine above by suitable gearing as in ordinary machines which are actuated by a treadle.—Patent abandoned.

1088 A. V. NEWTON, Chancery-lane. *Rotary engines and pumps.* (A communication.) Dated April 9, 1869.

This relates to engines or motors formed of two cylinders, one within and eccentric to the other, and provided with sliding pistons having a radial relationship to the inner cylinder, and working within and against the outer one, which is stationary, while the inner eccentric revolves with the pistons. The invention consists in the combination with those parts of one or more loose rings arranged within the inner cylinder and clipped by the inner ends or portions of the sliding pistons, which are thus connected in a free and independent manner to work in unison with each other and in close but free contact with the stationary outer cylinder, the loose ring or rings being kept concentric with the outer cylinder by means of the pistons, and the latter being kept in contact with the outer cylinder by means of the ring or rings. This combination and arrangement of the parts admits of the main shaft, which is connected with the inner cylinder and concentric thereto, being extended if desired through both cylinders.—Patent completed.

1089 T. H. BLAMIRES, Huddersfield. *Vote receiver and indicator.* Dated April 9, 1869.

According to this invention votes are received and registered by means of movable indexes such as are now used for counting the strokes made by the piston of a steam engine or in gas meters for registering the quantity of gas passed through, or by other similar indicating apparatus, which is actuated by the voter by means of levers either by his hand or foot or by a turnstile. The apparatus is carefully arranged, so that the voter can only give the correct number of votes.—Patent abandoned.

1090 W. R. LAKE, Southampton-buildings, Chancery-lane. *Waterproofing fabrics.* (A communication.) Dated April 9, 1869.

The inventor prepares a solution of paraffin by dissolving paraffin in pure naphtha, that is to say, naphtha free from any oily or greasy matter, or which will not stain letter paper when dipped into it and dried. The paraffin should be cut into small pieces and put into the naphtha in an easily and tightly closed vessel, and should then be well shaken or agitated. In this way a saturated cold solution may be quickly obtained without the use of heat. It is best to use an excess of paraffin in the naphtha, so as to have a saturated solution at about 70deg. of Fah. Into this solution the fabric is to be immersed.—Patent completed.

1091 P. JENSEN, Chiswell-street, Finsbury. *Pumps and syphons.* (A communication.) Dated April 9, 1869.

This consists in application of a jet of steam for the purpose of exhausting the air contained or accumulating in syphons, and in the bodies and pipes of centrifugal or other pumps.—Patent completed.

1092 H. W. LOBB, Sackville-street. *Velocipedes.* Dated April 10, 1869.

This velocipede is constructed with two wheels of large diameter formed of iron, or iron in combination with other material, and connected by a transverse axle, on the ends of which the wheels are respectively mounted so as to be free to revolve. The axle is bent in a backward direction somewhat in the form of a double crank. A bar of T-iron passes through or is attached vertically to the centre of the axle; this bar is curved, and the upper part provided with a wooden back furnished with a suitable padding for the support of the shoulders of the velocipedist.—Patent abandoned.

1093 S. F. VAN CHOATE, Boston. *Firearms.* Dated April 10, 1869.

In this arm the breech frame may be made integral with the barrel, although it is preferred to make it separate from the barrel, which is then screwed into the front end of the breech frame. From the end of the barrel, which is properly bored to receive flanged metallic cartridge sheets, the breech frame is slotted to its rear, the slot opening at the top of the frame and having straight parallel vertical sides and a concave bottom concentric with the axis of the barrel. At the rear of the frame the bottom of the slot is formed with a large radius to receive the recoil block or cam by which the breech-piece is locked and unlocked, the breech-piece being of such shape as to fill the slot in the breech frame.—Patent completed.

1094 E. BRASIER, New Cross, and J. E. HODGKIN, West Derby. *Flax cleaning.* Dated April 10, 1869.

In place of fixing wooden blades to iron or wooden radial arms to form the scutching blades of a radial scutching wheel, the inventors form such scutching blades in one piece of wood. By means of bolts they secure the improved scutching blades to a central boss, which they prefer to form of cast iron or other metal. The bosses are secured upon the axis, which revolves in bearings formed in suitable supports.—Patent completed.

1095 W. SMITH, Heywood, Lancashire. *Looms.* Dated April 10, 1869.

This consists in the application of a counter-acting tappet acting on the spring of the lever for putting in the wires.—Patent abandoned.

1096 H. A. BONNEVILLE, Sackville-street, W. *Sewing machines.* (A communication.) Dated April 10, 1869.

This consists, first, in making the needle bar and the presser slide either or both in the form of tubes closed below so as to prevent the oil used in lubricating the same from falling on the table and spoiling the work. Second, in the combination of a common holding plate or screw with the guide rods of the tubular needle bar and the tubular presser slide in such a manner that the operation of fastening the guide rods in position is materially facilitated; and, third, in making the guide rods of the tubular needle bar and of the tubular presser slide hollow, so that the air is allowed to pass in and out of the slides during their descent and ascent on the guide rods, and so that room is obtained for adjusting and operating various attachments for making different seams and fancy stitches.—Patent completed.

1097 W. ASHTON and J. H. STOREY, Manchester. *Ascertaining duty of steam engines.* Dated April 10, 1869.

A comparatively small cylinder is fitted with a piston, and is connected with the cylinder of the steam engine in such a manner as to allow the piston to be acted upon by the pressure of the steam or by the force due to the continued action of steam and of a partial vacuum at the same times and to the same degree in proportion to its area as the piston of the steam engine. The piston rod of the indicator is connected with a spiral spring, which controls the action of the indicator piston, the said spring resisting the movement of the said piston in either direction from the position of equilibrium, which is at about the centre of the cylinder, the spring being made about proportionate to the area of the piston and to the pressure acting thereon. On the piston rod is mounted a friction wheel or pinion, to which a variable rotary motion is imparted during the working of the engine by a disc, the surface of which is in contact with the circumference of the said friction wheel. The disc is caused to rotate alternately in opposite directions, the rotation being derived from the engine similarly as in the case of the barrel of the ordinary indicator, or in any suitable manner, the disc rotating to a suitable extent in one direction during the forward or upward stroke of the piston of the engine, and in the reverse direction during the return stroke thereof.—Patent completed.

1098 J. HYNAM, Deptford. *Crucibles.* Dated April 10, 1869.

This relates to means of gradually altering the position of the crucible relatively to that of the shaping tool while the crucible is being shaped, and of regulating or adjusting the apparatus to make crucibles of various sizes. For this purpose the inventor connects the revolving table or lathe which carries the mould frame and moulds to a lower frame, which is pivoted or hinged at one end, and is free to be moved in the arc of a circle like a wicket or gate. Adjustable stops regulate the distance to which this frame can be moved. The plastic material having been put in the mould, the tool placed therein, and rotary motion imparted to the revolving table and mould, the lower frame is gradually moved on its pivot with the revolving table and mould so as to bring the circumference of the mould gradually nearer the tool until the desired position is reached, which position is regulated by the adjustable stop according to the required size of the crucible.—Patent completed.

1099 J. M. HETHERINGTON, Manchester. *Combing cotton.* Dated April 10, 1869.

This consists in causing the backward motion of the rollers which convey the tufts to exceed one half of their forward movement.—Patent completed.

1100 J. B. SPENCE, Manchester. *Treating cast iron.* Dated April 10, 1869.

This consists in a method of using the salts whereby the decomposition is, to a certain extent, retarded. For

this purpose, the nitrate of soda or other salt is brought into a more or less solid body before the melted iron is allowed access to it.—Patent completed.

1101 P. HEADRIDGE, Lime Grove, Manchester. *Dentistry.* Dated April 10, 1869.

The upper and lower maxillary is expanded by a sectional base or plate. This sectional base or plate can be made of vulcanite, gold, or other materials. These sections are united by a spring or springs. The upper maxillary is expanded by means of a sectional base or plate covering the palate and back teeth. This sectional base or plate meets on the median line of the maxillary. Situated interiorally are two shoulders on the base near to the grinding surface of the teeth on each side to receive and hold a spring that fits close to the base. When put in the mouth, the spring exerts pressure against the sides, causing the upper maxillary to open in the centre, at the same time opening the nasal cavities.—Patent completed.

1102 D. B. PEEBLES, Edinburgh. *Gas meters.* Dated April 10, 1869.

This consists, first, in uniting the parts of gas meter castings of sheet iron by means of grooves and tongue joints. Second, in making the snugs for the fastening screws with guard flanges. And third, in applying a separate cover with details in connection with it over the crank spindle of a dry meter.—Patent completed.

1103 E. C. C. STANFORD, Glasgow. *Deodorising sewage.* Dated April 10, 1869.

The inventor employs instead of earth some kind of charcoal. He prefers seaweed charcoal on account of its high absorptive power and its cheapness, but any other charcoal may be used. Of this material only one-fourth the quantity as compared with earth is required. He finds 12cwt. of charcoal per annum to be sufficient for each closet when used by six persons, so that the total quantity to be removed does not exceed the house ashes. The mixed product from the closets is perfectly black and inodorous, so that it can be allowed to fall at once from the closet through a 12in. drain pipe directly into a small watertight cesspit built of brick and cement in the basement of the house, from whence it need be removed only once a year. One cartload or 24cwt. per annum is the produce of each closet. The charcoal to be used in the closets is in a granular form and is used in the same way as the earth in the ordinary dry closet, and with the aid of the same or similar appliances or apparatus. —Patent completed.

1104 G. HAWORTH, H. HAUGHTON, and R. GIBBONS, Blackburn. *Consuming smoke.* Dated April 10, 1869.

The inventors construct the bridge with an elongated opening therein. This opening is covered by a damper plate, to which is attached a rod supported by a crossbar at each end thereof, which extends from the damper plate to near the front of the flue. To the front end of the rod is attached an arm so constructed that, on the furnace door being opened, the damper plate is drawn from the opening in the bridge, and admits the cold air to the flue by way of such opening instead of direct to the fire during the operation of firing.—Patent abandoned.

1105 O. VIVIER, Sekforde-street, E.C. *Escapement for watches.* Dated April 10, 1869.

Instead of employing a large number of teeth and pins in the scape wheel (fifteen) as heretofore, the inventor forms such scape wheel with five or a less number of teeth (three by preference), and with a similar number of pins to give the impulse to the finger on the axis of the balance wheel, such finger being considerably larger in proportion to the scape wheel than has hitherto been the case. This arrangement requires an intermediate wheel connected with the scape wheel.—Patent completed.

1106 J. H. JOHNSON, Lincoln's Inn-fields. *Removing hair from skins.* (A communication.) Dated April 10, 1869.

This consists essentially in the employment of thin flexible straight blades, which are sprung into helicoidal grooves or seats made in the surface of the carrying drum or cylinder, and which are held in position by means of bolts and counter plates.—Patent abandoned.

1107 J. PARRY and R. MORRIS, Llanberis, Carnarvonshire. *Saws for metal.* Dated April 10, 1869.

This improved saw consists of three separate plates of iron forming the saw disc, riveted or otherwise fixed together. In the middle of these plates grooves are cut for the purpose of fixing in the steel cutters, which are held tight in their proper position by springs attached to the side of the saw or by other means.—Patent completed.

1108 E. T. HUGHES, Chancery-lane. *Improved stitch.* (A communication.) Dated April 10, 1869.

This consists in passing the needle and its thread through the under layer or thickness, partially through the upper layer or thickness, and out through the under layer or thickness, forming a stitch either by a chain made from the needle thread or by the interlacing of a second thread.—Patent completed.

1109 W. MARTIN, Manchester. *Shipbuilding.* Dated April 10, 1869.

The inventor forms the body of the ship or vessel of two parts or shells, both watertight at the bottom and sides, and fits the upper part into the lower one, and afterwards fixes the parts together by clamps, bolts, wedges, or by any of the well-known means of keeping large bodies together. The lower part holds the ballast engine and boilers, the fuel, and the bulk of the heavy merchandise; and, in the upper part, the cabins of the passengers and compartments for the mails, specie, and the more valuable part of the cargo are formed.—Patent abandoned.

1110 L. J. CROSSLEY and R. HANSON, Halifax. *Steam and air valves.* Dated April 10, 1869.

To an ordinary equilibrium valve the inventors preferably apply a cylindrical or other formed chamber, through which the valve rod passes. This chamber is constructed so as to form an annular reservoir for containing a column of mercury of suitable height, according to the amount of reduction required to be made in the pressure of the fluid to be discharged.—Patent abandoned.

1111 J. WADSWORTH, Manchester. *Lighting fires and economising fuel.* Dated April 10, 1869.

This consists in constructing an open-ended sheet or cast iron casing of any suitable shape having holes formed near its lower end, through which a portion of the clips used for lighting the fire are passed, so as to form a grid or support for other clips or other igniting materials, upon which the coals are placed, such coals being used by preference in small pieces. The inventor also forms other holes or slots in the casing for the admission of air.—Patent completed.

1112 D. JOHNSON, Wrexham. *Manufacturing flour.* Dated April 10, 1869.

This consists, first, in cutting the grain into thin slices or small pieces before reducing it to flour. Second, in the peculiar arrangement of a series of rotating knives or blades within a drum or case, which knives divide the grain into thin slices as they fall through a hopper. Third, in the peculiar arrangement of a series of reciprocating knives working above a horizontal disc, whereon the wheat or other grain is fed by a suitable hopper, this disc carrying the grain under the knives, which chop it into small pieces. Fourth, in the arrangement of rollers to work with their peripheries moving together to reduce the wheat or other grain, or portions of wheat or other grain, to flour, one of the rollers being made to run quicker than the other.—Patent completed.

1113 J. H. DALES and J. F. MAYGROVE, Wood-street E.C. *Looms.* Dated April 10, 1869.

A warp thread is passed between each of the dents of the reed, entirely across the same, in the usual manner. Below this warp foundation the inventors place a second row of warp threads, about forty or fifty in number, more or less arranged in two sets of equal number, one on either side of the centre of the piece. These two sets of threads constitute a second warp or warps, through which and through the opposite half of the upper warp, the weft threads are caused to pass alternately, the other half of the upper warp being raised clear of the shuttle until the next stroke by the jacquard or other suitable apparatus.—Patent completed.

1114 A. M. CLARK, Chancery lane. *Fountain pens.* (A communication.) Dated April 10, 1869.

The ink is contained in a tube of india-rubber or other elastic or flexible material. This tube is filled by doubling and squeezing it together so as to eject the air, the ink in which it is dipped being at once taken up by reason of the vacuum thus produced. This ink tube is enclosed in the case which constitutes the penholder.—Patent abandoned.

1115 W. CROMBLEHOLME, Manchester. *Automatic registrar.* Dated April 12, 1869.

This automatic registrar, which is described as applied to omnibuses, consists of two dials with registering fingers, the one for inside and the other for outside passengers. Each dial has one or more index fingers, which are actuated by a footboard, placed in the floor of the omnibus or on the steps. The footboard is connected by links and levers to a catch acting on a ratchet wheel, and this ratchet wheel is moved one tooth by every passenger entering into and going out of the omnibus. A second ratchet wheel is placed near the first, but having teeth in the opposite direction. This second ratchet wheel has a retaining catch and toothed break, and is to prevent the first one moving more than one tooth at a time.—Patent abandoned.

1116 E. D. TEMPLE, King William-street. *Railway signals.* Dated April 12, 1869.

This consists, first, in constructing railway semaphore signals of wrought-iron tubes of convenient lengths, bent or otherwise, and suitably connected by wrought or cast iron connecting joints and bearing plates. Second, in tying the tubes firmly together by means of one or more wire or other ropes, which may be fixed externally to the tubes or passed through the tubes themselves and subjected to any required degree of tension by means of a small wheel and ratchet or other suitable apparatus worked by a lever or otherwise, by which any lateral weakness of the signal is effectually counteracted. Third, in employing the arms of the semaphore signals for indicating the names of adjacent stations or giving any similar short notice of a permanent kind.—Patent abandoned.

1117 J. KIRK, Woolwich. *Cabs and carriages.* Dated April 12, 1869.

This consists in enclosing the footboard with side doors and front rails to receive the sides and front of the hood, which shuts down upon them.—Patent completed.

1118 S. F. SHORE, Uttoxeter. *Moving railway carriages.* Dated April 12, 1869.

This relates to an arrangement by which railway carriages may be moved short distances without the use of animal power, and the invention consists in attaching to each carriage a toothed wheel provided with a handle or crank, such wheel taking into a pinion on a shaft which works in suitable bearings beneath the carriage. This shaft is provided with a worm or screw gearing with a toothed wheel usually horizontal which gears with another toothed wheel on the axle of two of the wheels of the carriage, truck, or vehicle.—Patent abandoned.

1119 J. EASTON, Taunton. *Drop drills.* (A communication.) Dated April 12, 1869.

These drills are preferably made in three parts, the middle part being an oval casting forming a double bearing for the lever, and terminating in two sockets at opposite ends thereof to receive two prolongations which are held in place by keys.—Patent completed.

1120 W. R. LAKE, Southampton-buildings. *New railway.* (A communication.) Dated April 12, 1869.

The way consists of a line of vertical columns or pillars, which may be constructed of iron, stone, or wood. The columns project above the ground upon which they are erected from five to eight feet, and are placed at intervals of from eight to ten feet or more. The columns are connected by rails fastened therein at different heights. The main or vertical rail passes along the tops of the columns, and is designed to support the entire load of the train; this main rail is constructed of two single rails connected together, while the supplementary rails for preserving the balance of the carriages and for other purposes, are placed beneath the minor rail.—Patent abandoned.

1121 E. BEANS, Cordwalles. *Brewing.* Dated April 12, 1869.

This consists in the application and use of neutral or monosulphites of calcium, magnesium, aluminium, and ammonium, such as malt or sugar, or they may be mixed with the water added to them, either before their entrance into the mash tun, during the process of mashing, or during the process of boiling the wort with the hops, but, by preference, the inventor operates with them during the washing process.—Patent completed.

1122 A. D'AZAMBUJA, Joinville-le-Pont, France. *Felted fabrics.* Dated April 12, 1869.

On a table or like surface the inventor places a piece of canvas, and spreads hair cloth thereon, over which he extends one or more layers of animal hair, and thereon he places another layer of hair cloth, and he then spreads over all a second piece of canvas. He sews or otherwise attaches the two pieces of hair cloth together at all their edges, so that the layers of animal hair are enclosed therein.—Patent completed.

1123 H. BROWNE, Liverpool. *Velocipedes.* Dated April 13, 1869.

The front or driving wheel is made in the ordinary manner, having a fixed axle or spindle in the nave. This axle or spindle works in a bush of the following description:—This bush is made, by preference, of brass (but may be made of other metal), and is formed of a cylindrical piece, having collars projecting at both ends on the outside. Inside the cylinders or bush there is a small flange or projection at the side nearest the crank, and working into this cylinder there are a series of rollers which are fitted to work into two washers, one on the outside nearest the crank, and one on the inside or side nearest the nave.—Patent abandoned.

1124 C. D. ABEL, Southampton-buildings. *Aerial navigation.* (A communication.) Dated April 13, 1869.

This consists in constructing a narrow platform, to each side of which are hinged wings of a form approximating to a quadrant of a circle, constructed of a light but strong framing of wood, the surface inside which is filled in with thin louvre boards, laths, or staves.—Patent abandoned.

1125 S. HOLMAN, Laurence Pountney-lane. *Velocipedes.* Dated April 13, 1869.

The front wheel is provided with an axle, which may be either fixed in the boss or nave of the wheel, or be so made that the wheel will rotate without the axle revolving.—Patent abandoned.

1126 T. F. CASHIN, Gresham House, E.C. *Railway signals.* Dated April 13, 1869.

To the standard of the switch lever for which letters patent (No. 3,128) were granted to the same inventor the 13th of October, 1868, he now proposes to attach an upright rod or pipe mounted on a pivot, and passing through a bracket or arm projecting from the standard at any required height. At the top of this rod a lamp with two discs is fixed, and a light with a plummet dropped inside the pipe, so that the lamp may turn without the light necessarily turning.—Patent abandoned.

1127 T. B. BURNS, Camelford. *Cases for breech-loaders.* Dated April 13, 1869.

The inventor forms that portion of the case for containing the ammunition of a very thin case or shell of metal, by preference, of or about the 32nd part of an inch in thickness. By this means, the case when inserted in the breech piece of the firearm imperceptibly decreases the size of the breech end of the bore. The ammunition can be readily introduced from the muzzle if desired, or when the case is loaded in the hand, the charge when inserted in the breech as nearly as may be fills up the bore.—Patent abandoned.

1128 W. BROCK, Glasgow. *Slide valves.* Dated April 13, 1869.

This consists mainly in a peculiar form of slide valve in combination with another valve or plate, and so arranged that a very large area for steam admission is obtained with a very short travel of valve, whilst the plate is also made to answer the purpose amongst others of a supplementary or starting valve, with the additional advantage that the attendant cannot through carelessness blow steam through into the exhaust pipe, as with the ordinary arrangement of starting valves.—Patent completed.

1129 J. ROBERTS, Birmingham. *Fire draw plates.* Dated April 13, 1869.

The inventor makes the draw plate of a sheet of metal of a breadth somewhat greater than the length of the firebars and of a length about double its breadth. He bends this plate near its middle to nearly a right angle, and also bends it near its end to nearly a right angle, the bending in the latter case, being in a different direction to that in the former. The plate of metal thus bent constitutes a draw plate, which, when placed upon an ordinary oven grate, completely covers the top of the fireplace, the chimney hole, and the upper part of the firebars.—Patent abandoned.

1130 C. TURNER, Southampton. *Cowls for chimneys.* Dated April 13, 1869.

The inventor mounts a cowl (preferably bell-shaped) so as to oscillate on a central pivot fixed inside the top of the cowl. This pivot is tapered to a point, which is received in a conical socket placed above the centre of the chimney in suitable supports. The cowl in this manner is so nicely balanced that the slightest breeze will incline the windward side of the cowl against the chimney top, and prevent all down draught at the same time that the smoke is free to escape at the opposite direction.—Patent completed.

1131 B. J. B. MILLS, Southampton-buildings. *Boots and shoes.* (A communication.) Dated April 13, 1869.

In the machinery for the manufacture of boots and shoes, according to the inventor, the looping and feeding mechanism and the cast-off (which is employed to prevent the hooked needle from catching the same loop a second time) may all be constructed and arranged in any manner which is usual in machines of the same class in which a waxed thread is used and a chain stitch made, or in any other proper way. For manufacturing simple turned shoes without welts, the upper leather and sole are applied inside out to a last, which is preferably chamfered or grooved around the margin of its bottom to afford room for the hooked end of a bar, which, extending around the edge of the sole, bears against that face thereof which is next the last, and serves in conjunction with a vibrating bar, whose end bears against the outer face of the sole or against the upper leather over the sole, to clamp the sole firmly near its edge for the purpose of holding it in proper position horizontally, and, in some classes of work, to bend the sole at the time and place of stitching in such a manner that a straight needle may be made to dip into the sole and pass out on the same side or surface at which it enters, and then through the upper leather without passing through the entire thickness of the sole.—Patent completed.

1132 R. E. and C. MARSHALL, Cheltenham. *Distributing fumigating matter.* Dated April 13, 1869.

The apparatus consists of a frame mounted upon wheels. One of the wheels is adjustable on the axle for the purpose hereafter explained. This wheel can be put in com-

munication with a toothed wheel on the axle, which wheel is made to gear with a pinion on a shaft or spindle supported in bearings attached to the frame. This spindle also carries a band wheel, over which a band is passed. The band leads to a pulley or band wheel on the axle of a fan or blower fitted inside a casing attached to the frame. The frame is surmounted by a vessel, into which tobacco or other fumigating medium is placed. The lower part of this vessel leads by means of a tube to the fan or blower. —Patent completed.

1133 W. GILLESPIE, Coupland-terrace, Plumstead. *Furnace bars.* Dated April 13, 1869.

This consists in causing the firebars to rotate on their respective axes all in one direction simultaneously for the purpose of breaking up or disturbing the fuel thereon, and conducting it gradually from the mouth or entrance by which it is fed into the furnace so that the green fuel shall be carried towards the bridge of the furnace, at which part, the fuel being in a highly incandescent state, the gases evolved from the green fuel near the mouth of the furnace as they pass over the incandescent portion of the fire shall be consumed, and smoke prevented or very considerably lessened, and fuel economised.—Patent completed.

1134 W. E. NEWTON, Chancery-lane. *Railroad joints.* (A communication.) Dated April 13, 1869.

This consists in connecting the ends of the rails by a tongue and groove, and by a stay and side rail for breaking the joint, and to assist in resisting the tread of the wheels.—Patent completed.

1135 A. V. NEWTON, Chancery-lane. *Fan blower.* (A communication.) Dated April 13, 1869.

This consists in arranging a series of diaphragms within a number of cases or shells, in which a series of fans attached to a rotating shaft are provided.—Patent completed.

1136 J. H. JOHNSON, Lincoln's Inn-fields. *Manufacture of telegraph wire.* (A communication.) Dated April 13, 1869.

The various parts of the machine are so arranged and operated as that the sheathing, originally in the form of a flat ribbon, shall be first bent longitudinally into the form of a trough by passing between a pair of revolving die wheels made with concave and convex edges respectively. These wheels revolve not only on their own axis, but round the wire to be sheathed, which passes along in company with the sheathing through a hollow revolving shaft carrying a face plate and pair of jaws, one of such jaws being grooved for the passage of the trough-shaped sheathing and wire enclosed therein.—Patent completed.

1137 F. ERSKINE, Manchester. *Firebars.* Dated April 13, 1869.

This consists in forming the firebars with a vertical projection from that end of the firebar nearest the firebridge of such height as to come to a level with the top of the firebridge. These vertical projections are made so that there will be open vertical spaces between them from the under side of the firebar to the top of the projections, through which air can ascend and get heated, and, in its progress, meet the products of combustion at the firebridge.—Patent completed.

1138 J. H. JOHNSON, Lincoln's Inn-fields. *Dental wash.* (A communication.) Dated April 13, 1869.

The composition of this wash is as follows:—Essential oil of badiane or star aniseed, by measure, 2,000 parts; ditto French peppermint, 1,800 parts; ditto English peppermint, 0·350 parts; ditto of roses, 0·125 parts; ditto of cloves, 0·125 parts; alcohol of 40deg. of strength, 15·000 parts; ditto 53deg. of strength, 119,000 parts. The essential oils are to be mixed together, and the mixture is then to be added to the proportion of alcohol above mentioned. The desired tint may be imparted to the mixture by the aid of cochineal, and the whole is to be filtered, after which it will be ready for use.—Patent completed.

1139 M. SAMUELSON and C. ESKRETT, Kingston-on-Hull. *Expressing oil.* Dated April 13, 1869.

The inventors employ a metallic envelope composed of two separate corrugated plates of wrought iron, copper, or other ductile metal, backed by a wrought-iron frame and plate. The upper plate of the envelope is firmly fitted into and secured in the box of the hydraulic press. The bottom plate is loose and slides into a recess in a filling plate, which is free to work up and down in the press box, the bottom plate being provided with a handle for the purpose of sliding it into and out of the recess in the filling plate.—Patent abandoned.

1140 J. LEECHMAN, Hammersmith. *Steam engines.* (A communication.) Dated April 13, 1869.

This invention relates to means of transposing the motion of the piston from the rectilinear to the circular, whereby the ordinary disadvantages, such as the irregularity of motion of the piston in the cylinder or of the revolving main shaft, are obviated. It is, however, impossible to describe the improvements without reference to drawings, and readers are referred to the final specification of this invention filed by the inventor at the Great Seal Patent Office for further information.—Patent completed.

1141 E. DOWLING, St. John's Wood. *Pianoforte action.* Dated April 14, 1869.

This consists in dispensing with the ordinary back in which the adjusting screw is placed, and in applying a screw to the lower extremity of the fly, screwed through such fly in an oblique direction, in order that a button on the end of such screw may rest upon the key, and by being screwed backwards or forwards, thus alter the angle of the fly.—Patent completed.

1142 J. CHANDLER, Mile End-road. *Water waste preventors.* Dated April 14, 1869.

The invention consists of a cistern without division of the capacity of the maximum quantity of water to be contained. The apparatus may be constructed to deliver at one operation or draw. At the lower portion of the cistern is fitted an ordinary valve, communicating with the discharge nozzle or outlet. A second valve is also fitted in the cistern communicating with the source of supply, and by a lever or otherwise it is connected to the valve first mentioned.—Patent abandoned.

1143 P. A. BLAKE, Aberdeen Park, N. *Explosive compounds.* Dated April 14, 1869.

The constituents of this compound are sulphur and chlorate of potash, in the proportion of about one of sulphur to two of chlorate of potash, and the inventor calls his compound, from its properties, the safety explosive.— —Patent abandoned.

1144 A. H. BENTON, Great Queen-street. *Jointing pipes.* Dated April 14, 1869.

This consists in so constructing the ends of the pipes and the packing by which they are made tight that the internal pressure of the liquid or fluid upon the packings shall cause them to be pressed against or into contact with the internal surface of the pipes or the ends thereof, and thereby prevent leakage.—Patent abandoned.

1145 W. H. and T. HACKING and J. CHAMBERS, Bury, Lancashire. *Preparing warps.* (Partly a communication.) Dated April 14, 1869.

This consists, first, of an improved conical self-acting temple, used for the purpose of stretching the cloth to the full width of the reed; second, in the employment of one or more damping rollers, covered with flannel or other porous material for damping the warp as it passes over the back rest of the loom; third, of an improved picking motion; fourth, of an improved loose reed motion; fifth, of an improved one roller positive taking up motion.—Patent completed.

1146 G. KEIGHLEY, Burnley. *Velocipedes.* Dated April 14, 1869.

The cranks are not fixed direct to the driving wheel or its axle, but they act thereon through the intervention of some suitable mechanism (such, for instance, as the well-known "sun and planet" motion), which has the effect of increasing the speed so that the driving wheel revolves at a greater speed than the crank.—Patent abandoned.

1147 J. M'LAUCHLAN, Greenock. *Reburning charcoal.* Dated April 14, 1869.

The ingredients used in carrying out the invention are fireclay, flint, Cornish granite, felspar, Lynn sand, blue Devonshire clay, Cornish china clay, sulphate of baryta, and fired earthenware.—Patent abandoned.

1148 T. AKINSON and R. SMITH, Preston. *Distance indicators for vehicles.* Dated April 14, 1869.

The inventors apply and use a suitable box or casing fastened to the axle at a right or any other convenient angle to the traversing wheel or wheels. This casing contains a suitable train of wheels, which work by friction, each of these or every alternate wheel being covered with india rubber, gutta-percha, leather, paper, or any other suitable material to produce the necessary friction. —Patent abandoned.

1149 J. WHITLEY and S. J. PEET, Leeds. *Moulds and cones for casting metals.* Dated April 14, 1869.

The inventors employ a table in which is an opening of rectangular or other convenient form, and fitted to this opening is a plate which, when in its place, just fills the opening. This plate is arranged to be drawn down out of the opening and replaced by a screw or any convenient mechanical contrivance. The patterns having been prepared, pedestals are made to receive them; each pedestal on its upper surface corresponds in form with the base of its pattern, its sides are parallel or slightly tapered, and its bottom is flat to rest upon the movable plate of the moulding machine, to which it is fixed when in use.— Patent abandoned.

1150 B. W. FAREY, Bermondsey. *Steam engines.* Dated April 14, 1869.

In steam engines in which the steam, after having been worked in one cylinder, is caused to pass into a second cylinder as in what is known as Woolf's engine, the inventor has found that a considerable economy results from heating the steam as it passes from one cylinder to the other. This is done by causing the steam as it is conveyed from one cylinder to the other to be divided into numerous small streams by heated metal surfaces. With this object it is preferred to construct the conductor leading the steam from one cylinder to the other of cast metal plates. The plates are cast with corrugations, except at their edges or margins, where they are thicker than elsewhere, the thickness exceeding the depth of the corrugations. Each plate is planed on both sides, and in this way the edges or margins are trued, whilst on one side of the plate the tops of the corrugations are simultaneously levelled. The plates thus prepared are placed one over the other, so as to form a pile of numerous plates, and they are held together by screw bolts.—Patent completed.

1151 W. WRIGHT, Mostyn. *Treating ores.* Dated April 14, 1869.

The inventor takes any suitable ore, such as the refuse of burnt copper pyrites, and, after reducing it to powder, roasts or calcines it till all the sulphides of the metals are decomposed. He then places it into tanks fitted with suitable false bottoms, and adds weak muriatic acid and water, pumping it through until nearly all the copper is rendered soluble, it is then washed with water till all the soluble copper is washed out. The lead and silver remain behind in the ore in the form of chlorides, which are readily dissolved by brine, and are then washed out and afterwards precipitated with sulphide of sodium.— Patent abandoned.

1152 J. H. JOHNSON, Lincoln's Inn-fields. *Burning liquid hydrocarbons.* (A communication.) Dated April 14, 1869.

The apparatus consists of a gas generator or receiver, the bottom of which is provided with a manhole. A series of upper gas jets or burners is fitted into the top of the generator. Reverberating cups surround the burners, and the lower burners are fitted into the bottom of the gas generator, in order to heat it and so vaporise the oil therein. A chamber for superheating steam is used with the gas, and there is another chamber for heating atmospheric air which may be used either separately or in conjunction with the steam. These steam and air heating chambers are heated by the flame jets from the upper set of burners.—Patent completed.

1153 J. G. JENNINGS, Lambeth. *Building blocks.* Dated April 14, 1869.

The inventor prepares light metal frames, which he places in suitable moulds and charges with slate powder and pitch or other resinous matters; he then applies heat and great pressure, and so forms a solid slab. In carrying into practical effect this part of his invention, he prefers to proceed as follows:—He prepares moulds of the size of the slabs he desires to produce, such moulds consisting of strong rectangular frames jointed together at the corners, and stout top and bottom plates of a size just to enter within the frame. The slabs may conveniently be of a length of 3ft. or 4ft., of a width equal to the thickness of the wall in which they are to be used, and of a thickness of (say) 2in. or 3in.—Patent completed.

1154 T. WHITE, Birmingham. *Nut crackers.* Dated April 14, 1869.

The inventor fixes a rectangular or other shaped frame at the top of a tube. In the tube is a rack, or a screw, or a rod with a series of rings on it, the screw or ringed rod constituting a cylindrical rack. A pinion underneath the frame engages with the rack. To the axis of the pinion a handle is affixed by which the pinion may be turned and the cylindrical rack raised or lowered. The top of the rack carries a plate which, on the rising and falling of the rack, rises and falls in the frame.—Patent abandoned.

1155 W. GRADWELL, Manchester. *Steam boilers.* Dated April 14, 1869.

The inventor places a water chamber or chambers within the flue, consisting of one tube placed within another, and which he calls a case tube. Through the inner and around the outer of these tubes the products of combustion pass, and the water chamber thus formed is connected with the water in the boiler.—Patent abandoned.

1156 C. T. SWANSTON, Twickenham. *Railway trucks.* Dated April 14, 1869.

This consists in interposing ordinary carriage lock gear between the bottom of the railway truck or carriage and the under frame of the railway truck or carriage, each set of lock gear being connected with each axle and pair of wheels, as in common road carriages and waggons.—Patent completed.

1157 A. M. CLARK, Chancery-lane. *India-rubber nipples.* (A communication.) Dated April 14, 1869.

These nipples are usually made of a slightly bulbous form at one end, the other and open end being provided with a rim. These nipples are composed of several thicknesses of india-rubber, which is applied in a liquid state upon a solid mandrel or core.—Patent abandoned.

1158 C. E. BROOMAN, Fleet-street. *Burning liquid hydrocarbons.* (A communication.) Dated April 14, 1869.

This is chiefly applicable to reverberatory furnaces, and consists in causing a current of superheated air or combustible gas, or both combined, to meet the liquid hydrocarbon in a vesicular state above the sole plate of of the furnace. The hydrocarbon is spontaneously inflamed, and a great heat produced. Several applications of this principle are described.—Patent completed.

1159 C. E. BROOMAN, Fleet-street. *Motive power.* (A communication.) Dated April 14, 1869.

This consists in the use of a current of steam and air combined in order to constitute a motive power. To accomplish this a jet of steam is injected into the upright arm of a water or Barber's wheel, and draws with it a certain amount of air. The wheel works in a hermetically closed vessel furnished with valves for regulating the amount of water therein and to allow the escape of the compressed air and steam. The combined current escaping from the arms of the wheel causes its rapid revolution —Patent abandoned.

1160 H. J. WORSSAM, Wenlock-road, City-road. *Sifting machinery.* Dated April 15, 1869.

This consists in lifting casks, boxes or packages from one floor to another by means of a carriage with a tilting platform travelling up and down, being attached to and detached from a continually travelling endless chain.— —Patent completed.

1161 G. BLACK, Spittlegate, Grantham. *Agricultural drills.* Dated April 15, 1869.

This consists in substituting for the revolving barrel and cups as hitherto used rectangular boxes with reciprocating notched slide bars working in them and delivering the said grain or manure at each end of the said boxes into a pipe or tube for conducting the same to the soil or furrow in rear of the coulters. Each box is thus made to supply two drills. The reciprocating notched bars are connected to a cross bar and worked forwards and backwards by a crank, which receives its motion from the travelling wheels.—Patent abandoned.

1162 W. H. BUCK, Stretford. *Velocipedes.* Dated April 15, 1869.

This consists in attaching the ordinary crank pins to connecting rods secured to a block sliding upon a vertical slide bar having a triangular or other suitable shaped section. Upon these connecting rods the plates or rests for the feet of the driver are attached. The slide bar upon which the block slides is situated vertically between the axle of the front guide wheel and the framing supporting the upper end of such slide bar above the framing and in front of the driver, terminating in a handle, by which the vehicle is governed when in motion.—Patent abandoned.

1163 E. COOPER, Laurence Pountney-lane, E.C. *Waterproof coats.* Dated April 15, 1869.

Suppose the coat to be made of double texture, that is, of two thicknesses of material, the inventor inserts or shapes short flexible tubes or passages between them. The openings or mouths of the tubes or passages which come at the inside of the coat are just below that part of the "eye" of the sleeves that come under the arms of the wearer, and the mouths of the tubes or passages situate at the outside of the coat are about one inch more or less below the edge of the "eye" so that in a general way they are concealed from view.—Patent completed.

1164 R. HEYWORTH, Manchester. *Waterclosets.* Dated April 15, 1869.

First, instead of placing the escape-valve of the watercloset at the bottom of the basin and above the stench trays, the inventor places it at the outlet end of the trays and works it by a lever connected to the ordinary handle, the lever releasing the water-valve or tap for allowing a fresh supply of water when the escape valve is opened. Second, for opening by self-acting means the escape valve and water supply valve when the door of the apartment containing the closet is opened from the inside only. The inventor places in the box or frame containing the ordinary latch or fastener a desirable lever connected to a knob inside the door, and places in a guide at the top of the box a rod having its bottom close to the latch and near the end a cross-piece for the double lever to act upon. —Patent abandoned.

1165 A. W. C. WILLIAMS, Bridgeport, U.S.A. *Bottles and jars.* Dated April 15, 1869.

The bottle or jar is constructed with an exterior flange or shoulder surrounding the aperture or mouth, and within this flange is a vertical rim or collar. Around or over this collar the inventor places a flat ring of india-rubber or other elastic material, which lies upon the flange, and immediately under the latter is a groove or channel

The groove is formed to receive a metal ring, which is made in two halves to allow it to be placed in this groove around the neck of the bottle or jar.—Patent completed.

1166 F. J. BRAMWELL, Great George-street, S.W. *Steam engines.* Dated April 15, 1869.

The inventor combines with steam engines condensing apparatus by which the whole or a portion of the steam which has been employed in the engines is turned into water so that the boilers are fed entirely or in part by such condensed steam, thus dispensing with the bringing to the engine of so much water as is equivalent to that arising from the condensed steam, and ensuring the supply of the boiler with pure water to the extent of the water produced from the condensation of the steam.—Patent completed.

1167 J. VIVIAN, Falmouth. *Engines and pumps for mining.* Dated April 15, 1869.

This consists, first, in fitting two pistons in one cylinder; these are driven outwards by the action of steam admitted to the cylinder at or about the middle of its length. The rods of each piston are connected to vertical arms of rocking frames free to oscillate on arms or axles. The inner ends of the rocking frames are jointed to a cross head or coupling plate or plates capable of having an up-and-down movement imparted to it on a guide rod or bar. This crosshead supports the ropes or rods by which the plungers are worked. When the steam has driven the pistons the full length of their stroke the exhaust leading to the condenser is opened, whereby a vacuum is formed. The outer air then acts upon the pistons and drives them inwards to their first positions, to be again acted upon by the steam as before mentioned.—Patent completed.

1168 A. M. CLARK, Chancery-lane. *Compasses and pen cases.* (A communication.) Dated April 15, 1869.

This consists in the adaptation of an ordinary pen nib and holder to one limb of the compass, whereby to facilitate the drawing of circles, the lines of which may be equally as fine as those made by the ordinary compass pen.—Patent abandoned.

1169 J. H. JOHNSON, Lincoln's Inn-fields. *Motive power engines.* (A communication.) Dated April 15, 1869.

This consists of a double action oscillating cylinder worked with a given amount of expansion without the aid of a slide valve. According to one arrangement the full pressure steam (supposing that to be the agent employed) is first admitted on the piston-rod side of the piston, which is of considerably smaller area than the opposite side, and after having produced its effect thereon the steam is cut off and is allowed to operate upon the under side of the piston by expansion only, when it ultimately escapes by the exhaust.—Patent completed.

1170 W. J. COWLMAN and A. DOE, New Windsor. *School desks.* Dated April 15, 1869.

The parts forming the seat and desk are each separately supported on ornamental iron standards. Rising from a common footing on the top of the desk standard is a rule-joint supporting an arm, this arm is divided into two parts working together by a rule joint. The end of the short part of the arm terminates in a plate which is fastened to the desk-board; the action of the joints and arms forms a level table, and by the inserting of a pin in the first-named joint.—Patent completed.

1171 A. K. RIDER, New York, U.S. *Steam valves and gear.* Dated April 15, 1869.

This consists in the construction of the cut-off valve with its ends oblique to the direction of the movement of the main valve, and in so applying the valve to the back of the main valve that it may work transversely thereto without interfering with the longitudinal movement of the latter valve, which has the outer orifices of its steam ports arranged obliquely to correspond with the oblique ends of the cut-off valve. This construction of the valves, seat, and ports permits the point of cutting off to be varied throughout the whole length of the stroke of the piston by the transverse movement of the cut-off valve either by hand or by the governor.—Patent completed.

1172 F. MULLINER, Northampton. *Wheeled carriages.* Dated April 16, 1869.

This consists in fixing two elliptic springs or parts of elliptic springs (commonly called "side springs") to each other and placing them longitudinally on either side of the carriage in connection with the perch.—Patent completed.

1173 The abstract of this specification will appear in a future number.

1174 F. F. WHITEHURST, Putney. *Meshing grain.* Dated April 16, 1869.

This consists, first, in a centrifugal distributor which revolves on a pivot having two branches perforated or slit on the under slide in order to feed the mash tun, or other vessel in a uniform and continuous manner so as to distribute the grain over the whole area of the tun. Second, by means of rousers working in a contrary direction, in causing the greatest amount of agitation in the tun or vessel so as to prevent the conglomeration of the grain when fed in.—Patent abandoned.

1175 R. LEGG, Owen's-row, E.C. *Twisting tobacco.* Dated April 16, 1869.

A table is furnished with a travelling band, on the advancing surface of which the tobacco is fed or laid by the attendant. An upper band or a roller may be made to press upon the tobacco as it passes along the first-mentioned band, and so far the arrangement is only a modification of the construction described in a provisional specification dated 1st October, 1868 (No. 3,013), but instead of the cord of tobacco being passed, as therein described, directly to a common flyer or winding arm, the inventor now compels it to pass between two travelling bands, by which it is consolidated without abrasion of its skin, the said bands being placed at such an angle with the direction of the cord that their surfaces may move in a course corresponding with the twist on the surface of the cord.—Patent abandoned.

1176 W. H. THICK, Kentish Town. *Fret cutting.* Dated April 16, 1869.

This consists in leading a cord from the treadle to a horizontal roller or pulley, round which it is passed several times, and in then leading it to the lower saw jaw or to a part connected therewith. In each movement of the treadle the roller or pulley makes several revolutions alternately in opposite directions, the increased motion thus obtained being imparted by the cord to the lower saw jaw, and consequently to the saw.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated October 26, 1869.

3098 J. Lockwood, Leeds. Improvements in couplings for railway engines, carriages, and waggons.

3099 W. B. Haigh, Oldham. Improvements in circular saw benches.

3100 J. S. Grierson and R. Philips, Broughton Market, Edinburgh. An improved machine or apparatus for bronzing, colouring, and illuminating cards and paper of all descriptions, the same being applicable to bronzing or colouring wall papers.

3101 T. Hoey, Glasgow. Improvements in fireplaces for dwellings, and in arrangements in connection therewith to promote ventilation.

3102 D. Spill, Paradise-terrace, Hackney. Improvements in the preparation and use of solvents of xyloidine, so as to render the same more suitable for industrial applications.

3103 J. P. Rennoldson, South Shields, Durham. Improvements in steam lubricators.

3104 J. Dodge, Manchester. Improvements in machinery or apparatus for forging or shaping metals.

3105 J. H. Nutt, Kingston-upon-Hull. An improved manufacture of wrappers or envelopes used in hydraulic and other presses.

3106 J. Sheldon, Southampton-buildings, Chancery-lane. Improvements in machinery for manufacturing brushes.

Dated October 27, 1869.

3107 T. Briggs, Manchester. Improvements in the manufacture of materials used for packing and other purposes.

3108 T. Dunn, Pendleton, near Manchester. Certain improvements in locomotive steam engines and railway carriages.

3109 C. Simpson, Mount-street, Grosvenor-square, Chase Side, Southgate. Improvements in the manufacture of miniature or toy bricks for the use of children for model or architectural building and for artistic or engineering purposes, together with the apparatus in connection therewith.

3110 W. A. Martin and E. Wylam, Fleet-street, City. Improvements in fuel-feeding and smoke-consuming apparatus for furnaces.

3111 A. Bowater, Sheffield. An improved machine for rolling or shaping metals.

3112 J. Holding and J. Eccles, Manchester. Improvements in looms for weaving.

3113 W. Llewellyn, Park-street, Bristol. Improvements in armour plating ships, applicable also to forts, turrets, shields, and targets.

3114 J. Wakefield, Birmingham. Improvements in the manufacture of carriage and other bolts and pins, and tyre bolts and tyre and other rivets, and in machinery to be employed in the said manufacture.

3115 O. L. Hopson, Birmingham. New or improved machinery or apparatus for reducing the diameter of wire or rods for wire drawing, and for other like purposes.

3116 T. Clark, Cheapside, City. Improved implements adapted for constructing tube wells and driving hollow piles, and in the mode of operating therewith for those purposes.

3117 H. A. Bonneville, Sackville-street, Piccadilly. An improved box for enclosing portraits and photographic cartes.

3118 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in the manufacture of sheet iron.

3119 W. A. Ross, Captain in the Royal Regiment of Artillery. Preserving the surface of iron, steel, copper, brass, and other metals or amalgams from being rusted or oxidised by exposure to water or damp air or perspiration.

3120 J. B. Elkington, Newhall-street, Birmingham. Improvements in the manufacture of copper, and in separating other metals therefrom.

Dated October 28, 1869.

3121 H. B. Barlow, Manchester. Certain improvements in knitting machines.

3122 R. Ventress, Stockton-on-Tees, Durham. Improvements in saws, and in apparatus or machinery connected therewith.

3123 J. Watson, Buchanan-street, Glasgow. Improvements in presses for compressing cotton, jute, and other materials.

3124 S. Bennett, Richmond-road, Dalston. Obtaining valuable products from the waste liquors run off from tanneries.

3125 W. Brookes, Chancery-lane. Improvements in the electro-deposition of nickel.

3126 J. W. More, Market-street, Finsbury, and J. Norman, Hoxton-square. Improvements in means or apparatus for clipping horses and other animals.

3127 G. Tubbs, Goodge-street. Improvements in turn buckles for cupboard and other doors, and in the mode of adjusting and fixing knobs or handles thereto, which improvements are also applicable to adjusting and fixing knobs or handles to lock spindles.

3128 L. P. Muirhead, Leadenhall-street, City. Improvements in apparatus for raising sunken ships and other submerged weights.

3129 F. Taylor, Romsey, Southampton. Improvements in apparatus for receiving, drying, and deodorising human excrement.

3130 N. R. Vail, Brixton, Surrey. Improvements in axles for rail and tramway carriages and vehicles.

3131 W. E. Newton, Chancery-lane. Improvements in drawing frames.

3132 S. C. Salisbury, New York, U.S.A. Improvements in steam boilers and generators.

3133 M. Clemens, Boston, Suffolk, Massachusetts, U.S.A. An improved shaft coupling.

Dated October 29, 1869.

3134 J. James, Princes-street, Stamford-street, Surrey. Improvements in apparatus for bending and jointing metallic or other sheets, so as to form boxes, cans, or other vessels.

3135 A. Knowles, Pendlebury, Lancashire. Improvements in machinery and apparatus for cutting and getting coal.

3136 W. W. Girdwood, Lea Cottages, Barking-road, Bromley. An improved gland packing, especially adapted for high temperatures, to be known as Girdwood's self-lubricating metallic elastic packing.

3137 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in coiled or volute springs.

3138 T. Taylor and J. W. Davies, Manchester. Improvements in apparatus for singeing horses.

3139 J. A. Miller, Boston, Massachusetts, U.S.A. Improvements in the construction of steam generators and surface condensers.

3140 C. D. Abel, Southampton-buildings, Chancery-lane. An improved method of, and apparatus for, moulding and casting metal columns.

3141 M., L., and E. Darnbrough, Dewsbury, Yorkshire. Improvements in lubricators for steam engines, cylinders, or other purposes where steam can be applied to melt tallow for lubrication.

3142 A. Nairn, Leith, Mid Lothian. Improvements in steam carriages for common roads.

3143 G. Burge, jun., Rochester, Kent. Improvements in the manufacture of cement.

3144 B. J. B. Mills, Southampton-buildings, Chancery-lane. Improvements in machinery for manufacturing cigars.

3145 J. H. Spencer, Aston, near Birmingham. A new or improved compound for lubricating the journals or necks and bearings of rolls, rotating shafts, and other rotating bodies.

Dated October 30, 1869.

3146 R. J. Everett, West Ham, Essex. An improved process for the manufacture of salts of ammonia from ammoniacal gas liquor.

3147 E. H. C. Monckton, Threadneedle-street, City. Improvements in electricity and means of telegraphing.

3148 J. Elce, Manchester, and W. J. Gradwell, Longsight, near Manchester. Certain improvements in machinery for spinning and doubling.

3149 O. Fahnehjelm, Chiswell-street, Finsbury-square. Improvements in cooking apparatus.

3150 C. Sacre, Manchester, and S. Perkins and W. Smellie, Gorton, Lancashire. Improvements in the manufacture of wrought-iron or malleable metal of steely quality.

3151 J. C. Mewburn, Fleet-street, City. A new or improved photographic process for preparing printing surfaces.

3152 J. C. Mewburn, Fleet-street, City. Improvements in apparatus for feeding boilers, and for raising and forcing fluids generally.

3153 W. E. Gedge, Wellington-street, Strand. A novel method of welding iron or any other metal in the manufacture of every kind of water or gas pipe, boxes for power shafts, axle boxes, tubes, coupling boxes, gun barrels, and generally of all the cylinders and cones entering into the manufacture of firearms, as also in all analogous manufactures.

3154 L. Wray, Ramsgate, Kent. Improvements in motive-power engines.

3155 A. P. Wright, Overton Villas, Brixton, Surrey. Improvements in machinery for breaking, softening, and preparing flax and other fibrous materials.

3156 R. Marsden, Tinsley Park Works, Sheffield. Improvements in pulley blocks or apparatus for raising heavy weights.

3157 T. Moore, South Stockton-on-Tees, Yorkshire, and C. A. Head, Teesdale Ironworks, Stockton-on-Tees. Improvements in apparatus for raising and lowering weights.

3158 W. B. Espeut, Southwick-street, Hyde Park. Improvements in centrifugal drying machines.

3159 A. Minton, Kossuth-terrace, Victoria Park Station. Improvements in electro-coating iron and other metals.

Dated November 1, 1869.

3160 E. de Lagillardaie, Lorient, France. Improvements in the construction of suction syphons for raising liquids and producing condensations and evaporations in vacuum.

3161 W. R. Watson and R. Murray, Glasgow. Improvements in machinery for doubling yarns or threads.

3162 B. Bianchi, Rue de Rennes, Paris. Improvements in the manufacture of cartridges suitable for mining and general purposes, and in the apparatus employed therein.

3163 J. Dewar, Kirkcaldy, Fifeshire. Improvements in the treatment and application of paper waste.

3164 J. Dewar, Kirkcaldy, Fifeshire. Improvements in the manufacture of artificial fuel.

3165 E. Ford, Oakley-street, Chelsea. Improvements in chromatic slides for cornets, trumpets, trombones, and other similar musical instruments, and in devices for operating the same.

3166 R. C. Addy, Lisburn, Antrim, Ireland. Improvements in spindles or flyers used for preparing and spinning flax, cotton, silk, wool, and other fibrous materials.

3167 J. Hargreaves and T. Robinson, Widnes, Lancashire. Improvements in the treatment of pyrites, and in obtaining products therefrom.

3168 A. Thornton, Cleckheaton, Yorkshire, and B. Senior, Heckmondwicke, Yorkshire. Improvements in carding engines or machinery for carding wool or other fibrous substances.

3169 W. Birch, Salford, Lancashire. Certain improvements applicable to sewing machines.

3170 W. and J. Jackson, Halifax, and J. Cowgill, Bradford, Yorkshire. Improved means of preventing the escape of smoke from steam boiler and other furnaces.

3171 P. Jensen, Chiswell-street, Finsbury-square. Improvements in guns for bayonet drill.

3172 B. Tower, Moreton, near Ongar, Essex. Improvements in hot air engines.

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2469	2921	2953	2971	2987	3008	3029	3047
2475	2926	2955	2972	2988	3009	3031	3048
2521	2927	2957	2973	2989	3010	3032	3019
2589	2929	2958	2974	2990	3011	3034	3050
2721	2930	2959	2975	2991	3012	3035	3051
2735	2931	2960	2976	2992	3013	3036	3052
2749	2933	2961	2977	2993	3014	3037	3053
2761	2935	2962	2978	2994	3015	3038	3054
2778	2937	2963	2979	2995	3017	3039	3056
2781	2939	2964	2980	2996	3018	3010	3057
2831	2941	2965	2981	2999	3021	3041	3058
2835	2945	2966	2982	3001	3022	3043	3059
2845	2947	2967	2983	3002	3023	3044	3060
2913	2949	2969	2984	3004	3024	3045	3061
2915	2951	2970	2986	3005	3026	3046	3062

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," November 2, 1869.

1881 T. Silver
1885 A. S. Harington
1894 W. Pidding
1896 B. Bell
1897 A. Manbre
1901 T. F. Cashin and J. Green
1903 J. Martin
1904 G. Musgrove
1907 J. C. Norman
1919 O. Zabel
1922 H. A. F. Duckham
1925 R. N. Williams
1931 A. H. Still and D. Lane
1940 W. Madders
1945 F. Wohlgemuth
1947 T. Gray
1962 E. T. Hughes
1966 B. Templar
2037 W. Bray
2046 A. P. Price
2088 W. R. Lake
2112 A. V. Newton
2268 W. E. Tilley
2323 A. Louden
2539 A. Moncrieff
2638 H. D. P. Cunningham
2673 J. Betteley
2754 J. Tarbuck and T. Burns
2831 W. Blunn and J. Wild
2834 W. and A. Kempe
2896 C. E. Spooner
2911 J. F. M. Pollock
2929 J. Frearson
2949 A. Welch
2955 T. Greenwood and J. Keats
2960 R. L. Hattersley and J. Hill
2963 M. Andrew
2978 W. Challiner
2988 C. W. Siemens
2990 E. Lane
3003 J. Mackie
3039 A. Welch
3042 J. and J. Kippax
3106 J. Sheldon

LIST OF SEALED PATENTS.

Sealed October 29, 1869.

1346 J. P. Balm and R. Newton
1349 W. Broughton and T. Steven
1350 J. Conway
1357 J. B. Nimmo
1382 A. Cocke
1386 J. E. Phillips
1395 W. Galloway
1396 W. Galloway
1441 C. D. Abel
1465 J. Timmins and J. Gayton
1475 W. Cadogan
1536 W. R. Lake
1630 A. Edlmann
1801 W. A. Lyttle
1953 M. Kennedy
2276 T. Parsons
2379 A. Turner
2434 A. Smith

Sealed November 2, 1869.

1353 P. Barry
1354 J. Shackleton
1355 S. H. Hodges
1359 D. P. Wright and C. Butler
1364 C. Topham
1366 T. Cockroft
1372 J. Tall and A. Williams
1384 C. Moore
1392 J. Tolson
1399 J. M. Hart
1403 D. and A. Posener
1405 J. Ramsbottom and T. M. Pearce
1410 W. Henderson
1415 E. S. Copeman
1425 R. F. Hoppe
1436 J. Hall
1446 L. Wray
1498 F. Kohn
1527 F. Johnson and W. Hatchman
1530 J. H. Johnson
1541 P. M'Gregor
1559 G. Perkin
1595 W. A. Gilbee
1714 W. R. Lake
1858 B. Hunt
2279 W. R. Lake
2636 R. E. Hodges
2674 S. Fox

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2756 H. Phillips
2758 D. M'Dermid
2793 E. Alexandre
2785 M. and A. D. Hopkins
2808 H. M. Nicolls
2814 W. Robertson
2827 J. J. Holden and S. J. Best
2815 J. Dodd
2832 E. Tavernier and H. W. Whitehead
2838 J. Deas and R. C. Rapier
2853 E. P. North
2866 C. E. Brooman
2878 T. Hunt
3038 J. L. Clark

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2910 A. Krupp
2927 F. Gregory
2971 D. Scattergood
2985 J. Shirt and C. Briggs

LIST OF SPECIFICATIONS PUBLISHED

For the week ending October 30, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
658	1 4	755	2 6	802	1 6	853	0 4	872	0 4	897	0 4
692	3 4	758	0 10	803	0 6	854	0 4	876	0 4	898	0 8
697	0 10	763	1 10	809	1 4	855	0 6	877	0 4	901	0 4
711	0 10	766	1 0	821	1 0	857	0 10	878	0 4	902	0 4
714	0 10	769	1 10	823	1 8	859	0 6	880	0 4	903	0 4
715	0 10	770	0 6	831	0 6	860	0 4	882	0 4	905	0 6
732	2 6	774	1 6	832	0 8	861	0 4	883	0 4	906	3 6
733	1 2	779	1 6	838	1 2	862	0 4	884	0 8	908	0 4
736	1 0	780	0 10	841	0 6	863	0 4	885	0 4	909	0 6
737	0 10	783	0 6	843	0 10	865	0 4	886	0 4	910	0 4
745	1 8	784	0 10	844	0 6	866	0 4	888	0 4	912	0 4
748	0 10	789	0 8	845	0 8	867	0 4	891	0 4	929	0 8
750	0 6	791	0 8	851	0 4	869	0 4	892	0 4	1032	0 8
752	0 10	799	0 8	852	0 4	870	0 4	894	0 4	1079	1 6
754	0 10										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 12, 1869.

IRON ARCHES.

THE adoption of cast and wrought iron arches and girders for the purposes of railway traffic was a sad blow to the hopes and expectations of the advocates of the old stone type of construction. Nevertheless, with a laudable desire to make the best of their disappointment, they comforted themselves with the idea that stone bridges would still be employed for ordinary roads, and in other situations where the limitations imposed upon the span, headway, rise, and load were not of the same stringent character. Latterly, however, these pleasing illusions have been dispelled. Bridges have been built over roads, rivers, and in other localities where their duty was not to carry locomotive traffic, and iron, either cast or wrought, has been the material selected. The recent completion of new Blackfriars Bridge affords another instance of the substitution of iron for stone, and in all probability another arch of the latter material will never throw its shadow on the waters of old Father Thames. Omitting other considerations which are foreign to the comparison, what is the chief, the fatal objection, to an arch of stone? In a word, it is the rise. It is absolutely necessary to adhere to a minimum proportion of rise to span, and this adherence becomes impossible under certain conditions of headway and traffic. Engineers are therefore compelled to seek either in another material or another principle of construction for those qualities which they fail to find in that formerly in use. It is true that in arches of iron, either cast or wrought, there is also a limit to the proportion of rise to span, but the ratio is a great deal smaller than in those of stone. Moreover, by special treatment the rise may be confined to points not very remote from the springings, and the crown of the arch be practically perfectly flat. No such a disposition is practicable with stone or brick arches. This adoption of a flat crown was very successfully carried out by Mr. Page in the construction of the present Westminster Bridge. It was effected by introducing a horizontal wrought-iron plate girder for a certain length along the crown of the arch, and bolting it to the haunching or springing segments, which are of cast iron. The span of the largest arch is 120ft., and the length of the wrought-iron girder introduced at the crown 70ft., so that the actual rise of the arch does not increase beyond a distance of 30ft. from each springing.

So far as mere span is concerned, where there is nothing to prevent the proper rise being obtained, a stone arch can bear a very favourable comparison with one of iron. The Grosvenor Bridge over the River Dee, near Chester, has a clear span of 200ft., and is the finest stone arch in existence. On the other hand, the central arch of Southwark Bridge is 240ft. in span, and, in spite of its unscientific design and distribution of material, is yet a fine specimen of cast-iron construction. Its great span and rise give it a bold outline, which unfortunately is very much marred by the bad appearance of the piers, which are little better than those supporting its neighbour of Vauxhall higher up the stream. The expectation that with the substitution of iron for stone in the construction of arches much larger spans would be reached, has not, with one or two exceptions, been fulfilled. With the exception of Southwark Bridge and another to which we shall presently allude, all the arches of the iron bridges over the Thames are inferior in span to that of the stone structure over the Dee. The truth is that the mania, if the term may be used professionally, for large spans has died out. Unless there are no other means available engineers do not advocate the employment of very large spans in ironwork. The reason is that the weight, and consequently the cost, of the superstructure increases in a very disproportionate ratio to the span. There is manifestly, therefore, a certain proportion of span and a certain number of piers—or, what is the same thing, a certain number of spans—which will fulfil the conditions of maximum economy. Colonel Kennedy was the first to reduce this principle to practice, and adopted, with one or two unavoidable exceptions, a uniform span of 60ft. for the spans of the bridges along the whole of the Bombay and Baroda line in India. There is very little doubt but that the span of 60ft. is too small, and greater economy would have resulted from adding ten or even twenty additional feet to it.

In one of the first attempts to substitute cast iron for the older material—stone—in the construction of arches, the transition or the difference was very small, and consisted solely in the adoption of a different material. The same form and the same principle of voussoirs or arch stones were retained in the building of the Sunderland Bridge, with the exception that they were formed of hollow cast iron, and bolted together through flanges cast for the purpose. This was clearly a servile imitation of what had been already accomplished with stone, and iron cannot be correctly said to have been substituted for stone until the "rib" principle came into use. Numerous arches were constructed with cast-iron ribs in which there was not the slightest attempt at accurate designing or scientific and economical distribution of material. So long as they were made strong enough, they answered their purpose thoroughly, and do so still at the present day. The difficulty of obtaining sound and reliable castings of large size induced engineers to construct arched ribs of wrought iron. The two best examples of this nature are the Victoria Bridge, carrying the railway over the Thames at Chelsea, and the magnificent structure recently inaugurated by Her Majesty at Blackfriars. Theoretically, cast iron, from its great resistance to a compressive strain, is the most suitable and economical material to employ for the construction of arches, and it might be used in that situation a great deal oftener than it is. Engineers have conceived a bad opinion of cast iron from the failures with which it has been attended in some isolated instances. At the same time they altogether overlook the important fact that these failures were due not to the unsoundness or weakness of the material itself, but were entirely owing to the circumstance of it being placed in a situation and subjected to strains for the resistance of which it was not adapted. It is very probable that, by a pardonable *esprit de corps*, engineers prefer to lay the blame of these failures upon the material rather than upon the designers. But, as we have now arrived at a more scientific period, and are, from past experience, fully enabled to form a correct estimate of what may be fairly and reasonably expected of cast iron, there is no necessity for refusing to accord to that metal the merit which unquestionably belongs to it.

There are abundance of cast-iron arches carrying the various railways over the suburban roads of our metropolis, which have done duty for twenty or thirty years, and are "as good as new." There can be no question of their strength and stability, and it is difficult to comprehend why some engineers are positively afraid to erect similar structures, but, in their place, substitute others of a more expensive character. Where the span is large and the bridge intended for railway purposes, it is a question for consideration whether wrought iron should not be used instead of cast, especially if the rolling load bears a very large proportion to the fixed weight of the bridge. But, in a bridge intended for ordinary road traffic, where the conditions of the ratio of the fixed to the rolling load are inversed, there is no valid argument against the employment of cast iron within proper limits. The rejection of cast iron in situations where it is peculiarly applicable is a piece of professional pusillanimity which has had its origin in the ignorance and incompetency of some of the members.

THE BOILER EXPLOSION ON BOARD THE "THISTLE."

ON the afternoon of the 3rd inst., a fearful and fatal accident occurred on board H.M. gun-vessel "Thistle," and which was briefly referred to by us last week. This was the bursting of one of her boilers, which resulted in the death of nearly a dozen men, and severe injury to as many more. Such an occurrence, we believe, has never before taken place on board any of her Majesty's ships of war, and it is a matter of the greatest wonder how the present calamity originated. We have heard several surmises upon the point, but pending a thorough examination and the judicial inquiry which is now taking place, we forbear comment, and simply give an outline of the circumstances of this melancholy catastrophe. The "Thistle" is a double screw composite gun-vessel of 465 tons, and 120-horse power, carrying four guns. She was the last vessel constructed at Woolwich Dockyard, and just previous to the closing of that establishment was ordered to Sheerness to fit out and get ready for sea. The "Thistle" was fitted with two pairs of engines which had formerly belonged to gunboats. She had three boilers, two of which were condensers, and the third a high pressure boiler. Steam was got up on the morning of the 3rd inst., and the vessel started on a trip to the Maplin Sands for the purpose of testing her speed over the measured mile. The greatest care appears to have been taken by Mr. W. Williamson, the chief inspector of machinery afloat, and other officers, that everything was in proper order for the trial. Not the slightest defect was perceptible in either engines or boilers, and it was thought the trial would prove more than ordinarily successful. On reaching the Sands the "Thistle" was put on the measured mile, the condensing boilers only being first used. After a series of runs with those boilers, it was determined to try the vessel's speed with the high-pressure boiler. This was accordingly done, and two runs successfully made. On turning for the third run it speedily became evident that some very serious mishap had taken place in the engine-room. Mr. Williamson, in company with Mr. Bannister, chief engineer of the factory, had gone on deck only three or four minutes—leaving Mr. William H. Roberts, the engineer in charge of the vessel, and a number of engineers, fitters, and stokers, in the engine-room—when volumes of steam and smoke rushed up the hatchways and plainly indicated the calamity. On the steam clearing away from the engine-room a descent was made, and the bodies of the dead as well as those of the injured were found just as they fell when overtaken by the destructive blast. The chief endeavour was to get the wounded living men on deck; and very opportunely a private steam tug, named the "Rescue," belonging to Gravesend, the crew of which perceived that something was amiss on board the "Thistle," ranged up alongside, and her master (Forbes) in the most praiseworthy manner conveyed the injured men to Sheerness harbour.

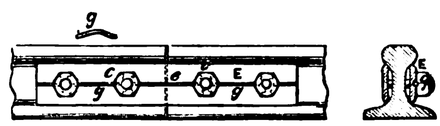
Such is the lamentable history of this catastrophe from an outside view; a record from the engine-room is given by Mr. John

Edgar, an engineering student, in the following words:—He was attending the counters, and was standing in the centre of the engine-room. Mr. Smithers was close to him, and two men, Daer and Mason, were watching the indicators. Suddenly, without any warning, and unaccompanied by noise, he found himself surrounded by what he terms a flash of white light. This was as suddenly succeeded by total darkness. He jumped, or was carried, over the starting levers, and found himself at the bottom of the hatchway ladder. In another instant he was on deck, where he lay in a fainting state. The high-pressure boiler was placed in midships between the two condensers, and an investigation has shown that one of the plates had cracked to an extent sufficient to allow the whole of the steam to escape, as it were, with one rush. The volume, having no other vent from the stokehole than by way of the engine-room and hatchway leading therefrom, instantly enveloped the whole of the unfortunate men in steam, killing or seriously injuring every one in the engine-room. These are the main facts of the case, which we leave without comment at present, except to observe that the explosion appears to be unaccountable. The manner in which it occurred was simple enough, and yet it is equally inexplicable, at least upon present information. We are told that the boiler which exploded had been tested recently under hydraulic pressure in the ordinary way up to 180lb. on the square inch, and during the trial trip it was only being worked at a pressure of 70lb., by no means an excessive pressure for a high-pressure boiler. Suddenly, without any loud report, the plates split asunder, and a volume of intensely heated steam filled the stokehole and rushed on into the engine-room, scattering death around. There remains a mystery which may be cleared up during the investigation, but at present can only be accounted for upon the hypothesis either of a lack of careful supervision or of an overstrained economy which at present obtains in certain Admiralty departments.

METHODS FOR PREVENTING THE LOOSENING OF NUTS.

A NUT that is screwed well home and never subjected to any shocks or vibration would remain in its place until it literally rusted away. The case is very different when it is exposed to incessant shaking and disturbance, and numerous have been the patents and inventions taken out to secure its immoveability under all conditions of local derangement. Obviously, the most practical example presenting itself is that of the bolts and nuts belonging to the permanent way of a railway. It is difficult to imagine an instance where a nut could be exposed to a severer trial than it undergoes in that situation. The commonest method of securing a nut is either to employ a second nut or a pin. A second nut is of no practical use whatever, for the cause that loosens one will infallibly loosen the other. A pin prevents the nut ever unscrewing to such an extent as to separate from the bolt, but has no effect in preventing its loosening. A chronological glance at the more important patents which have been obtained for the purpose under notice shows that within the last few years no less than seventeen have been taken out. This list does not include a large number which never came into practical operation, and, in fact, died as soon as they were born. Among the principles embodied in the former number, the most general are those of keys, grooves, peculiarly shaped washers and discs, and threads of different sizes and directions. The annexed cut represents one of the most recent methods, patented by M. Bouchacourt, and which consists in the employment of a grooved fishplate. There are very few railway companies who adopt any especial means of preventing the loosening of the bolts and nuts in the joints of the rails. When they are loosened they are re-tightened by hand, and the alternate operations are in constant repetition. The ordinary rail fishplate is represented in plan and section in the cut, and the method of making good the joint presents the following points of difference from that in common use. One of the plates E has a longitudinal groove *e* in it, which passes through the centres of the four bolt holes. The bolts are of the usual description, but the under or bearing surface of the nuts is provided with small radiating grooves, and the washer is dispensed with, but a pin *g* is employed, which is the special characteristic of this plan.

FIG. 1. FIG. 2.



In putting the joint together the only point to be attended to is that two of the grooves in each contiguous bolt should coincide with the groove in the fishplates, a condition readily ensured. Each pair of nuts is then ready for the introduction of the small pin *g*, which has been slightly bent to allow of its two ends being inserted at the same time in the cylindrical holes formed by the superposition of the grooves in the nuts and that in the fishplate. A blow or two of a hammer suffices to straighten the pin, and the keying of the nut is complete. The most economical manner of applying this principle is to have the groove made in the fishplate when it is manufactured, but ordinary fishplates can have it cut in them if required, although at a rather larger cost. It is also quite possible to employ this method when the fishplates have no groove, but it is evident that the keying is not so well performed or so efficient as when the key actually fits into the plate as well as the nut. When an ungrooved fishplate is used, the section of the key is rather different from that already described. It is thicker in that part which lies between the two adjoining nuts, and is fined down only at the ends. In making the nuts and fishplates the grooves could be introduced without any extra cost, so that the only increase beyond the outlay for ordinary joints would be the price of the keys and the royalty. Taking the rails at an average length of 20ft., this would amount to about £1 10s. per mile, a very trifling sum for effecting the purpose. This system of M. Bouchacourt has been tried for the last couple of years and found to answer very well. It has been very successfully applied to the railway from Paris to Lyons, as well as to other lines in various parts of the continent. Besides fixing the key in its place, it is necessary to be able to take it out. This is easily done by introducing a strong chisel or other suitable instrument between the key and the fishplate, and "prizing" it up until it assumes the bent form it had before it was inserted in its place. A fresh turn can then be given to the nuts, and the key replaced as before. Sometimes it might be requisite to use other means for undoing the joint, when that just described might not be efficacious. In that case, the nuts are turned by a spanner until they cut off the ends of the key, which then drops out. By this operation the key of course is destroyed, but the cost of replacing it is too trifling to deserve consideration.

DR. LIVINGSTONE.

THE friends of Dr. Livingstone were much gratified on Monday evening last by hearing read a long letter from our veteran explorer to the Earl of Clarendon, dated July, 1868. The letter was a long one and gave many interesting details of the great traveller's proceedings and researches. Dr. Livingstone has also written to Sir Roderick Murchison, and from these combined communications we learn that Dr. Livingstone has traced a chain of lakes, connected by rivers, from the tracts south of the Lake Tanganyika to south lat. 10deg. to 12deg., and he conjectures that these numerous connected lakes and rivers are the ultimate southern sources of the Nile. When he wrote he was about to travel northwards to Ujiji, on the eastern shore of Lake Tanganyika, where he expected to find some information from home, of which he had been entirely deprived for two years, as well as to receive provisions and assistance. As Dr. Kirk adds, in a letter to Sir Roderick, "You knew long ago of his safe arrival at Ujiji," we may infer that before this time he will have satisfied himself whether any of the South African waters flow into the Equatorial Albert Nyanza of Baker, of the existence of which great lake we now learn that Livingstone was cognisant. If this determination has been arrived at, Livingstone will have gloriously solved the great problem of African geography, and will have proved by actual observation that Ptolemy, seventeen centuries ago, really placed the sources of the Nile in about their true latitude, a view which has of late years been sustained by Beke, Arrowsmith, and Findlay. It is gratifying to learn that in consequence of the goodwill and letters of the Sultan of Zanzibar, Dr. Livingstone has been most hospitably treated by the Arab traders in the interior, of whom he writes in the most grateful terms. He says, writing to Dr. Kirk, "I am greatly obliged by the Prince's letter, and beg you to say so to his Highness. I don't know which of his subjects have served me most where all have shown kindness and goodwill."

BLACKFRIARS BRIDGE AND HOLBORN VIADUCT.

THESE two important City improvement works were opened by Her Majesty on Saturday last, the circumstance being everywhere marked by loyal demonstrations and rejoicings. The full descriptions, with illustrations, which we gave of both these works last week renders it unnecessary for us further to allude to them here. After the ceremony of opening, a great deal of work had to be performed in clearing away the temporary pavilions and stands which had been erected both on the Bridge and the Viaduct. This done, they were thrown open to the public—the Viaduct on Monday, and the Bridge on Tuesday morning. There still remain various minor details to be completed upon the Bridge, and some of importance upon the Viaduct. We regret to find that the traffic over the Farringdon-street Bridge of the Holborn Viaduct has had an injurious effect upon the granite columns of that structure. An examination shows that several of the blocks of which the columns are composed have settled irregularly. The edges are brought close together in some cases, resulting in cracks and chips, the opposite sides of the columns showing a wide space between the stones. The lower block in the second, third, and fourth columns from Farringdon-street on the east side appear to be cracked through, which indicates that these blocks are not nearly deep enough to resist the pressure brought upon them. The lower block of the third shaft on the west side is badly cracked, whilst the block immediately over it has a serious crack extending upwards some 3ft. of its length. There are many other flaws and defects of the same character, which we much regret to see in this portion of the structure. We can only attribute it at present to a want of proper care in setting the masonry, as well as in having the lower blocks of the granite shafts too shallow, and thus easily crushed. The

lower stones do not appear to have been truly set, and the weight and vibration of the traffic have discovered the inequalities of the bedding, and have caused shifting and cracking. We intend to give this subject further consideration next week; in the meantime we would suggest that this failure teaches a practical lesson of the wide difference between haste and promptitude.

NOTICES OF BOOKS.

THE great changes which a few years bring about in the practice of our machine shops renders it necessary that those works which are written for the instruction and direction of young engineers and students should be from time to time modified or even re-written. It is well, too, when a new mind is brought to bear upon the subject, provided that mind be of a practical turn and capable of imparting sound and useful knowledge. We are therefore glad to see a work of a specially practical character on the modern practice of our workshops,* from the pen of Mr. John G. Winton, whose name has often appeared in our pages in connection with various useful suggestions. The present treatise is classed as one of Weale's rudimentary series, No. 164, and most ably it fulfils its appointed position. It is the result of the author's experience in a wide field of practical engineering, and contains a fund of useful information upon the varied subjects of marine, land, and locomotive engines, floating docks, dredging machines, bridges, shipbuilding, cranes, and agricultural engines, besides a variety of miscellaneous information. We have here not merely a code of well-known and oft-repeated rules and formulæ for the various requirements of this class of work, but we have the results of the author's long experience, which makes itself known in a variety of useful ways. And the reader has not merely described to him the various parts of machines or the perfect engine, but he is frequently taken through the workshop with the parts themselves, so that he really attains a knowledge—so far as a book can impart it—of their actual production. Then, again, there are specifications and estimates of existing work which enter into all the details of weights, dimensions, materials, and cost. Where all is useful and to the point and purpose it is difficult to select one subject more than another for special notice. We may, however, refer to the chapters on land and marine engines and shipbuilding as embodying much that will be found useful in practice. The treatise is well illustrated with intelligible woodcuts, which complete it as a sound guide to the present practice of our workshops.

The twenty-eighth volume of the Transactions of the Institution of Civil Engineers for the session 1868-9† has been lately published. It contains fifteen papers on various subjects, all of which will be found of great value to the profession. As abstracts of these papers have for the most part appeared in our columns, it will only be necessary here to refer to them categorically. They are as follow:—"On Lighthouse Apparatus and Lanterns," by David Marr Henderson, Assoc. Inst. C.E.; "On the Roman Rock Lighthouse, Simon's Bay, Cape of Good Hope," by John Frederick Bourne, M. Inst. C.E.; "Description of the River Witham and its Estuary, and of the various works carried out in connection therewith, for the Drainage of the Fens and the improvement of the Navigation," by William Henry Wheeler, M. Inst. C.E.; "On Machines Employed in Working and Breaking Down Coal, so as to Avoid the Use of Gunpowder," by Samuel Parker Bidder jun., Assoc. Inst. C.E.; "On Coal-Getting Machinery, as a Substitute for the Use of Gunpowder," by Charles John Chubb; "Description of the New Ferry and the New Brighton Piers and Landing Stages on the River Mersey, near Liverpool," by Henry Hooper, Assoc. Inst. C.E.; "On the Mauritius Railways—Midland line," by James Robert Mosse, M. Inst. C.E.; "On the Lagoons and Marshes of Certain Parts of the Shores of the Mediterranean," by D. T. Ansted, M.A. F.R.S., For. Sec. G. S., F.R.G.S., &c.; "On Sinking Wells for the Foundations of the Piers of the Bridge over the River Jumna, Delhi Railway," by Imrie Bell, M. Inst. C.E.; "Description of Apparatus for Excavating Under Water, and for Sinking Cylinders," by John Milroy, Assoc. Inst. C.E.; "On American Locomotives and Rolling Stock," by Zerah Colburn, M. Inst. C.E.; "Experiments on the Standards of Comparison Employed for Testing the Illuminating Power of Coal Gas," by Thomas Mesham Kirkham, M. Inst. C.E.; "On the Outfall of the River Humber," by William Shelford, M. Inst. C.E.; "Description of the Low Water Basin at Birkenhead," by John Ellacott, M. Inst. C.E.; and, "On the Present State of Knowledge as to the Strength and Resistance of Materials," by Jules Gaudard, C.E., Lausanne (Translated from the French by William Pole, F.R.S., M. Inst. C.E.). Abstracts of the discussions are annexed to the papers upon which they have taken place, and the papers are copiously illustrated by folding plates. The volume has been ably edited by Mr. Forrest, who deserves credit for the satisfactory appearance of the proceedings.

† "Modern Workshop Practice." By JOHN G. WINTON, Engineer. STRAHAN and Co., 56, Ludgate-hill, London. 869.

* "Minutes of Proceedings of the Institution of Civil Engineers." Edited by JAMES FORREST, Assoc. Inst. C.E., Secretary. London: Published by the Institution, 25, Great George-street, Westminster. 1869.

The Transactions of the Institution of Naval Architects for 1869 have just reached us. The present forms the tenth volume of valuable papers upon naval matters, which commend themselves to all engaged either in the construction or the navigation of ships. These Transactions—which are published at the office of the Institute, 9, Adelphi-terrace, London, W.C.—are well edited and well got up, forming a handsome and at the same time a handy volume, and being illustrated with some excellent lithographs. The work contains the series of papers read at the annual meeting of the Institute, held in March last, together with the discussions which took place thereon. Of these papers—eighteen in number—we have but little to say, inasmuch as a full report of them, with our comments upon them, appeared in our pages at the time they were read and discussed. They refer to all the varied subjects connected with the construction and navigation of both sailing and steam ships, including armour plate resistance, liquid fuel progress, the qualities of boiler plates, strains in propeller shafts, copper and zinc sheathing, &c., &c. One thing, however, before closing, we feel bound to notice. We protest against the conversion of the Transactions of a scientific body into a medium for advertising a comic periodical, and that, not one of the highest order of merit. Inside the volume of Transactions under notice, we received two copies of a circular sounding the praises of a comic journal which we shall not advertise by naming, but shall simply refer to as one of the most recent of the mushroom tribe which have of late made their appearance, and the circular of which is written in the most painfully alliterative style. We know not with whom the fault lies in thus allowing the Transactions of a respectable body to be made the means of distributing trashy puffs, but we trust that means will be taken to prevent the repetition of such an undignified proceeding.

We continue to receive with regularity the monthly parts of Mr. Bourne's valuable work on the steam engine,* those for June and the intervening months to November inclusive being now before us. Part XIII.—that for June—contains the conclusion of a long list of improvements in the steam engine, and the commencement of a chapter on air and gas engines. The first idea in this direction appears to have been recorded in the patent office in 1794, when Mr. Robert Street obtained a patent for producing an inflammable vapour force by exploding the vapour of the spirits of tar or of turpentine in a cylinder mixed with air, the bottom of the cylinder being kept hot to vaporise the liquid, and the vapour being inflamed by a touch-hole, as in a gun. The piston, which was a solid block suspended on a rod at the end of a beam, was shot up by the explosion, and gave motion to a pump by which the power was communicated to any mechanism requiring to be driven. It is a long stride from this primitive device to the present perfected form of our gas engine, but its principle is there clearly indicated. This division is continued into Part XIV., where it is concluded. The next chapter commences with particulars of various projects for the production of motive power, selected from amongst the rest for their superior practical character. This subject embraces the many improvements which have been made from time to time in boilers and furnaces, some of which are due to Mr. Bourne himself. One of these improvements is that made in furnaces with a view of fitting them to burn coal dust, which will probably yet become an important article of fuel. This branch of the subject is still under consideration in Part XVIII., for November, the whole being profusely illustrated with wood engravings, and including the well-known systems of Ericsson, Lenoir, and others. Besides the woodcuts, each part is accompanied by large folding plates, which give examples of engines of the most modern and improved construction.

* "Examples of Modern Steam, Air, and Gas Engines, of the most recent approved types." By JOHN BOURNE, C.E., London LONGMANS and Co., Paternoster Row. 1869.

We have from the Commissioners of Patents, Southampton-buildings, Chancery-lane, a copy of the abridgements of specifications relating to acids, alkalies, oxides, and salts, from the year 1622 down to 1866. This series, besides embracing all inventions relating to the making or obtaining by any direct or indirect methods of acids, alkalies, oxides, or salts, includes inventions relating to the making or obtaining of several elementary bodies. Amongst these are bromine, carbon, chlorine, fluorine, iodine, hydrogen, nitrogen, oxygen, and sulphur, and some compound substances or bodies, such as cyanogen, none of which of themselves possess either the property of an acid, an alkali, an oxide, or a salt, but which in the process of their production are accompanied very frequently by the formation of one, two, three, and even in many instances of all of these substances in one and the same invention. The value of these abstracts are now so well known and so thoroughly appreciated that it is superfluous to say anything in their favour. Inventors and the public are under a special obligation to Mr. Benet Woodcroft and his able staff for the abstracts which so greatly facilitate inquiry and research into the numerous subjects covered by the specifications.

"Half Hours with the Stars" is the title of a very useful work by Mr. R. A. Proctor, F.R.A.S., which has been recently published by Mr. Hardwicke, 192, Piccadilly. It is a plain and easy guide to the knowledge of the constellations. It consists of twelve well executed maps, which show the position of the principal star groups, night after night, throughout the year. There is an interesting introduction, and each map is accompanied by a separate explanatory statement. The work is plain and simple, and "teaches the stars" in a way which cannot be misunderstood.

The "Popular Science Review" (Hardwicke) for the present month has for its opening article Dr. Miller's lecture on the method of determining the compo-

sition of the sun and other heavenly bodies by the spectrum, which was delivered to the working men of Exeter in August last. An abstract of this paper has appeared in our pages, but we would refer our readers to the whole subject, which is beautifully illustrated in the "Science Review," and is well worthy of careful perusal. Following shortly after this paper is one in which Mr. R. A. Proctor ably discusses the question "Are there any fixed stars?" He refers to Mr. Huggin's method of mapping stellar motions, and observes that it will be a matter of extreme interest to determine by this method whether the stars which seem to form drifting systems have a community of motion of recess or of approach. Should this be the case no doubt could possibly remain that the stars form sets or groups, and that there is no approach to that generally equable distribution described in our popular treatises of astronomy.

The "Journal of the Royal Agricultural Society of England," published by John Murray, Albemarle-street, contains its usual complement of valuable articles upon agricultural subjects. There is a very useful series of farm reports, seven in number, which describe the methods of farming adopted in various districts. The point of main interest to most of our readers will of course be the report on the exhibition and trial of implements at the Manchester Great Show in July last. As we reported fully upon the subject at the time, we need not here further refer to the matter, except to observe that the report now before us is an elaborate and well-digested production, and of course embodies detail information which our limited time and space naturally prevented us giving. The reports of the judges of the various classes are here given, and some conception of their work may be formed when it is stated that they had to wander through upwards of seven thousand articles to select seven for medals!

Mr. Henry Dircks, one of the inventors' ablest champions, read a paper upon the statistics of invention before the British Association at Exeter. This paper, which is published in pamphlet form by Messrs. Spon, 48, Charing Cross, illustrates the policy of a patent law, and forms the second part of a letter addressed to Lord Stanley, now Earl Derby, upon this important subject. It is of course a further answer to Mr. Macfie's ill-advised motion, and still more ill-written book of odds and ends, in favour of the abolition of patent law. Appended to the paper is a report of the discussion which took place after its reading, and in which the benefits of the patent laws are strikingly illustrated.

Mr. E. B. Marten, the chief engineer to the Midland Steam Boiler Inspection and Assurance Company, has compiled some useful information upon the subject of steam boiler explosions. We first have a paper upon the subject, which was read by Mr. Marten before the Institution of Mechanical Engineers in August, 1866, and which points out the great importance of inspection as a means of prevention. This paper is followed by consecutive statements of the boiler explosions for the years 1866-7-8. The whole of the matter is fully illustrated, and affords accurate and useful information, which will prove useful to all interested in the safe working of boilers. The volume is published by Messrs. Spon, of Charing Cross.

Mr. G. W. Jones, in a pamphlet published by Davies and Co., Finch Lane, Cornhill, and in which bombast and big type are alike conspicuous, addresses himself to the "people of England," and propounds a scheme for universal penny railways. He is careful to explain that he has no personal object to serve, and it is well that he has not, or he would not attain it by the present means. The pamphlet is too much in the *ad captandem* and stump-orator style to fix our attention at present, but if Mr. Jones will obtain the sanction of one or two of our leading railway managers to his scheme, we promise to give it our careful and dispassionate consideration.

PHOTOGRAPHY.

The Photographic Exhibition.—The American Solar Eclipse Photographs.

THE annual exhibition of pictures by the Photographic Society of London is now open to the public free, at the rooms of the Architectural Association, Conduit-street, Regent-street. The collection includes very many fine photographs, and it is perhaps the best exhibition ever brought under public notice by the society. Among the photographs are some of great interest taken by Captain Lyon, in India, showing the rich and elaborate nature of the architectural monuments of that remarkable country. There are also specimens of pictures by the various permanent carbon photographic processes, as well as some of the old Daguerreotypes. Breese's stereoscopic views are a great source of attraction, being very fine specimens of instantaneous photographs printed as transparencies; one of them, of a wave breaking on the seashore, is specially good, as even the drops of spray in the air have been taken, so rapid was the exposure. Some combination pictures, by Robinson and Cherrill, are beautiful specimens of photography, so also are some of their portraits, especially that of Mr. S. C. Hall. Colonel Stuart Wortley exhibits some very fine sea and cloud effects, labelled as moonlight scenes, though they are not so in reality. Perhaps the most remarkable pictures on view are some cabinet portraits by Reutlinger, which are marvels of beauty; the negatives from which they were taken having evidently been laboriously "touched up" by a master hand, so that the pictures cannot be considered to be samples of pure photography. The pictures of M. Adam Salomon, which attracted so much attention last year, have found many imitators in England, as proved by the pictures at the exhibition. Some photographic enamels, by Mr. Henderson, show progress in one very beautiful phase of photography, and a very valuable phase too, because of the permanence of the pictures. They require improving a little in richness of tone and colour. Some large pictures of the scenery of the Vale of Neath, by Mr. F. C. Earl, are also leading features in the exhibition. Visitors ought to know that there are no moonlight views in the exhibition, and that the pictures so labelled are really under-exposed views of sunlit scenes, the inscriptions upon these pictures not being exactly truthful. One fault in the exhibition is, that the pictures have not inscribed upon them the names of the processes by which they were taken.

A very valuable weekly periodical called "Nature" was issued for the first time on November 4 by Macmillan and Co. Thirty or forty of the leading philosophers of the day, including Darwin, Tyndall, Huxley, Lockyer, Stewart, and Thompson, are among those who intend contributing to its pages. The first number contains, among others, an interesting article by Mr. J. Norman Lockyer, F.R.S., on the photographing of the solar eclipse in the United States, and a woodcut copied from one of the photographs proves that the Americans have as yet succeeded better than anybody else in getting good pictures of a total eclipse of the sun.

TELEGRAPHIC NOTES.

LAST Saturday morning the "Great Eastern" left Portland, on her way to Bombay, carrying the British-Indian deep sea cable, and fitted with all appliances for submerging it. Her tanks contain 2,735 nautical miles, and her companion ships, the "Hibernia," "Chiltern," and "Hawk," carry among them 1,225 miles more, making a total of 3,600 nautical, or about 4,050 statute miles. This length will suffice for the communication between Bombay and Suez by way of Aden, and will join the present Malta and Alexandria line. As stated on a previous occasion, another cable is projected, to be laid from Falmouth to Gibraltar and Malta, and its completion will unite Bombay and the British fortresses in the Mediterranean along one line of submarine telegraphy which will be unbroken except at Suez.

A fortnight since we printed a letter showing the careless manner in which the telegraph system between this country and Portugal is conducted. As an appropriate sequitur we append the following from the "Bombay Gazette." That journal says of the new line of telegraphic communication with Europe, *via* Russia, which was opened a few weeks since:—"It is but due to it that we should acknowledge in our overland summary the remarkable service it has rendered to India as a means of transmitting public news and private advices. The following telegrams, printed as received, speak for themselves; they are Reuter's:— London, 17th.—Alderman salomon titus salt baromds crawfords refused corranclay another agriablan assination ireland carecton butury catholic archbishop Armach. 21st.—Days insurrection volontry Barcelona refused disarm erektea bariechres tatetupi send amaise of severe fighting orders restored Jestic feary pattot cornuned sonied. 22nd.—letter popp Rumming Kumming contat allap non—Catholics auter encommedial Concil for discussion from already contend abitury generally chained hoals ford times braves suppes deserved with drawtoc to presented spot his government saying excepted instructions and Washington government disavowes, proedirm a amors King Portugal accepting throne shrit abdicating favour Creditary prince secretary governor tarasend—assassinted republican mob for attempting put down revolutionary flows bank hole Canbreisen discute runoured large withdrawal to-morrow sneely telegraphed Washington Spain resolved not negociate for sale Empereur Napoleon have given audience to Lord Clarendon prince prussian Coning Constantinople afterchetir suez brashop excited. 27th.—Having change prefory by shareholders against manger directors Albert Assurance for consgnai conweed Saturday Ignidotlors examined no cancil fremd on part directors cose adanaten. 29th.—Spisow clarundas al ounheral association lord been an continent head opportunity collectired opinions seen persons who exercise influence on bestiwos Europe and believe at no time since prussians austrian paer oxisted faviar paus pant monte montement blessing peace."

The British Indian Extension Telegraph Company have given the order for the manufacture of their cable (to be laid between Ceylon and Singapore), accompanied by the necessary payment to the Telegraph Construction and Maintenance Company.

It is stated that the telegraph office in the Lombard Exchange and News-room will be connected with the central Government office by a pneumatic tube, and that it is the intention of the Postmaster-General to use this station for postal as well as telegraphic business.

The number of messages through the French Atlantic Telegraph during the week ending the 6th of November was 855, the cable charge thereon being £1,928, showing a reduction of £667 from those of the preceding week.

The following telegram relating to the Government Indu-European Telegraph, was received last Saturday:—

Cable ship "Calcutta," Nov. 1, 6·30 p.m.

"First November, noon. Three hundred and twenty miles cable submerged. Tests excellent All going well."

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

Preparation of Caustic Baryta—New Dressing for Black Stuffs—Effect of Heat and Cold on the Illuminating Power of Gas.

WE have on more than one occasion referred to processes for the manufacture of caustic baryta, the production of which at a cheap rate, it has been truly said, would revolutionise our alkali manufacture. The matter commands a good deal of attention among French industrial chemists, and a process has been brought before the Mulhouse Société d'Encouragement which up to a certain point is quite satisfactory. Necessarily, the first step is the reduction of the insoluble sulphate of baryta to sulphide. There is but one way of effecting this, and that is by roasting it

with small coal or other carbonaceous matter, but the management of this part of the process demands care. Some air must be admitted to the furnace, but if too much is allowed to enter, the sulphide produced is again oxidised to sulphate. By taking care, however, it seems that a large proportion of the sulphate employed can be reduced in one operation. The next step is to dissolve the sulphide of barium out of the roasted mass, which is done in ordinary lixiviating vats. We have now to remove the sulphur from the sulphide, and supply its place with oxygen. The inventor of the process we mention does this by digesting the solution with hydrated oxide of zinc, which exchanges its oxygen and water for the sulphur, and the zinc is precipitated as sulphide. This process it is admitted is quite practicable, and even economical, but not sufficiently so to allow of its use in the preparation of caustic soda from sulphate of soda. If the sulphur could be extracted from the sulphide of zinc and utilised, the cost of the process would be so much reduced as to make it a commercial success, but there are difficulties in the way of this which have not yet been surmounted. Two modes of treating the sulphide of zinc have been tried. One of these is roasting it and collecting the sulphurous acid. The other is allowing the sulphide to oxidise to sulphate of zinc. We give this process for what it is worth. It appears to be a great improvement on the methods previously tried, and gives us hope that we shall soon see caustic baryta a common and profitable manufacture.

A new kind of dressing for black woollen stuffs is used in Germany. The dressings generally in use are colourless, but the new invention is really a black dye, to which albumen is added. A practical dyer will see at once how a bath of this kind can be prepared. We can say from experience that a dressing of this kind gives a brilliant face to goods while adding somewhat to weight.

It is well known that variations of temperature considerably affect the illuminating power of gas. In winter less light is obtained, and more light may be got from gas by heating it. The exact extent, however, to which the illuminating power is affected has only recently been ascertained by Vogel. He passed gas through a U-shaped tube, which he immersed, in the one series of experiments, in ice and certain freezing mixtures, and in the other set, in boiling water and in a bath of heated paraffin. The gas was burned directly from the tube before any elevation or reduction of temperature could take place, and the light was compared with a normal flame, the light-giving power of which at 65deg. Fah., was taken as 100. Then, for reduced temperatures, we have the following results:—At the freezing point (32deg. Fah.), the illuminating power was only 76, and at 4deg. Fah., only 33. These figures show that the influence of cold is very considerable, much more considerable indeed than that of heat, for gas passed through boiling water, and compared as before with the standard flame, showed an increase of only 4 per cent., and heated in a paraffin bath to 320deg. Fah., an increase of only 18 per cent. in illuminating power was observed. The loss of power from the application of cold is the result of the condensation of hydrocarbon vapours. The gas reduced to 4deg. by the immersion of the tube in a freezing mixture left a congealed mass on the sides of the tube, which Vogel examined and found to contain benzol, ammonia, and nitric acid. The presence of this last no one could have expected, and it is very remarkable that it should be produced in the manufacture of gas.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the first ordinary general meeting of the session, held on Tuesday, the 9th inst., Mr. Charles Hutton Gregory, the President, made the following observations on taking the chair:—

Although every member of the Institution in this country has already received copies of the recent communications addressed to the Government of India, it is felt that the Institution ought not to meet for the first time after the vacation without some reference to an attack on the honour of the profession, which has justly aroused, in India and in England, a deep feeling of indignation. On the 18th of October, copies were received here of a notification gazetted by the Public Works Department of the government of India, in which it was alleged that the Governor-General in Council was given to understand that in the civil engineering profession in England it was a recognised practice for civil engineers employed by public companies and otherwise to receive, in addition to the salaries paid them by their employers, commission on contracts given out, or stores and materials ordered or inspected by them, and other like pecuniary considerations for services done, or intended to be done, which were considered legitimate sources of emolument.

The council immediately met, and unanimously passed a series of resolutions emphatically denying that such practices were recognised in the profession, and asserting that any engineer detected in such practices would be held to be guilty of disgraceful conduct, which would disqualify him from being a member of this Institution. Regret was expressed that so grave a charge should have been received and published by the government of India without proper inquiry, as such inquiry would have shown that the charge was absolutely untrue; and, having reference to the grievous wrong which such an imputation, stamped with such authority, was calculated to do to an honourable profession, an appeal was made to the government of India to cause the scandalous statement to be withdrawn. This protest was transmitted to the Secretary of State for India, who only reached London on the 25th of October, but who, on the 27th, amidst the pressure of other public business, received a deputation from this Institution, comprising the President and every member of the Council then in London. The deputation pointed out to his Grace not only the injustice which the notification had done to the whole profession, but also the serious effect which it would produce on the public service in India, as such a disgraceful stigma, cast upon civil engineers as a body, would bring to a crisis the widespread discontent already existing among the civil officers of the Public Works Department; and they submitted that unless the notification were withdrawn, it might be expected that the government of India, at the very moment of taking upon itself the construction of all the public works of that empire, would lose the services of the best of those whose experience would, at such a time, be essential.

The Duke of Argyll promised to investigate the case, and, with the natural instinct of a just and high-minded statesman, has put on record that "he regards with implicit confidence the indignant repudiation by the Institution of any recognition of the practice referred to in the notification." By the mail of October the 29th, the Council forwarded their protest to the Governor-General of India, and sent copies of the correspondence to the many engineers who had addressed them and claimed their intervention. Time will probably throw more light upon the causes and motives of this most ill-advised notification.

If in the engineering profession, as in others, there may be instances of secret dishonesty, such acts are not recognised as legitimate. The profession has not sought to parade its purity before the world, but the members of this Institution know how carefully anyone believed to be unworthy of it has been excluded from this the representative body of the profession; and, although happily such instances have been very rare, and such practices are from their nature most difficult of detection, yet steps have before now been taken, which have issued in some persons charged with misconduct ceasing to belong to the Institution. At the approaching annual general meeting the Council will ask that ratification of their action which they are confident that the members will unanimously and cordially give; and if among the public there be some cynical minds which, while very sensitive for their own repute, can take pleasure in a libel directed against others, the members of this Institution may feel sure that, in vindicating the honour of the profession, they will have the sympathy of all honourable men.

MR. CARLYLE has written to Dr. Longmuir, of Aberdeen, with reference to the inscription on the Keith statue at Peterhead, as follows:—"If you know any likely man in Peterhead, I wish you would tell him that the word '*Hochkirchen*' they have put on the inscription under Keith's statue is an *ugly blotch of error*, much requiring erasure for their sake and his! '*Hochkirch*' was the village where Keith perished; there is no such place as '*Hochkirchen*' in the whole world, nor ever will be. '*Hochkirchen*' is worse than '*Peterheadikin*;' an *incurable* solecism —exactly equal to *Alta-Ecclesiæ*,' of which you can judge! No remedy but cutting out that EN (at whatever cost) and substituting silent granite.

LAUNCH OF THE "BRITON" AND TH "VULTURE."

ON Saturday last the "Briton," unarmoured screw sloop, carrying ten guns, and of 350-horse power, was launched from Sheerness Dockyard. The "Briton" is from the designs of Mr. Reed, chief constructor, and is sister ship to the "Druid," which was launched at Deptford just previous to that yard being closed. She is in form and build nearly the same as the "Eclipse," which was launched from the dockyard in November, 1867, but is 8ft. longer. The following are the dimensions of the "Briton":—Length between perpendiculars, 202ft.; length of keel for tonnage, 193ft 11$\frac{1}{2}$in.; breadth extreme, 36ft. 1in.; breadth for tonnage, 35ft. 11in.; breadth moulded, 35ft. 3in.; depth in hold, 19ft. 7$\frac{1}{4}$in.; burden in tons, 1330 59-94. On the same day the "Vulture," wooden twin screw gun vessel, three guns, 160-horse power, which has been built in No. 2 dock, was floated into the basin. This vessel is sister ship to the "Bullfinch," which was floated from the same dock eighteen months ago. The following are the dimensions of this ship:—Length between perpendiculars, 170ft.; length of keel for tonnage, 151ft. 7$\frac{3}{8}$in; breadth, extreme, 29ft.; breadth for tonnage, 28ft. 8in.; breadth, moulded, 28ft. 2in.; depth in hold, 12ft. 5in.; burden in tons, 662 65-94. The engines of this vessel are being manufactured by Messrs. Rennie and Co.

THE PHOTOGRAPHIC SOCIETY.

THE opening of the session of the Photographic Society took place on Tuesday evening, with a fine display of photographs, at 9, Conduit-street. The increase of artistic qualities was the most marked feature of this exhibition over its predecessors. Mr. Wardley, of Manchester, had some remarkably fine pictures, large in size and treatment; and Mr. R. M. Gordon some of those little gems which are quite *sui generis*. Captain Lyon exhibited some photographs of Indian temples of rare excellence and of great architectural interest; and Mr. Stephen Thompson some fine specimens of Italian buildings. But his *chef d'œuvres* were two pictures of an "Old Kentish Homestead" of the sixteenth century, rich in quaint gables. Messrs. Vernon Heath, Mayall, W. England, Russell Sedgfield, and Beadell and Wilson, and other familiar and excellent artists, were also well represented.

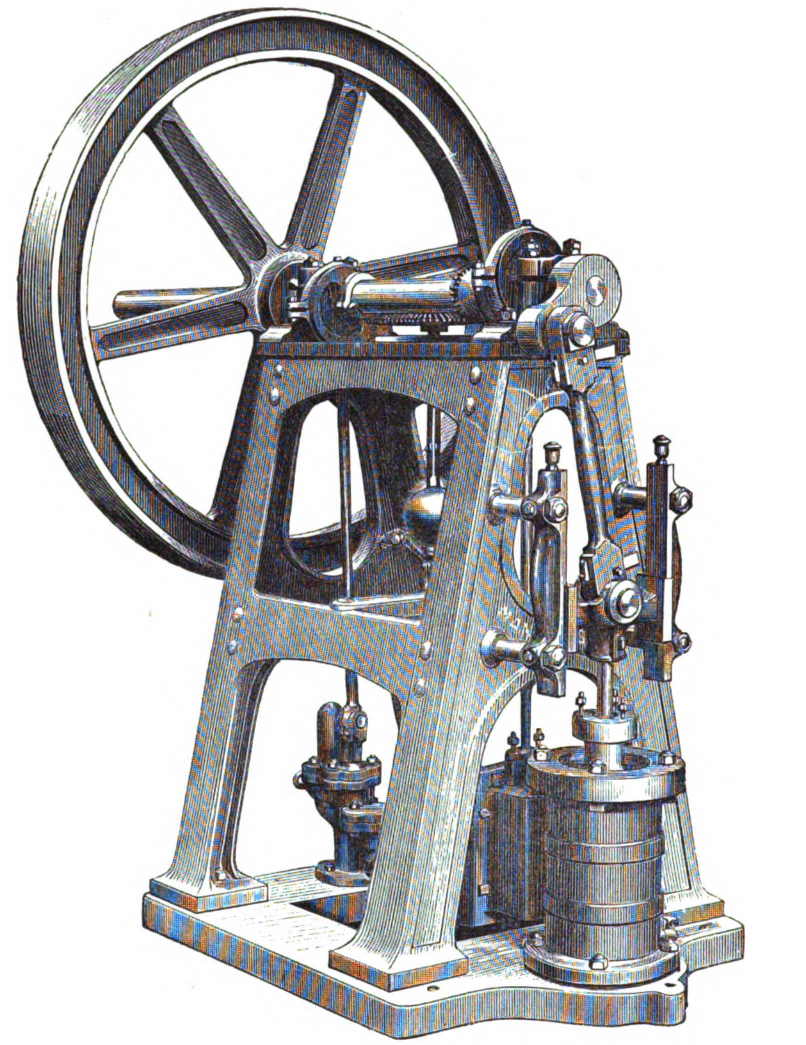
SOUTH KENSINGTON MUSEUM.

ON Tuesday last Professor Huxley gave, at the South Kensington Museum, the first lecture of the course, on the elements of physical science, which is intended for the instruction of women. The course will consist of three parts. The first part Professor Huxley calls physiography, under which rather alarming name many of the audience were no doubt surprised to hear an excessively simple and lucid description of a river basin. The Thames basin was the illustration employed—and the manner in which water is continually circulating between the land, the sea, and the atmosphere. Professor Huxley will proceed in the remainder of this first part to treat in the same broad general manner the most obvious facts and phenomena in the universe, leading up to the second and third parts of the course. These will treat, with somewhat more of detail, of the laws of nature. The second part, by Professor Guthrie, will take up the nature and relations of force in its various forms—the outlines, in fact, of physics and chemistry. In the third part (biology) Professor Oliver will illustrate the phenomena of life (whether physiological or morphological) by the names of elementary botany. The lectures take place on Tuesdays and Fridays, at 11 a.m.

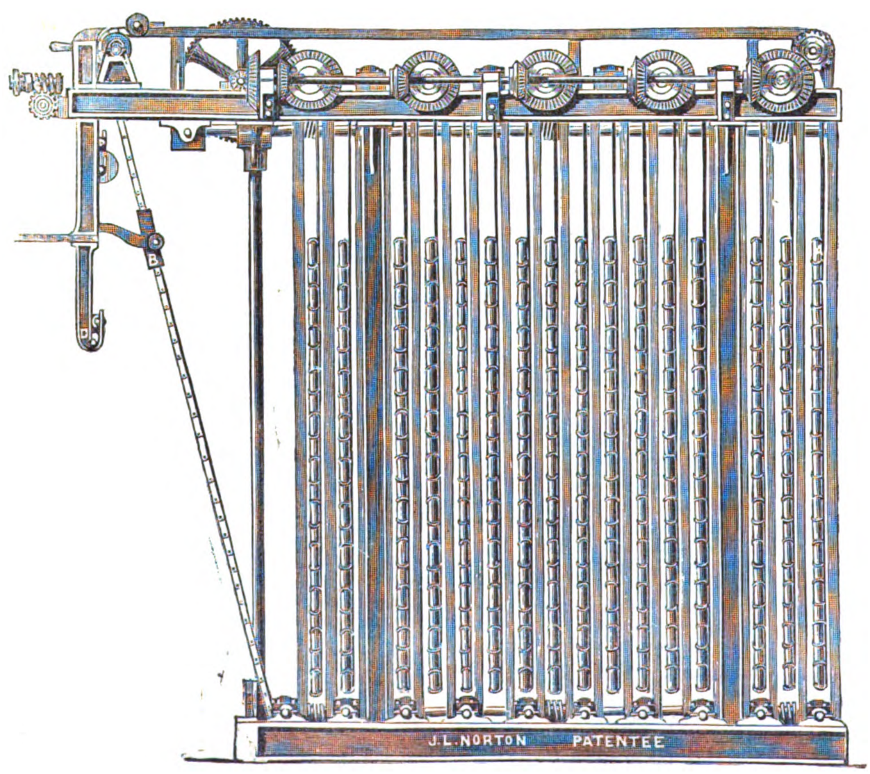
A CORRESPONDENT writes:—This (Saturday) evening, November 6, at about 7 o'clock, two friends and myself were driving along the road adjoining Pen Wood, Highclere, Hants, within a short distance of Lord Carnarvon's park, when we were startled by the appearance of a most brilliant meteor in the south-west. It was of a blue colour, and to our vision seemed to be of the size of a man's head. Unlike many previous meteors, it did not traverse the heavens, but appeared to descend immediately, leaving behind it a long tail of pale blue light, serpent-like in shape. Such was its illuminating power that for a moment or two we might have seen to have picked up a pin in the road. The meteor appeared to descend in the direction of Faccombe.

VERTICAL HIGH-PRESSURE ENGINE.

BY MR. J. L. NORTON.



NORTON'S TENTERING MACHINE.



VERTICAL HIGH-PRESSURE ENGINE AND TENTERING MACHINE.

WE illustrate herewith an improved form of vertical high-pressure engine for general purposes, which is finding favour with users of steam power, and which has been introduced by Mr. J. L. Norton, of 38, Belle Sauvage-yard, Ludgate-Hill, London, well known in connection with the Abyssinian Tube Well. These engines are fitted complete with governors, patent spring equilibrium throttle valves, metallic piston, wrought-iron flywheel shaft, brass pedestal steps, brass eccentric straps, brass connecting rod steps, brass governor wings, &c. The steam joints and jointings of framework are planed and well fitted together, and the workmanship of the engine is finished in a superior style, and to standard gauges. They are strong in build, compact, easy to get at every working part, are extremely easy to fix, requiring but a very trifling foundation. Many of them are working without any foundation stone, being simply bolted to a common boarded floor. They are tested with steam, and proved to work well before they are permitted to leave the works, consequently they may be depended upon for good working as soon as they are bolted down and the steam applied.

A number of these engines are at work in woollen manufactories in connection with Mr. Norton's tentering machines, one of which we also illustrate herewith in side elevation. These machines are used for tentering, stretching, and drying woollen fabrics, and they are in operation both in England and upon the continent, being found very advantageous. They occupy a very small space, a machine to tenter any width of goods from 20in. to 64in. wide, measuring over all about 12ft. 6in. long, 9ft. 6in. wide, and 12ft. high, and being capable of drying at the rate of 1,500 yards of medium cloth per day, and of lighter goods 3,000 to 10,000 yards, according to thickness Goods varying in width from extreme narrows to. 90in. and upwards can be tentered upon the same machine by the introduction of telescopic rollers, which support the cloth its entire width, a desideratum never before accomplished. By a very simple arrangement, velvet or goods with any length of pile can be tentered upon this machine, as the face of the cloth does not come in contact during the drying. The machine is readily set to any width by the man in charge (without leaving his feed-board) by simply moving a handle which regulates the width of the whole apparatus.

INSTITUTION OF MECHANICAL ENGINEERS.

THE general meeting of the members of this Institution was held on Thursday, 4th November, in the Lecture Theatre of the Midland Institute, Birmingham; John Ramsbottom, Esq., Vice-President. in the chair. The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, a number of new members were elected, and the officers of the Institution were nominated by the meeting for the next annual election. The following papers were then read:—

On Well Boring and Pumping Machinery.

BY MR. WILLIAM MATHER.

IN the operation of excavating boreholes for wells and other purposes, the principle adopted and carried out by the writer for all depths of boring has been the use of a rope for working the boring tool in the hole; and this principle obviates the serious expense and delay attending the plan of using rods for working the tool, when great depths of boring have to be executed. In the plan described in the paper the boring tool is worked by a flat hemp rope, which is wound round the drum of a winding engine, and on quitting the drum passes over a large pulley carried in a fork at the top of the piston-rod of a vertical single-acting steam cylinder. The boring tool having been lowered by the winding drum to the bottom of the borehole, the rope is clamped secure at that length; steam is then admitted underneath the piston of the vertical cylinder, and the tool is lifted by the ascent of the piston-rod and pulley; and on arriving at the top of the stroke the exhaust valve is opened for the steam to escape, allowing the piston-rod and carrying pulley to fall freely with the boring tool, which falls with its full weight to the bottom of the borehole. A cushion of steam prevents the piston from striking the bottom of the cylinder, and the steam and exhaust valves are worked by tappets

on a plug-rod; a rapid succession of blows is thus given by the boring tool on the bottom of the borehole.

The boring tool is composed of a number of chisels or cutters, fixed in the cast-iron head at the bottom of the long wrought-iron boring bar, which is guided vertically in the borehole by a couple of collars; and it is made to rotate a little between each blow, so as to strike in a fresh place each time, by means of a simple self-acting arrangement. The lifting shackle at the top of the boring bar is allowed to slide up and down through a short distance on the neck of the boring bar between two fixed collars; the upper face of the lower collar is formed with ratchet-teeth, and the under face of the top collar is formed with similar ratchet-teeth, but set half a turn in advance of the teeth on the lower collar. The intervening boss of the lifting shackle is also formed with corresponding ratchet-teeth on both its upper and lower faces, these teeth being in a line with one another. When the boring tool falls and strikes the blow, the lifting shackle, which during the lifting has been engaged with the ratchet-teeth of the top collar, falls upon those of the bottom collar, and thereby receives a twist backwards through the space of half a tooth; and on commencing to lift again, the shackle rising up against the ratchet-teeth of the top collar receives a further twist backwards through half a tooth. The flat rope is thus twisted backwards to the extent of one tooth of the ratchet, and during the lifting of the tool it untwists itself again, thereby rotating the boring tool forwards through that extent of twist between each successive blow of the tool; and this turning is found to be quite certain and continuous in action during the working of the tool.

When a sufficient quantity of material has been broken up at the bottom of the borehole by the blows of the tool, the working of the percussion cylinder and pulley is stopped, the rope unclamped, and the boring tool wound up with great rapidity by the winding drum. A shell-pump is then lowered down the borehole by the rope, consisting of a long cylindrical shell or barrel, with a clack valve at the bottom opening inwards, and a bucket containing flap valves opening upwards. The rope is attached to the bucket, and when the pump reaches the bottom, the bucket is worked up and down by the rope several times, so as to draw in the broken material through the bottom clack; after which the pump is drawn up again with the material contained in it, and the boring tool again lowered into the hole for continuing the boring. In the event of accidents from breakages or from any of the implements sticking fast in the borehole in rising, grappling tools with hooked claws of suitable shape are employed for laying hold of the obstacle and raising it; or if it cannot be brought up by this means, a solid wrought-iron breaking bar of very great weight is lowered into the hole, and allowed to fall upon the obstacle from a sufficient height to break it up into fragments, which are then raised either by grappling tools or by the shell-pump.

Numerous boreholes have been executed by this plan of boring, both in this country and abroad, for the purpose of obtaining water, and also as trial boreholes for ascertaining the nature of the strata in searching for coal or other minerals, the depth of the borings extending to as much as 1,800ft. The tubing employed, where the borehole is required to be lined, is of cast iron, and is fitted together with turned joints, made with a wrought-iron covering ring, which is let into the thickness of the cast iron and secured by countersunk screws, so as to make the joints perfectly flush both outside and inside. The tubes are forced down the borehole either by screw-jacks or by hydraulic presses, without interfering with the operation of boring, which is carried on simultaneously within the tube. For raising a water supply by pumping from a borehole, the arrangement employed consists in suspending a pump barrel by pipes of the same diameter from the top of the borehole, with two pump buckets working in the barrel, one above the other; the rod of the top bucket is hollow, and is suspended from the horizontal arm of a bell crank lever at the surface, and the rod of the bottom bucket passing up through the hollow rod of the top bucket is suspended from the horizontal arm of a second reversed bell crank lever facing the first lever. The two levers being coupled by their vertical arms and worked by an engine, the two buckets move always in opposite directions; the top bucket in rising lifts the water above it while the bottom bucket is descending, and in the return stroke the bottom bucket ascending delivers the water through the top descending bucket. Although a continuous delivery of water is thus obtained of equal amount in each stroke, a serious shock is occasioned at the beginning of the stroke, in consequence of both buckets stopping and starting simultaneously, causing the whole column of water to be stopped and put into motion again at each stroke; and, as an air vessel for keeping up the motion of the water is inapplicable, a modification of the two bell crank levers has been arranged, which completely answers the purpose. The two levers are centred one above the other, the upper one being inverted; and the vertical arms are slotted, and are both driven by the same crank pin working in the slots; in the revolution of the crank the dead point of one of the levers is thus passed before that of the other is reached, so that the first bucket is started into motion again at the end of its stroke before the second comes to rest. By this means the water is maintained continuously in motion with entire freedom from concussion. Specimens were exhibited of the boring tool and shell pump employed in excavating boreholes, together with a large collection of cores raised from various boreholes, showing the nature of the strata passed through.

Machine for Shaping Nuts.

BY MR. W. F. BATHO.

This machine is for the purpose of shaping the external faces of hexagonal nuts, and consists of six horizontal revolving cutters, arranged radially at the same level, and driven by a single bevel wheel gearing into the six bevel pinions that carry the cutter spindles. The cutters are so fixed in their spindles that when the cutting edges of one tool are horizontal those of the adjoining ones are vertical, and they consequently miss one another in revolving, and can thus operate on work the faces of which are narrower than the breadth of the cutters; by this means the contiguous faces of the hexagonal nuts are all shaped simultaneously by the revolving cutters. The nuts to be shaped are threaded upon a vertical centre mandrel, to which a vertical feed motion is given, traversing the nuts upwards or downwards in the middle of the revolving cutters; and the shaping of the six faces of the whole row of nuts on the mandrel is completed in a single traverse of the machine. The cutters are made with the cutting portions limited to the two sides of the tool, acting like two independent cutters in an ordinary fly-cutter, so that the cutting action is similar to that of a roughing-out tool in a lathe or planing machine; with this shape the wear upon the cutters is so small that each lasts a long time before it is ground down so low as to require renewal. Different sizes of cutters are used according to the size of the work to be shaped; and each cutter is set up by hand-wheels to the required distance from the centre of the machine. The vertical feed motion is obtained by a screw and worm-wheel driven by bevel gearing, with a reversing clutch which is thrown out of gear by a tappet at each extremity of the vertical traverse. A working specimen was exhibited of the machine, together with samples of nuts shaped by it of various sizes, and of other work with a different number of sides, made by using a different number of cutters.

On Le Chatelier's Plan of Using Counter-Pressure Steam as a Brake in Locomotive Engines.

BY MR. C. WILLIAM SIEMENS.

In ordinary locomotive engines, when the valve gear is reversed while running forwards, for obtaining in an emergency the retarding effect of the full boiler pressure opposing the motion of the pistons, the reversed working cannot be continued longer than a few minutes without serious injury, owing to the heating of the cylinders and the cutting of the rubbing surfaces from want of lubrication; the cylinders act as pumps in the reversed working, drawing in the heated gases from the smokebox, and forcing them into the boiler. The object of the present plan is to enable locomotives, in taking trains down inclines, to be worked continuously for any length of time with the valve gear reversed, so as to obtain the advantage of the counter-pressure steam as a retarding power instead of the train brakes, without involving the objections hitherto preventing the use of continuous reversed working.

In the regular working of locomotives, not reversed, the piston, in its forward stroke, is propelled by the full pressure of steam from the boiler, until the steam is cut off by the slide valve; after which, the propelling power is continued through the remainder of the stroke by the steam expanding in the cylinder. But in the reversed working, the distribution of steam is effected by the slide valve in the inverse order and on the opposite side of the piston, while the motion of the piston and driving wheels still continues in the same direction as previously; in the first portion of the stroke, therefore, the cylinder is open to the exhaust on the front side of the piston; but, in the latter portion, the steam at full boiler pressure is admitted, and opposes the forward motion of the piston. In the return stroke, the front of the piston in ordinary working is in communication with the exhaust until nearly the end of the stroke; but in the reversed working, it is to the back of the piston that the exhaust is open, and the piston accordingly draws in the heated gases from the smokebox at atmospheric pressure; and in the next forward stroke, the contents of the cylinder are compressed as soon as the exhaust port closes, and forced by the piston into the boiler against the full pressure of steam. The latter portion of each stroke of the piston is thus made against the full boiler pressure, which resists the motion of the piston, and consequently acts as a powerful retarding force to check the rotation of the wheels in the direction of running.

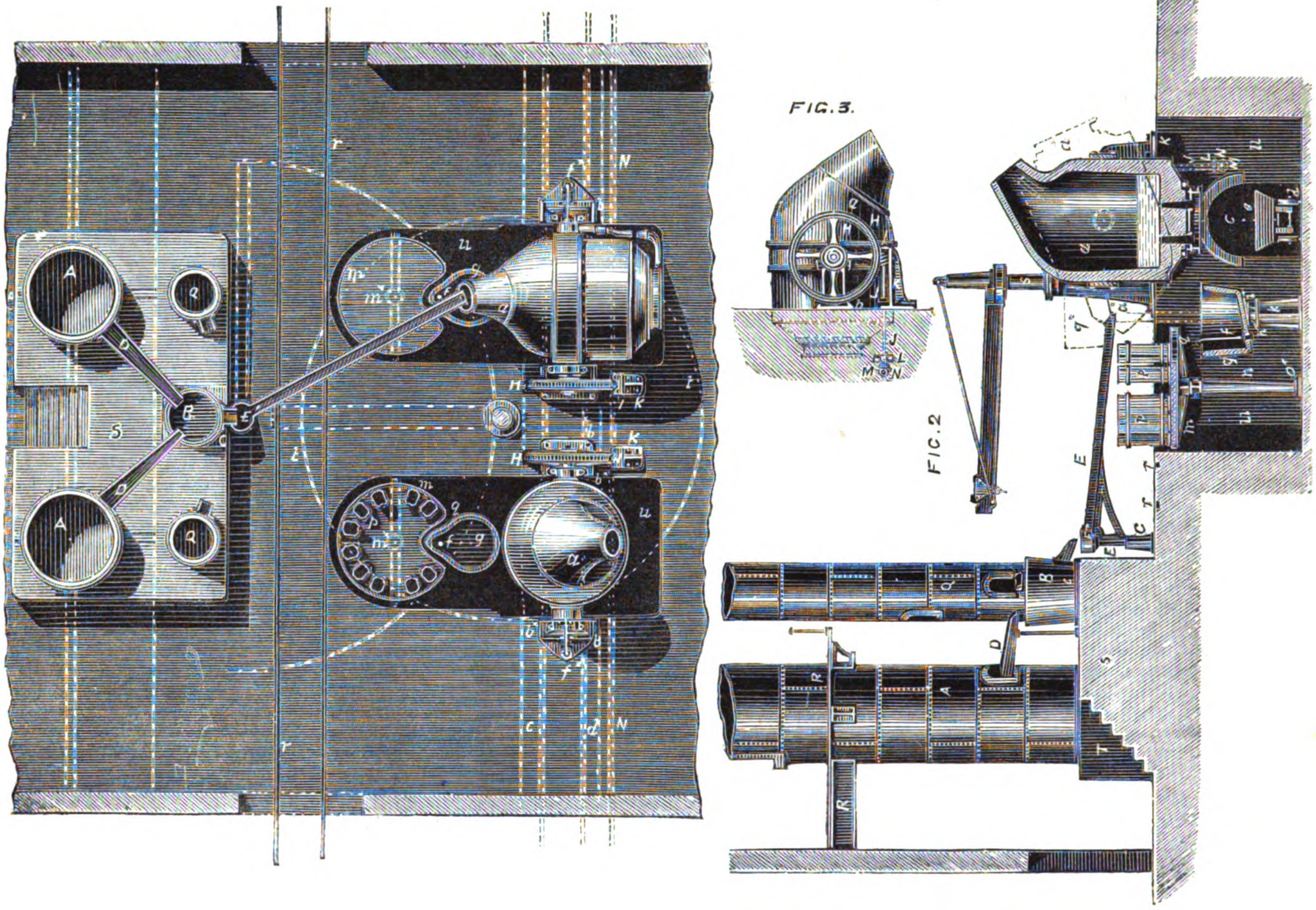
The simple and efficient plan designed and carried out by M. Le Chatelier for counter-pressure working consists in introducing a small jet of hot water from the boiler into the base of the blast-pipe or the exhaust port of the cylinder; this jet being discharged at boiler pressure into the atmospheric pressure of the exhaust passages, the greater portion of the water instantly flashes into steam at atmospheric pressure, and, instead of the heated gases from the smoke-box, a moist vapour or fog is now drawn into the cylinder behind the piston. The rubbing surfaces are thus maintained constantly lubricated by the presence of saturated steam, and all heating or cutting is entirely prevented. The jet of water is regulated so as to be always slightly in excess of the precise quantity required, the object being to prevent the possibility of drawing in any of the heated gases from the smokebox; and the constant escape of a slight cloud of steam from the chimney affords an indication to the driver of the sufficiency of the jet. Mixed jets of hot water and steam in various proportions have also been employed in particular cases of working. The use of the counter-pressure working has the important advantage of rendering the great weight of the engine available as brake power; and as the amount of retarding power obtained from the counter-pressure steam against the pistons when running reversed is less than the propelling power of the steam in ordinary working, the engine wheels are not skidded upon the rails; but a steady retarding force is continuously applied to them within the limit of their adhesion. The wear of rails and tyres that is caused by the friction of the train wheels when skidded by the ordinary brakes, and the consequent injury to the wheels by wearing flat places in their circumference, are avoided to the extent that the counter-pressure steam is used as a brake on the engine; and the practical working of the counter-pressure plan has been found so satisfactory, that its use has even been carried so far in many cases as to supersede the employment of the train brakes, not only in descending inclines but also in stopping and shunting at stations. In shunting, the steam regulator is left constantly open, and the motion of the engine is controlled entirely by the reversing handle. The employment of the counter-pressure working has now been extensively adopted in France, Spain, and other countries, as many as fourteen hundred locomotives being regularly worked on this plan on the Paris and Lyons Railway alone, both in descending inclines and in stopping and shunting at stations; and in all cases its adoption has been attended with complete success.

The Royal Seamen and Marines' Orphan School and Female Orphan Home, Portsea, is an institution which has claims to national support. We are glad to learn that our seamen and marines are taking an increased amount of interest in its welfare, and recently the reading-room club of the "Pallas," armour-plated screw corvette, on paying off, sent by the Rev. F. Davies, the chaplain, £2 10s. to the institution, and £2 to the National Lifeboat Institution. The serjeants of the Royal Marine Artillery, stationed at Eastney, Southport, have sent to the Seamen and Marines' Orphan School £4 12s., being the proceeds of an amateur dramatic performance. We may mention that the institution is in want of funds, and that subscriptions will be received by the Rev. E. S. Phelps, chaplain of Portsmouth Dockyard, honorary secretary.

APPARATUS FOR MANUFACTURING STEEL AND IRON.

BY MR. BESSEMER.

FIG. 1. FIG. 3. FIG. 2.



MANUFACTURE OF CAST STEEL AND MALLEABLE IRON.

THE production of ingots of cast steel or malleable iron from pig or other carburet of iron by the forcing of atmospheric air upward through the molten metal, and now generally known as the Bessemer process, consists of several distinct operations carried on in succession. The most important of these operations consist in melting the pig metal, transferring it in the molten state to the converting vessel, blowing air through it, and converting it into a malleable metal, mixing the metal so converted with a certain quantity of fluid manganesian pig iron, pouring the mixed metals into a casting ladle, and running it from thence through a valve into moulds, and the removal therefrom of the ingots when solidified.

It is essential to the economic performance of these successive operations that the several kinds of apparatus employed should occupy such positions in reference to each other that no unnecessary time should be employed in passing the metal from one to the other, that the metal in its fluid state should not be unnecessarily cooled by exposing it to radiation in open gutters of great length, and that the motion of the several parts of the apparatus should be capable of being effected with ease and certainty, with a view to economise time, save labour, retain heat, and conduct the process with safety. These objects are sought to be accomplished by the apparatus we are about to describe, and which has recently been patented by Mr. Bessemer. In this arrangement the first cost of the combined apparatus will be much reduced as compared with the cost of the apparatus now generally employed in the manufacture of Bessemer steel and iron, while the size and cost of the building will also be much reduced.

The arrangement and construction of the converting apparatus is represented in plan at fig. 1, and in vertical section at fig. 2 of our engraving; a side elevation of the converting vessel showing the gearing for giving it rotation is shown at fig. 3. *a a* represent two converting vessels so placed that their respective axes are in a straight line, in which position any required number may be placed along one side of the "converting house;" the axes of the vessels are supported on massive castings *b*, the upper parts of which are formed into plummer blocks *b** for the axes to turn in. Each of the converters *a* stands over a separate pit *u*, through which an arched passage *c* leads to the outer sides of the building. In this passage are fixed the rails *d*, on which an iron truck *e* may be moved beneath any number of vessels placed in a line and receive from them the slags, cinders, or other debris, and convey it out of the converting house. The pipe and usual valve arrangement for the supply of air to the converter is shown at *f**. In front of each vessel is a casting ladle *g* mounted on the top of a vertical slide or ram *h*, the upper part of the slide having a table *i* for the ladle to stand upon. The ram has a vertical movement given it by means of hydrostatic pressure acting in the cylinder *k* in which the ram works. The casting ladle so mounted will be lowered as the metal from the converter is poured into it, after which it will be raised again so high that its under side will rise above the top of the moulds, as shown by dots at *g**; the moulds are brought successively under it by turning the table *m*, and are filled by means of the valve arrangement *f* now generally employed in casting Bessemer steel.

In front of the casting ladle is mounted a circular bed or table *m* on a vertical spindle *n* moving in a bearing *o* and foot step *o**; the upper surface of the table is protected with brick or sand *m**. On this table the moulds *p* are placed in a concentric circle; a hollow or indented part *q* is formed on one side of the table to allow the casting ladle *g* to rise up past it; the table is rotated, and thus each mould is quickly and with little force brought under the ladle to be filled. Against the side walls are fixed small cranes to lift off the ingot moulds and ingots from the revolving tables and transfer them to trucks moving on the rails *r* laid in a line parallel to the line of converting vessels; or in lieu of the wall cranes Mr. Bessemer uses an hydraulic crane such as is generally known as an ingot crane, and represented at *s*, figs. 1 and 2, and placed between each pair of converting vessels, the range of the gib shown by dots *t* being such that the top of the converter or the tuyere box may be removed by it on to a truck moving on the rails *r*, and be carried out of the converting house.

Both when using the line of rails or the circular table to move the moulds Mr. Bessemer prefers to place the cupola melting furnaces A A before the converting vessels, so that when the vessels are turned down, as shown by dots at *a**, fig. 2, to receive a charge of molten iron the mouth of the vessel shall approach nearer to the cupola A. When two converting vessels are used Mr. Bessemer employs two large cupolas, as shown at A A, but when a greater number than two converting vessels are used in a line the arrangement and number of cupola furnaces is varied to suit the requirements of the manufacturer and the hours of working. The cupola furnaces may be of the ordinary kind used by founders, but Ireland's upper tuyere furnace or Woodward's steam jet cupola are preferred. In either case in a line between the cupolas, but preferably nearer to the converting vessels, a ladle or receiver B is mounted on a weighing machine C with a short spout D from each cupola leading into it, so that the charge of iron to be converted is first run into the receiver B and weighed. Beneath the tap hole of the receiver is placed the enlarged end E* of a swinging gutter E, by which the iron may be run (above the level of the turntable or line of moulds and trucks) into the mouth of the converter. The movable gutter or spout D is supported in a vertical spindle F, which is retained in position by a pedestal G bolted to the foundation. The spout E is capable of supplying both converting vessels, and when not in use may be moved out of the way by turning it in a direction parallel to the rails *r*. By this arrangement each of the cupolas may be employed to supply either of the converters, the exact quantity of

MACHINERY FOR WELDING BOILER PLATES.

BY MESSRS. BEELEY AND HANSON.

FIG. 1.

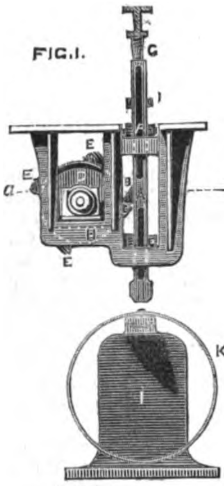


FIG. 2.

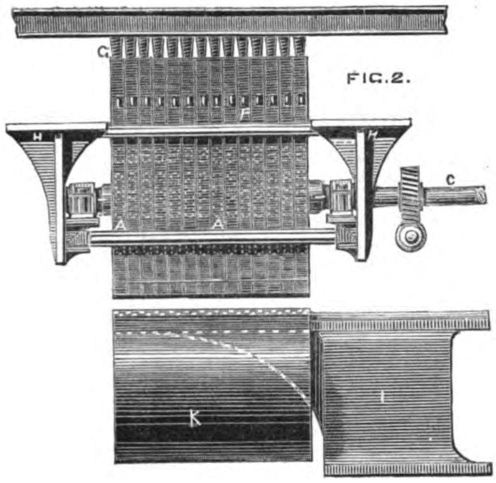


FIG. 7.

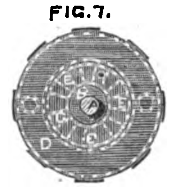


FIG. 5.

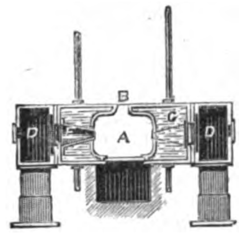


FIG. 3.

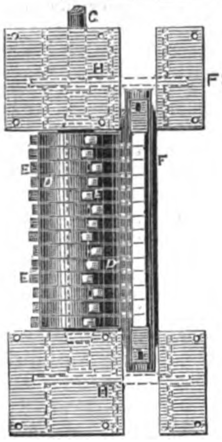


FIG. 4.

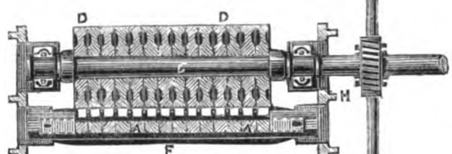


FIG. 8.

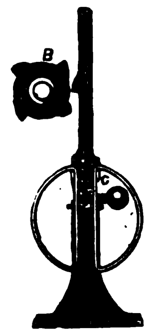
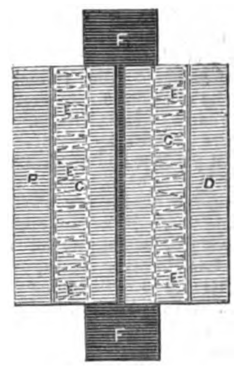


FIG. 6.



metal employed being ascertained by weighing it in the receiver B before running it into the converter.

At fig. 3 a large worm wheel H is shown on the axes of the converting vessel; a worm I on the vertical shaft J gears into the worm wheel, and is supported by the frame K bolted to the foundation. A bevelled wheel L is keyed on to the lower end of the shaft J, and is geared into another bevelled wheel M on the horizontal shaft N; this shaft extends entirely across the building, and is connected with an engine having a reversing valve gear, so that the shaft N may be put in motion, reversed, or stopped when required by a workman so placed that he can see the pouring out of the molten metal into the ladle, and be enabled to regulate the motion of the converter. A clutch is also provided for the purpose of disengaging the bevelled wheel M, when the vessel to which it gives motion is required to be at rest. When two converting vessels are grouped as described two small cupola furnaces Q Q are used for melting the magnesian carburet of iron or spiegeleisen. These may be placed near the weighing ladle, as shown, and the iron from them be run into the vessel or casting ladle along the gutters before named. But Mr. Bessemer prefers to tap these small furnaces into a swing or travelling ladle, where the iron may be weighed, and be thus transferred to the converter or casting ladle without being cooled or wasted by passing along a gutter. An upper floor is formed on girders, as shown at R, fig. 2, at that part of the converting house where the cupola furnaces are situated, on to which floor the metal and fuel are hoisted by a lift. The cupola furnaces A and Q are erected on a raised bed of masonry S in order that the workman may have a platform to stand on when tapping the furnaces; the steps T give access to this raised platform.

The trunnion bands generally employed in converting vessels are of forged iron, and from the difficulty of making them are very expensive; Mr. Bessemer therefore replaces them in some cases by employing a hoop of cast iron with the trunnions and air passages formed therein. In this case he uses rolled angle irons to embrace the cast-iron hoop, and by passing bolts entirely through the cast iron and rolled angles the several parts of the cast-iron hoop would be supported in case of accidental fracture.

WELDING PLATES AND TUBES FOR BOILERS.

MR. THOMAS BEELEY, of Hyde Junction Iron Works, Chester, and Mr. David Hanson, of Dukinfield, have lately patented some useful improvements in boiler making. In the first place, their invention consists in a machine by which the blows for welding the seams are struck, instead of employing a number of labourers for this purpose as at present. The machine consists of a number of stampers or strikers, which are arranged side by side in a row. These strikers are so arranged that they may be raised to a certain definite height, and then be allowed to fall by their own weight. Below this row of strikers is the anvil, which may be similar in shape to that now in use for this purpose, or curved to the requisite form for welding or flanging.

A machine of this description is shown in the accompanying engraving, at figs. 1, 2, 3, and 4, fig. 1 being a side view; fig. 2, a front view; fig. 3, a plan; and fig. 4, a sectional plan taken on line a b in fig. 1. A A are the stampers, upon which are formed the projections B B; C is the shaft which carries a number of circular plates D D, upon which are formed the cams E E. These plates are shown in section in fig. 4. The stampers A A slide in guides F F, and the force of the blow may be increased by the springs G G. The machine is carried by side frames H H. I is the anvil, and K represents a plate being welded. This is the most convenient method of putting this part of the invention into practice, although other methods may be adopted. The shape of the face of the stampers corresponds to the shape of the plates to be welded, being straight for flat plates and curved for curved plates, and there are a sufficient number of them in the machine to weld the longest plate used in the works. Each stamper is provided with a catch, by means of which it may be kept out of gear with the revolving shaft, and thus be prevented from striking, as in some plates there will probably be a portion which will not require to be welded. The simplest form of catch for this purpose consists of a key placed in a slot in the stamper, as shown at I, fig. 1.

In the next place, the present invention consists in an improved form of furnace for heating the plates intended to be welded by the apparatus we have described. The furnace is made of sufficient length for the longest plates used, and is constructed of iron plates, the mouth being narrowed along its whole length. On each side and next to the furnace is a water chamber, which is supplied in the usual way, and next to each of these water chambers is an air chamber, which serves to distribute the blast. The water chambers and air chambers extend the whole length of the furnace, and a row of tuyeres proceed from each of the air chambers through the water chambers into the furnace. These tuyeres are arranged so that the nozzles of one row do not come directly opposite, but half way between those of the other row. Fig. 5 is a cross section, and fig. 6 is a plan of a furnace constructed according to this part of the invention. A is the furnace with the narrow mouth or opening B; C C are the water chambers, and D D the air chambers; E E are the tuyeres passing from the air chambers through the water chambers to the furnace A. This furnace is not charged with fuel on the top, but at the ends, that is, at F F, fig. 6, the ends being kept closed by a charge of black fuel. The advantage of this arrangement is that it will be unnecessary to blacken that portion of the furnace which heats the plates when feeding the furnace with fresh fuel. This furnace is provided with dampers underneath, as shown at G, fig. 5.

Messrs. Beeley and Hanton's improvements further consist in a novel form of furnace for heating the ends of the cross tubes and the corresponding

openings in the flues, and the cylindrical portions of flues or boilers required to be welded together. The furnace is made of an annular form, with the tuyeres arranged in a radial direction around it, the tuyeres passing through the water chamber, as before described. Fig. 7 is a plan of this furnace. The centre A is made of firebrick; B is the annular furnace; C is the water chamber; D is the air chamber, from which the tuyeres E E pass to the furnace.

A simple apparatus for welding the cross tubes into the flues of boilers is also included in the present invention. This consists of a rising and falling striker, the face of which is shaped to suit the corner formed by the junction of the flue and the cross tube. In conjunction with this striker is an anvil which has been previously patented by Mr. Beeley. This arrangement is illustrated in fig. 8. A is the rising and falling striker, to which the necessary motion may be imparted by the revolving shaft B; C is the anvil. This apparatus has been at work for some time, and is found very effective and economical.

THE ROYAL POLYTECHNIC INSTITUTION.

A VERY interesting addition has recently been made to the numerous attractions offered by the Royal Polytechnic Institution to the public. This consists in an exhibition of imperial relics of the unfortunate Maximilian Empire, and a number of Mexican curiosities. Chief in prominence amongst the former are two life-size portraits of the late Emperor Maximilian and his wife, the Empress Carlotta. These rare gems of art were painted by Santiago Rebull, the great portrait painter, and professor of the Academy of St. Carlo, city of Mexico. There is also a large oil painting portraying the Emperor's entrance into Mexico. Next we come upon a miniature sarcophagus, containing an exact representation of the late Emperor as he appeared when embalmed and passed into the keeping of Admiral Toghatoff, for removal to Austria, on the 12th of November, 1867. His body is clothed in the citizen dress. The sarcophagus is made of the same wood, and by the same mechanic who made the original. Another miniature sarcophagus contains a representation of the dead body of the Emperor, showing the six points at which the bullets entered his body. In addition to these is a numerous collection of interesting articles, including hats once worn by Maximilian, the immense Mexican sombrero which he had on when captured, uniform, coats, hats, with the Empress Carlotta's riding hat, autographs, glass ware, &c., all of which are full of mournful interest to the public, who will well remember the sad fate of the unfortunate Emperor, and the affliction which has darkened the days of his devoted wife.

Amongst the Mexican curiosities are several relics of the dark ages, when the Spanish Inquisition annually numbered its victims by thousands. There is a manuscript work in the handwriting of the Junta, City of Mexico, bearing date 1595, and containing the records of the trials of many of the victims of the Inquisition, together with the horrible sentences pronounced against them. A remarkably fine mummy also calls for attention, being in an extraordinarily good state of preservation. That this was one of the victims of the cruelties then perpetrated there can be no doubt, as the body is somewhat distorted and indented by ligatures. Altogether this collection will well repay a visit, and must prove a great attraction to the Polytechnic Institution.

MINERALS AND METALS IN 1868.

THE following facts and figures relating to the produce of various minerals and metals in the year 1868 are compiled from reports and returns upon the matters in question, and will be found both interesting and useful. They include gold, silver, lead, tin, zinc, coal, clays and china stone, and salt. We first turn to the present aspect of gold in Australia, and we find that the imports of Australasian gold into the United Kingdom in the eight months ending August 31 this year amounted to £5,151,549, as compared with £4,361,243 in the corresponding period of 1868, and £3,277,613 in the corresponding period of 1867. The amount of the gold brought down by escort in the province of Otago, New Zealand, in the first six months of this year was 71,214oz., as compared with 71,618oz. in the first six months of 1868. It is stated that there is a prospect of a valuable goldfield being found in the Marewhenua district, about forty miles from Oamaru, in the province of Otago. Mr. Warden Robinson has been directed to visit the workings, and report upon them to the Provincial Government. About 100 men were at work in the locality at the last dates. some good specimens of auriferous quartz had been found, and, as the district adjoins that of Mount Ida, it is expected that a similar formation will be found to exist over a wide extent of country. There are now eighty-seven companies formed in connection with the gold mining of the Thames fields, in the province of Auckland, New Zealand. These eighty-seven companies had raised between them capital to the amount of £1,270,201. A large demand for skilled mining labour is stated to prevail on the Thames fields, which are extraordinarily rich.

From another return, it appears that the average number of gold miners employed in Victoria in 1868 was 63,181, being a decrease of 2,676 upon the corresponding average for 1867. The average earnings of each man last year were £104 18s. 8d., as compared with £87 1s. 7d. in 1867. There are 2,651 ascertained quartz reefs, and 886,228 tons of quartz were crushed in 1868. The average yield of gold was something over half an ounce to the ton, while the cost of crushing ranged from 2s. 6d. to £1 10s. per ton. The extent of auriferous land opened up by gold miners in Victoria is 882 square miles, and the value of the machinery and mining plant employed was estimated last year at £2,150,432. The total area of the land held as claims was 100,942 acres, of which nearly one-third was last year lying idle; the computed value of the whole of the claims was, last year, £8,869,504. Twelve new goldfields were discovered last year, and 329 new companies, with a nominal capital of £3,719,198, were registered during 1868. The aggregate value of the gold exported from Victoria to the close of 1868 was £147,342,767. The total quantity of gold exported from Queensland in the six months ending June 3 was 67,080oz., or at the rate of 11,180oz. per month. If the exports continue at the same rate for the remainder of the year, they will amount in value to upwards of £500,000 for the whole of 1869. The exports for the second quarter of this year showed, however, the slight decline of 657oz.

Turning next to silver and lead, we find that the quantity of lead ore raised and sold in the United Kingdom was but 78,944 tons in 1848, but since 1850 it has almost always ranged between 90,000 tons and 100,000 tons in the year; in 1868 it was 95,236 tons, of the value of £1,150,768, the price at the Holywell sales averaging £12 1s. 8d. or about 16s. lower than in 1867. The quantity of load obtained from the ore was 53,373 tons in 1848, but in 1868 it reached 71,017 tons, of the value of £1,378,404. In 1848 it took 147·9 tons of ore to make 100 tons of lead, but the required quantity has been reduced since then, and in 1868 it took only 134·1 tons, or, in other terms, there were 74·568 tons of lead in 100 tons of ore. The quantity of silver produced was but 496,475oz. in 1853; it had risen to 569,345oz. in 1858, and reached 841,328oz. in 1868, of the value of £231,365. In 1853 there were obtained 8·143oz. of silver from the ton of lead; in 1858, 8·336oz.; in 1868, 11·846oz. From the ore produce of lead mines in Cornwall there were obtained in 1868 6,310 tons of lead and 303,033oz. of silver; from Durham and Northumberland, 17,805 tons of lead and 81,447oz. of silver; from Yorkshire, 5,655 tons of load and 2,500oz. of silver; from Derbyshire, 4,396 tons of lead and 1,150oz. of silver; from Cumberland, 4,097 tons of lead and 33,057oz. of silver; from Shropshire, 3,823 tons of lead; from Westmoreland, 1,388 tons of lead and 21,314oz. of silver; from Devonshire, 1,141 tons of lead and 39,865oz. of silver. In Wales, Denbighshire in 1868 supplied 6,382 tons of lead and 33,370oz. of silver; Cardiganshire, 5,414 tons of lead and 67,502oz. of silver; Flintshire, 3,255 tons of lead and 29,808oz. of silver; Montgomeryshire, 3,050 tons of lead and 19,546oz. of silver. The supply in Scotland is chiefly from Dumfriesshire. In Ireland, Wicklow produced 1,324 tons of lead and 13,245oz. of silver; Tipperary, 31 tons of lead and 1,127oz. of silver; Waterford, 154 tons of lead; and Louth, 53 tons. The totals for Scotland in 1868 were 2,437 tons of load ore, 1,812 tons of lead, 8,201oz. of silver; all these are smaller quantities than in the preceding year. The totals for Ireland in 1868 are 2,089 tons of ore, 1,562 tons of lead, 14,372oz. of silver; all these are larger quantities than in the preceding year, but there are returns from more mines in 1868. The Isle of Man supplied in 1868 4,290 tons of lead ore, 3,089 tons of lead, and 178,718oz. of silver.

With regard to tin and the tin-plate trade, we first note that the produce of the tin mines and streams of Cornwall and Devonshire in the year 1868, according to returns obtained from the smelters, was 13,953 tons of tin ore (black tin), of the value of £770,205, an increase of 304 tons over the quantity in 1867; and the quantity of metallic tin (white tin) obtained was 9,300 tons, of the value of £901,400, an increase of 600 tons over the quantity in 1867. The average price of tin ore in 1868, as deduced from all the sales, was £55 4s. per ton. This is considerably lower than the average for the ten years 1856—65, but higher than the average prices of the years 1866 and 1867, which were £48 10s. 9d. and £50 18s. respectively. The mean price of metallic tin in the London market in 1868 was £98 per ton for English blocks, £95 13s. 4d. for Banca, £93 16s. for Straits; all of them materially higher prices than in 1867. Dues were paid to the Stannary Court in 1868 on 11,584 tons of tin ore —viz., in Cornwall, on 2,276 tons from mines in the western district, on 7,820 tons in the west central district, on 780 tons in the east central district, on 453 tons in the eastern district, and on 201 tons from sundry mines selling ore in the stone; and, in Devonshire, on 54 tons. The total is above that of 1867, but below that of any of the five years preceding 1867. The Dolcoath mine, in the west central district of Cornwall, continues at the head of the returns, showing in 1868 a production of 984 tons of tin ore, of the value of £55,847.

The position of the tin-plate trade has, we regret to say, been exceedingly unsatisfactory for some time past, the demand having fallen off to a great extent, and the prices realised are quite unremunerative. Last year, and for the first three or four months of the present year, such an enormous quantity of plates was exported to the United States that the markets there became glutted, and the result was that plates were selling at New York at lower prices than at Liverpool. As might be naturally expected, the extreme depression has brought about heavy failures in the trade, which have necessitated the stoppage of several works, and it is generally agreed that there must be a reduction of make at all the tin-plate establishments before stock can be sufficiently reduced to command higher quotations. The Abertillery works, which have been at a standstill in consequence of the failure of the late proprietor, have been sold at less than one-half the purchase-money thirteen years ago, which is a proof of the unfavourable position of the trade just at present. There are strong hopes, however, that with the reduced make and increased American purchases the next spring will witness some degree of revival in the demand.

The returns obtained from the zinc mines of the United Kingdom show a production in the year 1863 of 12,782 tons of zinc ores, principally sulphide of zinc (black jack), the value being estimated at about £39,192. The number of mines was 35—18 in England, 15 in Wales, 1 in Ireland, 1 in the Isle of Man. In England and Wales the chief production was from three counties; 3,350 tons from Denbighshire, 2,858 tons from Flintshire, 2,061 tons from Cornwall. 3,278 tons were produced in the Isle of Man. The production of metallic zinc was about 3,713 tons, of the value of £75,436. All these figures are lower than those for the preceding year, 1867. Prices were lower in 1868 than in 1867 in the London market, the mean price of spelter falling from £21 6s. in 1867 to £20 6s. 4d. in 1868, and the mean price of zinc (in sheets) from £27 7s. 6d. to £25 13s. 4d. per ton.

Our "black diamonds" next demand a notice, and here we may observe that the 103,141,157 tons of coal produced in the United Kingdom in 1868 were raised from 2,922 collieries. The quantity was above 1,300,000 tons less than in 1867, a result attributable to the long-continued commercial depression. In Durham and Northumberland 24,394,167 tons were raised in 1868, being 473,277 tons less than in 1867. In Cumberland 1,378,026 tons were raised in 1868, a decrease of 134,488 tons. In Yorkshire 9,740,510 tons, a decrease of 103,065 tons. In Derbyshire 4,957,879 tons, an increase of 407,329 tons. In Nottinghamshire 1,508,439 tons, a decrease of 66,561 tons. In Leicestershire 608,088 tons, a decrease of 541,912 tons. In Warwickshire 624,859 tons, a decrease of 255,991 tons. In Staffordshire and Worcestershire 12,294,780 tons, a decrease of 231,774 tons. In Lancashire 12,800,500 tons, a decrease of 41,000 tons. In Cheshire 837,500 tons, an increase of 2,500 tons.

In Shropshire 1,495,500 tons, a decrease of 63,000 tons. In Gloucestershire and Somerset 1,969,000 tons, a decrease of 6,000 tons. In Monmouthshire 4,2[illegible]0,500 tons, a decrease of 319,000 tons. In South Wales 8,959,500 tons, a decrease of 132,800 tons. In North Wales 2,385,000 tons, an increase of 13,750 tons. In Scotland 14,709,959 tons, an increase of 584,016 tons. In Ireland 126,950 tons, an increase of 1,950 tons. The mean price of Newcastle coal, Wallsend, in the London market in 1868, was 15s. 9d. per ton, being 2s. 6d. less than in 1867.

The returns stating the production of the more important clays and china stone in this country in the year 1868 show that Cornwall produced 100,000 tons of porcelain clay, of the value of £91,666; 29,000 tons of china stone, of the value of £23,200; and 1,479 tons of fireclay, of the value of £554. The first two items show smaller quantities than in 1867. Devonshire produced in 1868 12,000 tons of porcelain clay, of the value of £9,600, and 45,000 tons of Teignmouth clay, of the value of £20,250. The last item shows not quite so large a quantity as in 1867. In Dorsetshire 150,000 tons of pottery and other clays, of the value of £3,750, were obtained in 1868. There were also produced in Staffordshire, Yorkshire, Derbyshire, &c., 675,000 tons of fireclays, of the value of £168,750. These items amount to 1,012,479 tons of fine and fire clays, of the value of £317,770. This is not so large a return as that of 1867. A list of porcelain and other clay works working in 1868, compiled by Mr. Robert Hunt, the keeper of mining records, shows 90 in Cornwall; in Devonshire 5 producing porcelain clay and 4 Teignmouth clay, and there were also 11 producing Poole clay, and 16 in Staffordshire producing Stourbridge clay.

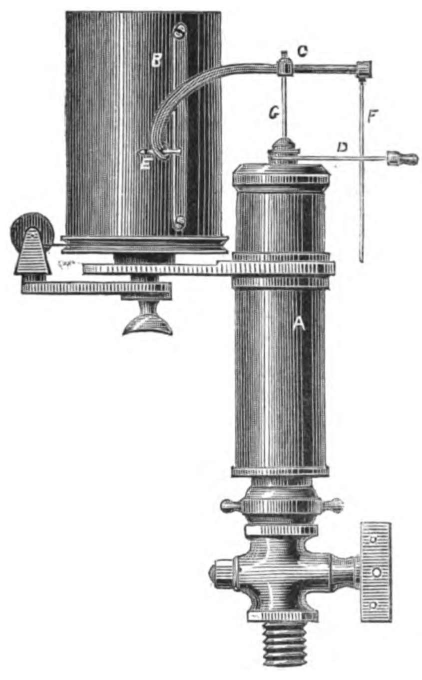
Finally, with regard to salt we find that the quantity made in Cheshire in the year 1868 is stated at 1,250,000 tons, the same quantity as that reported in the preceding year; but the quantities sent down the River Weaver show a large increase, the quantity of rock salt sent down with the year ending with March, 1869, reaching 58,696 tons of 26cwt., and of white salt, 901,566 tons, making a total of 960,262 tons. The returns of the quantity of salt made in Worcestershire show 240,000 tons in 1868—namely, 115,000 tons at Droitwich, and 125,000 tons at Stoke Prior. In Ireland the quantity in 1868 was 23,840 tons, an increase of 4,151 tons over the preceding year. The export of salt from the United Kingdom continues to increase. In 1865 it was 579,050 tons; in 1866, 601,440 tons; in 1867, 724,333 tons; in 1868, 797,502 tons. The declared value of the salt exported in 1868 was £485,537. The increase is chiefly in the exports to India and to Russia.

DIRECT-ACTING STEAM ENGINE INDICATORS.

MESSRS. J. A. and J. HOPKINSON, of Huddersfield, have patented some improvements in direct-acting steam engine indicators, which consist in making the indicator with a detached revolving barrel, and dispensing with the slides in which the pencil holder usually works. For this purpose an arm or pencil holder is fixed upon the top of the ordinary piston rod of the indicator, which arm turns on a swivel centre. At a lower point there is fixed a swivel guiding arm, which is so formed as to admit of a drop guiding rod passing through it, so that, by turning the swivel arm, the pencil can be brought upon the paper which is usually fixed on the revolving barrel, thereby facilitating the taking of diagrams. This arrangement not only dispenses with the ordinary slides, but also with joints, and prevents unnecessary friction, together with the liability to derangement, and allows other improvements to be carried out.

In our engraving, E is the pencil at the end of the swivel arm C, a part of which is turned down to a collar and fits on the piston rod G, being held by a nut on the upper side. D is a horizontal arm working from the cap cover of the barrel A, and acted upon as required by the hand of the attendant. In this arm is formed a hole, through which the drop guiding rod F slides. It will be seen from this connection that any upward or downward motion of the piston rod will be imparted to the swivel arm C, and that, by directing this motion through the medium of the arm D upon the barrel B, the pencil may be applied or withdrawn with the utmost facility, and indications may be registered as required.

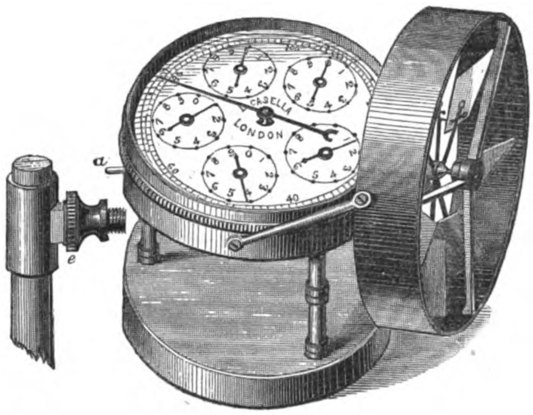
The internal arrangement of piston and spring is similar to the usual description of indicator, and does not therefore need to be described. The novelty in this instrument consists in the lightness



of the arm, and the important feature of having only one joint, thereby securing increased steadiness and firmness at the point of the pencil.

AIR METER.

BY MR. CASELLA.



AIR METER.

THE object of the little instrument illustrated herewith is to give correct means of measuring the velocity of currents of air passing through coal and other mines, and the ventilating spaces of hospitals and other public buildings. It was first constructed for Dr. Parkes, F.R.S., of the Royal Victoria Hospital, Netley, for measuring the state of ventilation in that large military establishment, and declared to be the most perfect instrument of the kind in use. Since then it has been adopted in the Houses of Parliament, the United States Senate, several of our northern mines, and many of the prisons and hospitals throughout the country. The graduations for each instrument are obtained by actual experiment by means of machinery made for the purpose, so that the indications of all are as comparable with each other as the weight or measure of ordinary substances.

The indications are shown by means of the large dial and hand, and five smaller ones, as shown in the engraving. The whole circumference of the large dial is divided into 100 parts, and represents the number of feet up to 100 traversed by the current of air. The five smaller dials are each divided into ten parts only, one revolution of each being equal to ten of the preceding dial, and representing 1,000, 10,000, 100,000, 1,000,000, and 10,000,000 respectively. By means of the large dial the low velocity of 50ft. per minute is measured, and by the smaller ones continuous registration is extended up to 10,000,000ft., or 1,893 miles, being practically beyond what the most extended observations can require. Jewelling of the pivots and bearings ensures the utmost delicacy of action. By moving the small catch *a* backward or forward the works are put in or out of gear without affecting the action of the fans; this prevents the injurious effect of stopping them suddenly, and enables the observer to begin or end his observations to a second. A small handle with universal joint accompanies the instrument, and may be screwed in at the base; by putting a stick through this it may be raised or lowered to any required height and used in any position.

The instrument is read off by writing down the position of all the hands. For this purpose the operator places the instrument before him, with the 0 on the outer circle facing him. The first circle on the left-hand indicates hundreds of feet, the next thousands, the third tens of thousands, the fourth hundreds of thousands, and the last circle to the right of the 0 marks millions. He begins to write down the position of the hands with the million circle, and then goes round from right to left, always writing down the lowest of the two numbers if the hand is between two. Let us say that the hand on the millions dial is at 0, the hundred-thousands between 2 and 3, the ten-thousands between 7 and 8, the thousands between 1 and 2, the hundreds at 5, and the large hand which marks units and tens at 73. The millions hand would be omitted, as it has not reached 1, and the remaining numbers would run 271,573. The instrument is then put in the current to be measured, and when removed after a given time is read in the same way; the first being deducted from the second reading gives the velocity (uncorrected) in feet during the time. A simple table is provided by means of which (in strict observations) allowance may be made for the difference caused by inertia at high and low velocities. This excellent little instrument promises to be of the greatest utility in investigations connected with ventilation and draughts. It is manufactured by Mr. L. Casella, the philosophical instrument maker, of Hatton Garden.

THE MANCHESTER STEAM USERS' ASSOCIATION.

THE last ordinary monthly meeting of the executive committee of this Association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, October 26, Mr. Hugh Mason, Vice-President, Ashton-under-Lyne, in the chair, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the past month 167 visits of inspection have been made, and 404 boilers examined, 274 externally, 7 internally, 6 in the flues, and 117 entirely, while in addition 4 new boilers have been tested by hydraulic pressure, and specially examined both as regards their construction and equipment of fittings. In the boilers examined 61 defects have been discovered, 3 of them being dangerous. Furnaces out of shape, 3; fractures, 6; blistered plates, 8; internal corrosion, 14—2 dangerous; external ditto, 6—1 dangerous; internal grooving, 4; safety valves out of order, 1; pressure gauges ditto, 1; boilers without glass water gauges, 6; without pressure gauges, 4; without feed back pressure valves, 8.

Five explosions have occurred during the past

month, by which nine persons have been killed, and twelve others injured. These explosions occurred with such rapidity at the close of the month that it was with difficulty they could be kept pace with and full particulars obtained. In four cases, however, the scene of the catastrophe has been visited by officers of the Association. Not one of the explosions which have taken place during the past month, or any referred to in this report, have occurred to boilers under the charge of the Association. The following is a statement of explosions from September 25 to October 22, 1869, inclusive:—September 26, plain cylindrical, egg-ended, externally-fired, 1 killed, 1 injured; October 6, double-flued furnace, internally-fired, 2 killed, 6 injured; October 14, plain cylindrical, egg-ended, externally-fired, 2 killed, 1 injured; October 18, plain cylindrical, egg-ended, externally-fired, 2 killed, 1 injured; October 19, single-flued or Cornish, internally-fired, 2 killed, 3 injured. Total, 9 killed, 12 injured. At the meeting at which the report from which the foregoing is extracted was read, the following resolution was passed:—"That a special edition of the chief engineer's report for the present month be sent to every coroner in the United Kingdom, with a circular letter signed by the President, calling attention to the verdicts given at the inquests therein referred to, and also that the same be accompanied by a copy of the report presented at the recent meeting of the British Association in Exeter by the committee appointed to consider 'How far coroners' inquisitions are satisfactory tribunals for the investigation of boiler explosions, and how these tribunals may be improved.'"

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

THE ordinary monthly meeting of members was held at the City Terminus Hotel on Saturday, the 6th inst. Mr. Newton, of the Mint, occupied the chair. After the transaction of the ordinary business, Mr. John Humes proceeded to read a paper on the "Warsop Aero-Steam Engine." After describing the earlier experiments made by Mr. Warsop in his attempts to reduce to practice a theory which had long occupied his mind, the author went on to explain the construction and arrangement of the most recently made engine on the Warsop principle. This was a marvellously simple piece of mechanism, and comprised merely the addition of an air-pump and conducting pipes to an ordinary high-pressure steam engine. The boiler in this case was on the Cornish multitubular plan. The radiating surfaces of the pipes were clothed, and the feed water was heated by the exhaust steam to 200deg. The air on its first emission from the pump was conducted into the vessel wherein the engine discharged its exhaust steam. It then passed down the chimney through a coiled pipe which led to the bottom flue of the boiler, the latter being set on the split draught principle. Thence it passed on to the smoke box or combustion chamber, and through a coil of sufficient size to allow of cleaning. The heated air was then conducted through the under flue to the front of the boiler, into which it was admitted by a check valve. A perforated pipe laid along the bottom of the boiler received the air and distributed it evenly. The lengths of pipe were as follows:—Feed heater, 12ft.; exhaust pipe, 13ft. 6in.; coils, 58ft.; in all 83ft. 6in., the total surface being 36 square feet. The boiler had a total heating surface of 130 square feet. A trial of this engine yielded most favourable results. In fact, the gain demonstrated by its use was equal to 47 per cent. as compared with the duty performed by the same engine with steam alone. They had thus, therefore, produced a machine which, when worked as an ordinary steam engine, performed its brake duty as well as any average commercial engine not designed to work with a high rate of expansion, whilst the addition of the pneumatic arrangement enhanced very considerably the amount of its useful duty. By the contact and intermingling of the two elements, a twofold advantage was gained. The air rose by force of its own levity through the water, which thus became "aërified" and subdivided, and the air itself on rising above the surface of the water, became saturated with steam, which assisted lubrication subsequently when the compound entered the cylinder.

Such is the pith of the invention which Mr. Humes described to the Associated Foremen on Saturday, and which he then explained very elaborately by aid of models and diagrams. It was understood that Mr. Eaton had purchased the patent right of the contrivance, and that several engines on the Warsop principle were now in course of construction by Messrs. Easton and Amos, Messrs. Roby and Co., and other well known engineering firms. A discussion followed the paper, and in this Messrs. Ives, Edmonds, Sisson, Eaton, Irvine, and the chairman joined. In putting the customary vote of thanks to the meeting, the chairman complimented the author of the paper and remarked that, although two historical events—the opening of the new Blackfriars Bridge and the Holborn Viaduct—had that day taken place, and might be supposed to dwarf all other proceedings in the City, yet the sitting of that night would be memorable in the annals of engineering. It might be that the names of Eaton and Warsop would one day become as celebrated as those of Boulton and Watt, and then the Association would regard with satisfaction the fact that the new engine of those gentlemen had been critically analysed and approved of in that hall.

Messrs. Humes and Eaton having acknowledged the conjoint vote of thanks unanimously accorded to them, the sitting was formally closed.

UTILISING THE WASTE STEAM OF LOCOMOTIVE ENGINES.

THE invention we are about to describe relates to the utilisation of the waste high-pressure steam and heat of locomotive engines. It has been patented by Mr. A. Dillon, of Dublin, who proposes thus to increase the heating power of the furnaces and to effect an important saving in fuel, and at the same time to utilise the waste heat of the engine. By the term "waste steam," is meant the steam which is given off from the cylinders through the blast pipe after its initial work is done, or the waste steam from the safety valves, and by "waste heat" is to be understood the heat which is carried off by the steam blast after heating the boiler, and also that heat which ordinarily acts injuriously on the fire-bars and other parts of the furnace, and which is of such little value in the generation of steam. The results of Mr. Dillon's arrangements are that the oxygen contained in one portion of the waste steam and the atmospheric air which is induced or impelled by another part of such steam is caused to come in contact with, and either prevents the formation or promotes the combustion of, the carbonic oxide, which is so frequently and so detrimentally evolved from the burning fuel, thus greatly increasing the heating powers of the furnace. At the same time the steam which is brought to bear upon the furnace bars has the effect of cooling them, thus preventing the adherence of clinkers.

The apparatus for effecting these purposes is as follows:—A bell-mouthed steam pipe leads from the side of the blast pipe to the fire-box, where it is formed into a zig-zag coil beneath the fire-bars, and terminates in the fire-box or water tank. The pipe of which the coil under the fire-bars is formed is perforated with small holes through which a portion of the waste steam rushes. The steam jets thus produced are caused by the arrangement of the coil to play partially on the fire-bars and partially into the fire, the effect of which is, first, to abstract from and utilise the excessive heat of the fire-bars and keep them cool, thus preventing the accumulation and adherence of clinkers thereon. Secondly, the steam is thus forced into contact with the heated bars, the incandescent part of the fuel, and the carbonic oxide, and is decomposed into its elements, and free hydrogen is liberated. In order to supply a sufficient quantity of oxygen for the combustion of the hydrogen thus liberated, atmospheric air is brought into contact and mingled with it either by the steam which issues from the rear end of the coil of pipe, or from any other part of the coil itself.

THE INSTITUTION OF CIVIL ENGINEERS.

SUBJECTS FOR PREMIUMS.

THE Council of the Institution of Civil Engineers invite communications on the subjects comprised in the following list, as well as upon others; such as, first, authentic details of the progress of any work in civil engineering, as far as absolutely executed (Smeaton's account of the Eddystone Lighthouse may be taken as an example); second, descriptions of engines and machines of various kinds; or, third, practical essays on subjects connected with engineering, as, for instance, metallurgy. For approved original communications, the Council will be prepared to award the premiums arising out of special funds devoted for the purpose.

1. On steam and hydraulic cranes, and on the application of steam power in the execution of public works.
2. On the different systems and the results of the use of road traction engines.
3. On the theory and details of construction of metal and timber arches.
4. On land-slips, with the best means of prevent ing or arresting them, with examples.
5. On the principles to be observed in laying-out lines of railway through mountainous countries, with examples of their application in the Alps, the Pyrenees, the Indian Ghats, the Rocky Mountains of America, and similar cases.
6. On the working expenses of railways.
7. On railway ferries, or the transmission of railway trains entire across rivers, estuaries, &c.
8. On the systems of fixed signals at present in use on railways.
9. Description of a modern locomotive engine, designed with a view to cheapness of construction, durability, and facility of repair.
10. On the cost of maintenance of railway locomotives.
11. Description of continuous brakes which have been extensively employed on railways, and the general results.
12. On the most suitable materials for, and the best mode of formation of, the surfaces of the streets of large towns.
13. On the construction of catch-water reservoirs in mountain districts, for the supply of towns, for irrigation, or for manufacturing purposes.
14. Accounts of existing waterworks; including the sources of supply, a description of the different modes of collecting and filtering water, the distribution to the consumer, and the general practical results.
15. On pumping machinery for raising water, both for high and low lifts.
16. On the principles applicable to the drainage of towns, and the disposal of the sewage.
17. On the employment of steam power in agriculture.
18. On the ventilation and warming of public buildings.
19. On the design and construction of gas works, with a view to the manufacture of gas of high illuminating power; and on the most economical system of distribution of gas, and the best modes of illumination in streets and buildings.
20. Description of successfully applied gas engines.
21. Critical observations on tides, and particularly as affecting coasts, estuaries, rivers, docks, and navigation.
22. On the maintenance, by sluicing, of the Harbours on the Coasts of France, Belgium, and Holland.
23. Description of the sea works at the mouth of the River Maas, and the effects produced thereby.
24. On the construction of tidal or other dams in a constant or variable depth of water; and on the use of wrought iron in their construction.
25. On the arrangement and construction of floating landing stages for passenger and other traffic, with existing examples.
26. On the different systems of swing, lifting, and other opening bridges, with existing examples.
27. On the measure of resistance to bodies passing through fluids at different velocities, and of fluids passing through pipes and in channels.
28. On the results of the best modern practice in ocean steam navigation, having regard particularly to economy of working expenses, by superheating, surface condensing, great expansion, high pressure, &c.; and on the "life" and cost of maintenance of merchant steam ships.
29. On the practical employment of heated air as a motive power.
30. On ships of war, with regard to their armour, ordnance, mode of propulsion, and machinery.
31. On the measures to be adopted for protecting iron and iron ships from corrosion.
32. On coal mining in deep workings.
33. On colliery explosions, and on the influence of different modes of "getting" coal on the safety of mines.
34. On the present systems of smelting iron ores; of the conversion of cast iron into the malleable state and into steel, and of the manufacture of iron and steel generally, comprising the distribution and arrangement of iron and steel works.
35. On machinery for rolling heavy rails, shafts, and bars of large sectional area, and for forging heavy masses of metal.
36. On steel, and its present position as regards production and application.
37. On the safe working strength of cast and malleable iron and steel, including the results of experiments on the elastic limit of long bars of iron,

and on the rate of decay by rusting, &c., and under sudden and prolonged strains.

88. On machinery for washing lead ores.

89. On the present state of submarine telegraphy, and on the transmission of electrical signals through submarine cables.

The Council will be glad to receive, for the purpose of forming an "appendix" to the minutes of proceedings, the details and results of any experiments or observations on subjects connected with engineering science or practice.

The Council will not consider themselves bound to award any premium should the communication not be of adequate merit, but they will award more than one premium should there be several communications on the same subject deserving this mark of distinction. It is to be understood that, in awarding the premiums, no distinction will be made whether the communication has been received from a member or an associate of the Institution, or from any other person, whether a native or a foreigner.

The communications must be forwarded, on or before February 1, 1870, to the house of the Institution, No. 25, Great George-street, Westminster, S.W., where copies of this paper, and any further information, may be obtained.

TRIASSIC DINOSAURIA.

PROFESSOR HUXLEY has communicated to the new scientific journal "Nature," a note of the utmost importance referring to a very remarkable discovery he has recently made. The note reads as follows:—It will probably interest geologists and palæontologists to know that a recent examination of the numerous remains of Thecodontosauria in the Bristol Museum, enables me to demonstrate that these Triassic reptiles belong to the order Dinosauria, and are closely allied to Megalosaurus. The vertebræ, humerus, and ilium, found in the Warwickshire Trias, which have been ascribed to Labyinthodon, also belong to Dinosauria. The two skeletons obtained in the German Trias near Stuttgart, and described by Professor Plieninger, some years ago, are also unquestionable Dinosauria; and, as Von Meyer is of opinion, probably belong to the genus Teratosaurus, from the same beds. Von Meyer's Platœosaurus, from the German Trias, is, plainly, as he has indicated it to be, Dinosaurian.

As Professor Cope has suggested, it is very probable that Bathygnathus, from the Triassic beds of Prince Edward's Island, is a Dinosaurian; and I have no hesitation in expressing the belief, that the Deuterosaurus, from the Ural, which occur in beds which are called Permian, but which appear to be Triassic, is also a Dinosaurian. It is also very probable that Rhopalodon, which occurs in these rocks, belongs to the same order. If so, the close resemblance of the South African Galesaurus to Rhopalodon, would lead me to expect the former to prove a Dinosaur. I have found an indubitable fragment of a Dinosaurian among some fossils, not long ago sent to me, from the reptiliferous beds of Central India, by Dr. Oldham, the Director of the Indian Geological Survey. Further, the determination of the Thecodonts as Dinosauria leaves hardly any doubt that the little Ankistrodon from these Indian rocks, long since described by me, belongs to the same group.

But another discovery in the same batch of fossils from India leaves no question on my mind that the Fauna of the beds which yield Labyrinthodonts and Dicynodonts in that country represents the terrestrial Fauna of the Trias of Europe. I find, in fact, numerous fragments of a crocodilian reptile, so closely allied to the Belodon of the German Trias that the determination of the points of difference requires close attention, associated with a Hyperodapedon, larger than those discovered in the Elgin Sandstones, but otherwise very similar to it. Thus, during the Triassic epoch, extensive dry land seems to have existed in North America, Western and Central Europe, Eastern Europe, Central India and South Africa, as it does now; and throughout this vast area, the Dinosauria—the links between reptiles and birds—seem to have been represented by not fewer, probably by many more, than nine or ten distinct genera. I hope, shortly, to have the honour of placing the details of the researches into the structure and distribution of the Dinosauria in which I have been engaged for the last two years, and of which the above notice is one of the results, before the Geological Society.

EVERITT'S ACOUSTIC TELEGRAPH.

A SERIES of experiments with the newly-invented Acoustic Telegraph were recently made at the Fulton Ferry Houses, Brooklyn, in the presence of a number of gentlemen, who were as much astonished as gratified at the accuracy of the general messages that were transmitted by the acoustic telegraph through wires connecting two houses 150 yards from each other. The first message sent was that of Rev. Dr. Deems, "He that hath ears to hear, let him hear." The Rev. Dr. Hall asked, "How long before the new bridge is to be built, and what about stocks in it?" Mr. Samuel Orchard inquired, "Can a man be held responsible for the place of his birth without having been consulted by his parents?" The reporter of the New York "Tribune," from which paper we take these particulars, asked, "What is the time at the ferry?" and Dr. Boscowitz inquired "the relative diagnosis between rubeola and scarlatina." These messages were all transmitted safely, and much more accurately rendered than ever could have been anticipated.

The invention is a battery that works without electricity through a wire that does not call for the protection of insulators, nor tall, massive poles, and that delivers a message through wire, of any length, one-eighth of an inch in diameter, submerged in water, buried in the ground, or suspended in the air. The battery consists of a solid iron cylinder one foot long or more, and four inches in diameter in facial and general, but toward the other end, which becomes conical and tapers like a Minie ball, is an aperture, admitting the entrance of a metallic wire, the medium of communication, the whole supported by solid iron frame work, and weighing not more than 100 pounds. At the facial end of the cylinder is a hollow hemisphere of iron, whose interior surface is covered with silver plate, constituting an elliptical mirror having a solid rim one inch in diameter. The face of this rim is ground so smooth that when it is placed in contact with the cylinder no air can intervene, and it is held and kept in this position by a strong spring twelve inches long, arched above, and supported by the frame-work, and curved below, so as to form the signal key, by which the battery is worked and made to evolve sounds from the organic atoms of the air which surround and press upon the fan of the rim and of the cylinder, with a force equal to 15lb. on the square inch, the moment one face is separated from the other. The distance of this separation is graduated by two metallic bars, which constitute the Diatomic Staff, and from each bar a different order of sound is created, called the vowel and the consonant sounds respectively. By uniting in regular order the first and second orders of sounds, the Fulcimen or third order is produced. By uniting the second and first order, the Bifulcimen or fourth order is generated, and in commingling together the first and second primary orders, the Valorem or fifth order of sound is created, and together they represent and express, under specific symbolic formula of sounds, each letter of the English Alphabet, and each Arabic Notation; and each one is so characteristic and expressive of itself that no mistake can occur in translating a message.

The inventor is Dr. Lancelot Hope Everitt, of New Orleans, La., who was elected a member of the Royal College of Surgeons in Edinburgh some years ago. The doctor's theory is that sound is a triune molecule of matter, silent inertia, impulsive force, and explosive sound, and exists in all the organic atoms of the world. That he can evolve these molecules from the organic atoms of the air in such a way by means of his acoustic battery as to collect them into two dissimilar units of sound, which he converts into two primary orders. When thus evolved the hemispheric mirror reflects them through the solid cylinder, which then inducts them into the cone of the wire, through which it passes with great velocity to the distant end of the wire. This end is all the time in contact with a glass bell made for the purpose. When a message is about being sent a tattoo is sounded by the battery, and this rings the bell so loud that you can hear it twenty feet off. The message then follows in symbolic order, and as they chime their intonations upon the bell they are easily interpreted by the receiver of the message.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular November 11.)

IN most branches of the chemical trade there has been increasing activity throughout the week past, and it is anticipated that, at the turn of the year, a considerable advance will be established in the values of the staple articles. In minerals the business effected has been rather under the average; prices, however, remain very firm. There is little doing in metals, with the exception of iron, in which large transactions have taken place; but, as an endeavour is made to establish an advance of 20s. in manufactured iron, a falling off in orders is certain to result. Soda: for soda ash, prices still rule at £7 to £7 5s. for 48. Caustic meets with a steadier sale at £13 7s. 6d. to £13 12s. 6d for 60. Crystals rather easier, at £3 17s. 6d. to £4. Bi-carbonate dull, at £9 10s. Nitrate of soda: still receding from the late forced rise, sells now at 15s. 6d. to 16s. per cwt. Potash: muriates offering in small quantities at £7 to £7 5s. for 80, for later spring delivery. Saltpetre: inactive, and at last week's quotations. Alum: in continued home and foreign request, at £6 5s. per ton, for loose lump, £7 in export barrels, and £7 for ground. Ammonia: sulphate still scarce, and selling at £15 5s. for secondary, to £17 7s. 6d. for fine white. Copperas: green and rusty values remain stationary. In dry a largely increased business has taken place at £2 10s. Chloride of iron, 52s. Pyrites: unaltered in value, with a steady consumption. Calcined wanted, at 44s. 6d. to 44s. R.C. Lime: in phosphate not much has been done, and prices remain at 52s. 6d. for 65. Bleaching powder readily obtains £8 5s. to £8 10s. for 35, at which large sales have been effected. Disinfectants meet with an active sale, especially among farmers dreading the cattle disease, price as before, 5s. 3d. per cwt. Manganese: is rather dull, with no change in prices. Acids: a considerable business in tartaric, at 1s. 1½d. for foreign; English ground, 1s. 2¼d.; citric, 2s. 5d; oxalic, 7¼d.

METALS.—Iron: Scotch pigs have advanced to 54s. 11d. to 55s. 2d., at which they closed firm. Cleveland very firm, at 44s. 6d. for forge, to 49s. 6d. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 45. Copper: no alteration in this. English tough, £72 to £73; Chili Slab, £68. Tin: is weaker. English, £122 to £123; Straits, £124. Lead: in good demand, and present prices are readily obtainable. P.G. best English soft pig lead, £18 15s. Spelter: some large sales have been made. English nominally quoted at £20 10s.; Silesian, special brands, £19 15s. to £20; Hard spelter, for export, £16 5s. to £16 10s.

Obituary.

IT is with sincere regret that we record the death of the great modern philanthropist, George Peabody, whose name will remain dear to both Englishmen and Americans. He died on the 4th inst., in Eaton-square, whither he had but lately arrived from the United States. Mr. Peabody had been in failing health for some time past, and was on his way southward, in the hope that a milder clime might restore him, when death overtook him, in the 74th year of his age. The deceased gentleman devoted a large portion of his fortune to promoting the interests of science and education, as well as to ameliorating the condition of the poorer classes. He gave immense benefactions to Harvard University, to the Southern Educational Fund, and to charities in his native State of Massachusetts, the exact amount of which was probably known to no one but himself. At the time of the Great Exhibition of 1851, Mr. Peabody redeemed the good name of his countrymen by promptly supplying a sum of 15,000 dollars, which was required in order to place the contributions of America in orderly array, and to save that country from putting in an appearance quite unworthy of its public and private enterprise. In our country—that of Mr. Peabody's adoption—he bestowed on the poor of London upwards of a quarter of a million of money, to be laid out for their benefit. Such an act of princely munificence is without a parallel, and stands out the more prominent from the fact that the donor declined all the numerous offers of honours which were made to him, contenting himself with the reflection that he would be best remembered on both sides of the Atlantic as plain George Peabody.

Legal Intelligence.

VICE-CHANCELLORS' COURT.

NOVEMBER 10.

(Before Vice-Chancellor SIR R. MALINS.)

POUPARD *v.* FARDELL.

THIS bill sought to restrain the making of "skids" (for skidding wheels) with shoes according to the pattern of those the subject of a patent taken out by the plaintiff in January, 1859, for delivering up of all skids in the defendant's possession, and for an account. The plaintiff was a scale and machine maker, and the defendant was a carman in the neighbourhood of the docks, and the discovery of the alleged use by him of plaintiff's skids in February, 1868, was the cause of the present suit. The case was opened on Monday, continued on Tuesday, and occupied the whole day, the further hearing being appointed for Thursday. The plaintiff's various workmen, and Colonel Philpot, and two soldiers of the Royal Horse Artillery were examined in court *viva voce*.

Mr. Glasse, Q.C., and Mr. Bovill appeared for the plaintiff; Mr. W. W. Mackeson, Mr. Stevens, and W. W. Cooper appeared for the defendant.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

MESSRS. DAWSON and CHRISTY (Lille).—We have replied to your communication by post.

RECEIVED.—C. M.—J. F.—J. G.—T. and F.—E. B.—R. J. W.—C. W. M.—H. S.—T. and P.—F. H. W.—G. B.—G. W. H.—S. E.—F. H.—J. L. and Co.—J. H.—E. S.—P. D.—G. F.—S. K.—J. L. N.—S. and J.—H. O.—C. G.—J. W.—E. M.—A. B.—W. S. T.—M. W.—W. and O.—J. N.—R. F.—G. E. B.—E. O.—F. S.—A. F. E.—T. B.—R. T.—J. D.—J. M'L.—E. A. B.

Meetings for the Week.

MON.—Society of Engineers.—On "The Need for further Experiments on Strength of Materials," by Mr. Charles J. Light, at 7.30 p.m.

TUES.—Institution of Civil Engineers.—Discussion upon M. Gaudard's paper on "The Strength and Resistance of Materials," and, time permitting, a paper will be read on "Public Works in the Province of Canterbury, New Zealand," by Mr. Edward Dobson, A.I.C.E., at 8 p.m.

Naval, Military, and Gunnery Items.

HIS Majesty the King of Portugal has awarded a silver medal and a diploma to Captain John Hesketh, master of the British vessel "British Queen," of Barrow, Lancashire, for having on the 19th June, 1869, saved two of the crew of the Portuguese fishing smack "Born Jesus," off Cape St. Vincent.

THE Duke of Cambridge has issued an order to the effect that soldiers who have been so fortunate as to save life shall be permitted to wear the decorations they have so acquired on the right breast. The navy will be disappointed if Mr. Childers does not follow the example which the Field-Marshal Commanding-in-Chief has set him.

A STEAM travelling crane, supplied by Messrs. Taylor and Co., of Birkenhead, for use alongside No. 2 dock in Chatham Dockyard, to be used in the construction of the "Sultan" armour-clad ship, has just stood a successful test. It was tried up to 17 tons, while it is required to lift only 15 tons; and acted very satisfactorily.

THE issue of the medals for the campaign in Abyssinia has been considerably delayed by the death of the late Master of the Mint, and by the necessity of having the name of each individual officer or soldier engraved on the medal to be given to him. Many of them have, however, now been distributed, and the remainder will soon be delivered.

BETWEEN 6 and 7 on Thursday night week the "Avon," a large steamer trading between Newport and Bristol, came into collision off Pill, a few miles below Bristol, with the steamer "Athlete." The "Avon" sank in five minutes. Twenty passengers were on board, and were all rescued with difficulty in the steamer's own boats. The crew swam ashore. Hundreds of pigs, sheep, and other animals were drowned.

A FINE new self-righting lifeboat, 33ft. long has been purchased with the proceeds—amounting to £500—from penny readings in different parts of the kingdom. The boat is to be stationed at Wells, on the Norfolk coast, under the management of the National Lifeboat Institution. It is to be publicly launched at its station on the 12th inst., when the Countess of Leicester will name the boat. To Mr. E. B. Adams, surgeon, of Bungay, is due the great credit and perseverance of organising and collecting the "Penny Readings" Lifeboat Fund.

THE artillery experiments at Finspong, in Sweden, have been completed, and the new 11½in. gun, which is made entirely of Swedish iron, has met with general approval both among the Swedish and Danish artillerists. It was fired from a distance of 580ft. at a target made of six plates of iron, each 2 in. thick, and backed with strong wooden beams. About 20 yards behind it was a wooden target 2ft. thick, leaning against an embankment of gravel. The conical projectile of the gun, weighing 150lb., pierced both targets and buried itself to a depth of 8ft. in the embankment.

SOME interesting experiments have been carried out at Portsmouth for testing the relative effects of gunpowdee and gun-cotton under equal and unequal conditions, and for ascertaining the comparative action of the regular service fuse used in firing mines, and of the new detonating fuse invented by Abel, the chemist to the War Department. The gun-cotton was in most instances used in the forms of discs and cylinders, and when placed in proper position gave excellent results; but it appears by slight carelessness the greater portion of the advantage is lost.

THE pattern wrought-iron carriage and platform for 12-ton rifle guns, now under course of construction by Colonel Clerk, R.A., at the Royal Carriage Factory, Woolwich, from designs submitted by Captain Moncrieff, of the Edinburgh Militia Artillery, will shortly be completed. With a view to ascertaining its working qualities it is intended to fire a few rounds at Woolwich from a 9-inch 12-ton rifled muzzle-loading gun mounted on it, using 250lb. shot, and battering charges of 43lb. of powder. If the working of the carriage and platform should be found to be satisfactory, it will then be forwarded to the School of Gunnery at Shoeburyness, for use in extensive experiments.

A COMMITTEE has been formed at Sheerness, with Vice-Admiral Warren, commander-in-chief at the Nore, as chairman; Dr. Lisburne, staff surgeon, her Majesty's Reserve, as treasurer; and Mr. H. F. Pullen as secretary; for the purpose of collecting funds for the relief of the widows and orphans of those who were killed by the lamentable explosion on board her Majesty's gunboat "Thistle," on the 3rd inst., by which eight widows and eleven orphans were thrown into mourning. Subscriptions will be thankfully received by the treasurer and the following gentlemen:—Mr. Hugh F. Pullen, R.N., secretary, Sheerness; Mr. J. W. Ashby, C.B., R.N., secretary, Portsmouth; Mr. Richard Munday, R.N., secretary, Devonport; Mr. Henry G. Barlow, R.N., secretary, Queenstown; Messrs. Woodhead and Co., 44, Charing-cross, London; and Messrs. Stilwell and Co., 22, Arundel-street, Strand, London. Bankers, London and County Bank.

Miscellanea.

THE annual dinner of the Society of Engineers will take place at the Westminster Palace Hotel, on Friday, December 17.

LAST week a shock of earthquake, which lasted a few seconds, took place at Sebastopol. Furniture in the houses was shaken, and even upset.

LORD HOUGHTON goes to Egypt as representative of the Royal Geographical Society at the opening of the Suez Canal, by invitation from the Viceroy.

A HEAVY snow storm which recently fell in Italy broke down the telegraphic wires in many places in the interior of Bologna, and caused other damage along the line.

THERE has been a severe earthquake at Manilla. Every building was shaken. Walls were thrown down. Many accidents occurred at Manilla and neighbouring provinces.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending November 6, was 3,838. Total number since the opening of the Museum, free daily (May 12, 1858), 1,678,459.

IT is said that there are only two persons in the United States who have not communicated their views on the Byron question to the newspapers, and they are citizens of Cape Cod, who went off mackerel fishing six weeks ago, and have not returned.

THE number of Cornish pumping-engines reported for September is 20. They have consumed 1,158 tons of coal, and lifted 7·5 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 44,360,000lb., lifted 1ft. high, by the consumption of 112lb. of coal.

THE castor bean, from which the oil is made, is becoming an important industry in Perry country, California. One prominent dealer received at his warehouse 1,000 bushels in one day, paying 3 dollars 18 cents. per bushel. It yields more bushels in the acre than wheat.

THE operations of the diggers at the Sutherland Gold Diggings have during the last week or two been interrupted by unfavourable weather, and the success of those employed has not been equal to that of former mouths, so that it is generally believed gold digging in Sutherland is, for the present at least, at an end.

THE inauguration of the first railway constructed in Wallachia, from Bucharest to Guirgevo, has just taken place, in presence of the representat ves of the foreign Powers. The line, which is not quite 20 miles in length, was commenced in 1863, so that the works have progressed at the rate of 3½ miles per annum.

A HANDSOME free library was opened by the Mayor of Tynemouth at North Shields yesterday week. It is the first that has been started in the Tyneside towns, and is a very complete establishment, consisting of a circulating library of over 13,000 volumes, a large reading-room, reference library, museum, and science and art classes.

THE recent gales have done so much damage to the South Garl Breakwater at the mouth of the Tees that it has been resolved not to proceed further with the constructing of it until some eminent engineer shall have given his opinion as to the desirability of continuing the tipping of the immense quantities of slag from the various iron-works on Teeside.

AN improvement in the manufacture of horse collars has just been devised by a Philadelphia mechanic. The collar, being stuffed with elastic cork, is light in weight, and adapts itself to the shape of the animal as readily as if it was moulded. It is highly elastic, does not chafe or gall the neck, and the cork being a non-conductor, injury from the heat is prevented.

THE coal and coke trade of Northumberland and Durham is growing better, and the prospects are more cheering. The pig iron trade is in a most satisfactory state. From the monthly returns of the Cleveland Ironmasters' Association it appears that the make amounted to 106,685 tons, an increase of nearly 15,000 tons compared with the same time last year. The foreign shipments have been heavy, amounting to 13,716 tons, an increase of about 3,000 tons.

THE Great Central Belgian Railway Company has just laid down some Bessemer steel rails on the Lodelinsart incline near Charleroi; these rails were furnished by the Barrow Hematite Steel Company at £11 18s. 6d. per ton, with delivery in trucks at Antwerp, a guarantee for seven years being also given. Some iron rails of good quality placed three years since upon the incline have recently been found to have been quite worn up in that period.

THE number of visitors to the South Kensington Museum during the week ending November 6, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 12,214; Meyrick and other galleries, 1,420; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,590; Meyrick and other galleries, 90; total, 15,314. Average of corresponding week in former years, 9,375. Total from opening of Museum, 8,931,296.

THE Registrar-General reports that the population of Victoria increased in the second quarter of the year 1869 by 6,623 persons, viz., 3,302 males and 3,321 females, and he estimates the number of the population on the 30th of June, 1869, at 696,161, there being 391,146 males and 305,015 females. During the quarter the gain by excess of births over deaths was 3,988, viz., 1,813 males and 2,175 females. The gain by excess of arrivals over departures was 2,635, viz., 1,489 males and 1,146 females.

WE read in an American paper that a happy thought suggested itself to an engineer in want of tracing paper and unable to procure it readily, to try petroleum. To his surprise he found the experiment extremely satisfactory, and by coating the paper with the petroleum and pressing it between blotters to extract the excess of oil, he obtained a paper in a few minutes which was superior to anything that could be found elsewhere, taking as readily as ordinary paper any marks with writing ink, Indian ink, or colours.

ACCORDING to advices from San Francisco, it appears that a Japanese immigration is likely to be introduced into California simultaneously with that from China. A German named Schnell, who had been for a long time a resident of Japan, came to El Dorado county in June last, and made a purchase of lands for the purpose of establishing a Japanese colony, to be conducted upon the co-operative labour system, to engage in the culture of the tea plant, the oil plant, wax and mulberry trees, and the manufacture of silk, and the results thus far are alleged to have been very successful.

THE "Melbourne Argus" states that attention is being drawn in different parts of Australia to the alterations which the climate is undergoing in consequence of the systematic denudation of tree-covering which the surface of the country is being subjected to. It is shown, for example, that in the case of the Ballarat district the destruction of the timber has been accompanied by a corresponding diminution in the rainfall, and that since 1863 there has been a more or less regular reduction—from 37·27in. in 1863 to 17·23in. in 1868. During the first seven months of the present year, and including two of the ordinarily wettest, the rainfall has been only 11·20in. The government of Victoria have appointed an inspector of State forests, whose duty it will be to prevent the waste of timber and the reckless destruction of live wood, and at the same time to establish nurseries of forest trees in various parts of the colony. The appointment has been conferred upon Mr. Ferguson, late gardener to Mr. Hugh Glass.

In reference to the well-established fact that water, after having been deprived of air as much is possible, either does not boil at all when heated, or does so with violent, sudden starts and concussions, some experiments have been made by Kremers, who observed that, in order to assist in expelling air from water, the addition of spirits of wine, in the proportion of one part of the latter to three of the former, is very useful. He cautions against a danger which exists when such a mixture is heated too rapidly, since it is very apt to boil over, especially after a portion of the spirit has evaporated. It is rather curious, says the "Quarterly Journal of Science," that though both the water and spirits of wine were pure, the mixture when boiling should assume a greenish-yellow hue, which disappears again on cooling. The boiling-point of fluid easily becomes as high as 109 deg. As a result of a large number of experiments, the author finds that water, as fully deprived of air as possible, may be heated as high as from 108 deg. to 200 deg. C., without boiling permanently.

All who have occasion to make use of tracing paper in their professional duties will be glad to know that any paper capable of the transfer of a drawing in ordinary ink, pencil, or water-colours, and even a stout drawing-paper, can be made as transparent as the thin yellowish paper at present used for tracing purposes. The liquid used is benzine. If the paper is damped with pure and fresh distilled benzine, it at once assumes a transparency, and permits of the tracing being made, and of ink or water-colours being used on its surface without any "running." The paper resumes its opacity as the benzine evaporates, and if the drawing is not then completed, the requisite portion of the paper must be again damped with the benzine. The transparent calico on which indestructible tracings can be made was a valuable invention, but this new discovery of the properties of benzine will prove of further service to many branches of the art profession, in allowing the use of stiff paper where formerly only a slight tissue could be used.

The island of Jersey is in a fair way of shortly possessing its first railway—a species of locomotion never yet witnessed by a large portion of the inhabitants. The States recently met especially for the consideration of the bill, and unanimously agreed to it. The line is to run between St. Helier and St. Aubin (formerly the chief town and port of the island, but now completely shorn of its former glory). The line is to round St. Aubin's Bay, near to the main road (a distance of four miles), with intermediate stations. The line is to be formed by a limited company, composed, it is understood, of a small number of English gentlemen, who have in view the contemplated harbour of Noirmont, near to St. Aubin, where it has been for some time past proposed to establish a harbour which will be accessible to the mail packets at all states of the tide. The company is bound to commence the undertaking within three months after the bill has received the sanction of the home Government, and to complete it within twelve months. The line will be a single one.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

Boilers and Furnaces—1200, 1222, 1228, 1255

Buildings and Building Materials—1227, 1236, 1243 1244

Chemistry and Photography—1178, 1207, 1224, 1242, 1243

Cultivation of the Soil, including agricultural implements and machines—1188, 1239, 1240, 1251

Electrical Apparatus—1250

Fibrous Fabrics, including machinery for treating fibre pulp, paper, &c.—1202, 1211, 1219, 1230, 1234, 1235, 1237, 1258

Food and Beverages, including the apparatus for preparing food for men and animals—1187, 1195, 1217, 1220

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c.—1183, 1191, 1194, 1196, 1198, 1201, 1204, 1205, 1213, 1215 1223, 1226

General Machinery—1240, 1245, 1249

Lighting, Heating, and Ventilating—1181, 1199, 1215

Metals, including apparatus for their manufacture—1197, 1203, 1206, 1212, 1231, 1256, 1260

Miscellaneous—1177, 1179, 1186, 1189, 1209, 1221, 1238

Roads and Vehicles, including railway plant and carriages, saddlery, and harness, &c.—1182, 1185, 1190, 1192, 1208, 1210, 1216, 1218, 1225, 1229, 1233, 1240, 1246, 1248, 1252, 1254

Ships and Boats, including their fittings—1173, 1214

Steam Engines—1222

Warfare—1180, 1184, 1193, 1232, 1247, 1257, 1259

1173 L. Eggert and O. E. Pohl, Liverpool. *Vessel of war.* Dated April 16, 1869.

The invention consists in the peculiar form of the vessel. The following is a description of midship section:—The displacement being calculated, and the area of the greatest midship section determined, the inventors construct the same, marking the load water line according to the calculation. They make another mark below the water line down to that point where projectiles passing through the water and touching the body of the vessel will prove ineffective. From this mark downwards, the under body must be constructed according to the size of the vessel of wood only, while all above is constructed of iron.—Patent abandoned.

1177 S. Harrison, Liverpool. *Ventilating sewers.* Dated April 16, 1869.

The apparatus consists of a manhole and ventilating cover combined with movable sludge box or mud basket; in the arrangement of a charcoal basket, which is used for purifying the noxious gases arising from the sewer or drain and escaping through the ventilating cover in an overflow or drain pipe connected with the manhole and extending into the sumphole at the bottom of the manhole shaft, where it is trapped in a flushing valve fixed on the edge of the sewer or drain, where it joins the shaft; in a portable winch for raising the said flushing valve; in a flushing box connected with the above, for flushing the sewers and drains and lamphole cover, for the purpose of lighting and ventilating sewers and drains when workmen are engaged therein; and in a trap gulley made with a hopper and movable sludge box, and in a flushing valve or differential outlet pipe for subsidence tanks and cesspools.—Patent completed.

1178 G. T. Bousfield, Brixton. *Hydrocarbon oils.* (A communication.) Dated April 16, 1869.

This consists, first, in treating heavy hydrocarbon oils for the purpose of deodorising them by distilling off a portion containing the odorous matters, and then stopping the distillation, leaving the main body of the oil in the still free from the characteristic odours of heavy hydrocarbon oils, and having when cooled only a slight smell like a sweet fatty oil. Second, in the combination with a still suitable for distilling oils, the superheating coil within the still, with its steam pipe, outlet pipe, and return pipe, and their stopcocks.—Patent completed.

1179 A. F. Craig, Paisley. *Cutting pasteboard.* Dated April 16, 1869.

The cutting is effected by circular knives fixed on spindles, which are made to revolve by any convenient gearing. The sheet first passing longitudinally between one pair of these knife spindles to receive what may be termed the longitudinal cuts; and the strips so formed are then passed without derangement, but in a transverse direction, between a second pair of knive spindles, by which the transverse cuts are produced.—Patent abandoned.

1180 J. H. Johnson, Lincoln's Inn. *Firearms.* (A communication.) Dated April 16, 1869.

This consists, first, in the increased simplicity of the mechanism; second, in the double fastening of the breech by means of a lever cover piece, which admits of the projectile being driven home and centred in the rifled grooves; third, in a peculiar arrangement of the trigger and parts in connection therewith; fourth, in a peculiar safety apparatus for preventing discharges till the breech is properly closed; fifth, in a peculiar system of cartridge extractor; sixth, in a peculiar system of rifled grooves having a sharp twist and narrow projecting ribs between them; seventh, in a peculiar elevation sight, which admits of the correction of lateral deviation arising from any cause, the effects of which are very sensible at long ranges.—Patent completed.

1181 W. E. Newton, Chancery-lane. *Safety gas burners.* (A communication.) Dated April 16, 1869.

A chamber filled with sand or granular mineral matter is applied between the burner and the pipe from which it is supplied.—Patent abandoned.

1182 J. Ives, Thame. *Velocipedes.* Dated April 16, 1869.

The inventor provides a crank transverse frame to carry the seat and foot board, and this frame is suspended on the trunnions of a pair of carrying wheels. Connected with these trunnions are cranked handles, through which rotary motion is communicated to the carrying wheels by the person on the suspended seat. Or the wheels may be keyed to a cranked axle divided in the middle and capable of connection by means of a sliding friction or other clutch.—Patent abandoned.

1183 P. Bogler and H. Kayser, Vienna. *Lifts.* Dated April 17, 1869.

This improved lift consists of four wooden columns, set in a square and united by suitable cross bars. The inner sides of the columns form a slide wherein the lift may rise upwards and downwards as desired. A suitable screw is provided for this purpose, which is turned by a lever or handle below, and passing through a nut fixed to the movable platform or landing.—Patent abandoned.

1184 E. T. Hughes, Chancery-lane. *Firearms.* (A communication.) Dated April 17, 1869.

This consists in the construction of gun barrels with a compound bore, consisting of three sections, one of which at the breech end is a perfectly smooth bore; another section at the muzzle end is a rifled bore (the calibre of this section should be just the depth of the rifling, smaller than the smooth bore section); the third and middle section consists of a tapering bore, which at each end coincides with the bore with which it is connected. The rifling is continued through the middle section to the same depth as the muzzle section, and should be a gaining twist.—Patent completed.

1185 P. Bogler and H. Kayser, Vienna. *Railway tickets delivery regulator.* Dated April 17, 1869.

This consists in causing the button to act by pressure on a lever, the turning point of which is fitted with a spiral spring. The bar actuated by the lever acts on the tickets so that they can pass the slit through which they are delivered. The spiral spring also returns the lever and button to their normal positions when the pressing operation is over.—Patent abandoned.

1186 F. J. Knewstub, James-street, S.W. *Printing.* Dated April 17, 1869.

This consists in printing by the ordinary mode from plates, stones, or otherwise, an ornamental background, outline, or border, in ink or colour, or in gold, silver, bronze, or other metal. A pattern or device is then produced upon the background, outline, or border, with or without ink or colour, or gold, silver, bronze, or other metal, either by stamping, embossing, printing, or other similar means.—Patent abandoned.

1187 H. W. Dee, Sherwood-street, Golden-square. *Bottles and jars.* Dated April 17, 1869.

This consists in making grooves or channels in the neck of the bottle, or in a collar fitting over the neck in such a manner that when the top or cap is forcibly pressed over the mouth, and turned partly round by the hand, the pressure of a spring within the head of the top or cap causes it to move upwards, and to bring pins or studs into grooves or notches made at right angles to the grooves or channels before mentioned.—Patent abandoned.

1188 T. Amies, Peterborough. *Warming greenhouses.* Dated April 17, 1869.

The inventor forms the boiler of the apparatus of a vertical water space, enclosing three sides of a rectangle, the fourth side of the rectangle being merely closed in by a door. At the top of the boiler, the three-sided vertical water space opens into a horizontal water space, which forms the top of the boiler. Below the bottom of the boiler is placed a gas burner, and the products of combustion as they rise up from it are caused to pass in a zigzag direction between water spaces which project out alternately from the opposite sides of the vertical three-sided water spaces, and these horizontal water spaces extend nearly from the one side to the other.—Patent completed.

1189 J. Willats, Stamford-road, N.E., and A. J Martin, Stratford. *Mode of advertising.* Dated April 17 1869.

This consists in the application to ordinary playing cards of announcements in the form of advertisements.—Patent refused.

1190 T. Page, Adelphi, W.C. *Locomotives.* Dated April 17, 1869.

The inventor provides a tank or receiver placed in a horizontal position above the boiler, and secured thereto in any suitable manner. This tank, which is divided into compartments by partitions or otherwise, or traversed by tubes, contains the water to be supplied to the boiler. These tubes open into a smoke box at either end, and the flue tubes of the boiler also communicate with the forward or smoke box proper in the usual manner. The products of combustion after leaving the flue tubes of the boiler are passed through the tubes or divisions of the tank to the area of the smoke box for heating the water contained in the said tank in their passage.—Patent completed.

1191 A. Smith, Mauchline. *Ornamenting hats.* Dated April 19, 1869.

When the colouring matter is applied directly upon the foundation or body, the inventor prepares the same with size, and varnishes the coloured surface when dry to secure it from injury by the weather and render it waterproof.—Patent abandoned.

1192 R. Chapman, Shrewsbury. *Railway fish plates.* Dated April 19, 1869.

The object of the invention is to prevent the screw bolts of railway fish plates and the nuts on them from working loose, and this is accomplished by having a ledge or projection made on the outside of that fish plate against which the nut presses in such a position that when the nut is in its place and pressing against the fish plate, the ledge or projection prevents it from turning round.—Patent abandoned.

1193 J. Horsley, Cheltenham. *Blasting powder.* Dated April 19, 1869.

This consists in the incorporation of nitro-glycerine either with a mixture of powdered aleppo or other foreign gall nuts and chlorate of potash, or with a mixture of powdered galls, cream of tartar, and chlorate of potash, or with a mixture of galls, hard sugar, and chlorate of potash, or with plain mealed gunpowder, so as to form a powerful blasting powder or explosive compound.—Patent completed.

1194 H. A. Bonneville, Sackville-street. *Making hat rims.* (A communication.) Dated April 19, 1869.

The apparatus consists of a cast-iron table resting upon a frame. This table carries the mechanism, which is as follows:—Motion is imparted to the three gearings by a crank; the first gearing is shipped upon the arbor of the crank and actuates the two other gearings. The object of each of these is to impart motion in one direction or the other to the levers by means of the nuts and the screws. The levers oscillate. The screws are wormed some to the right and the others to the left, in such wise that by means of their nuts the levers act simultaneously either in drawing nearer to or in receding from the centre of the apparatus.—Patent completed.

1195 P. Bourchani, Paris. *Raising beer.* Dated April 19, 1869.

A main reservoir is provided with two openings, one for the entrance of the water which is to fill the reservoir, the other for the exit of the water and the emptying of reservoir, the latter opening having a pipe at least 12 yards in length, and plunging for this purpose into a well or drain or other conduit. The first reservoir is in direct communication with a recipient which, fitted near the bar or counter, is intended for the reception of the raised liquids.—Patent abandoned.

1196 W. H. Smith, jun., Salisbury-street, W.C. *Lavatories and taps.* (A communication.) Dated April 19, 1869.

The inventor so mounts and fits the basin that by turning it partially round it is caused to rise or fall, and either close or open the discharge or escape passages instead of employing the ordinary description of plug and shell, tap or cock, for regulating the admission of water.—Patent abandoned.

1197 H. AITKEN, Falkirk. *Treating iron ores.* Dated April 19, 1869.
This consists in coking or carbonising in contradistinction to roasting or calcining the iron ores or ironstones in the open air on a platform or bed of clay, brick, stone, iron, or other material, which may be situated horizontally or at angle to that position (an angle of about one in fifteen is preferred); or in place of using a platform, the iron ores or ironstones may be placed in an open casing on the top of a blast furnace, and when coked or carbonised dropped into the furnace, or they may be treated in an open tower or kiln.—Patent completed.

1198 J. E. WARD, Bredbury. *Hats.* Dated April 19, 1869.
This consists in making hats with a sufficiently stiff but elastic "leather" or lining so secured to the body or shell of the hat that there will be space all round between the "leather" or lining and the body or shell of the hat, equal in depth at least to that of the ordinary "leather" or lining. This "leather" or lining is not attached to the body of the hat at the brim in the ordinary manner, but is secured or suspended from a point or points within the body of the hat, the lower edge being loose and not fast as in the ordinary hat.—Patent completed.

1199 A. V. NEWTON, Chancery-lane. *Friction matches.* (A communication.) Dated April 19, 1869.
The invention comprises, first, a composition containing caoutchouc (or india-rubber) or gutta-percha for the manufacture of matches. Second, the match safe constructed so that the coiled match and tube may be properly secured and used.—Patent completed.

1200 H. Y. D. SCOTT, Ealing. *Pottery ovens.* Dated April 19, 1869.
The novel features in this oven are:—A feeding hopper having a considerable inclination downwards towards the far end of the fireplace, or that which is nearest to the working chamber. Second, inclined firebars to which the fuel descends after it leaves the hopper. Third, a rectangular or horizontal chamber such as is now commonly used in the potteries, and in which the fuel is retained by a reticulated wall or glut, or in some instances such as is used at the copper smelting works, where the depth of the fuel on the firebars is required to be considerable, and the fire is chiefly retained by the masses of slag which collect upon them. It is to this chamber that the fuel introduced into the hopper finally descends.—Patent completed.

1201 S. SHAW, Boston. *Feeding boilers.* (A communication.) Dated April 19, 1869.
In a piston which is fitted to work in a pump, barrel, or cylinder, the inventor forms a chamber which, as the piston moves to and fro in the cylinder, is alternately brought opposite to each one of two apertures, one of which communicates with the source of supply, and the other with the boiler. The centre of the said chamber coincides with the desired water level in the boiler. The chamber is filled with water through the supply aperture, and carries the same to the outlet aperture, through which, if the water in the boiler has fallen below the proper level, this water or a portion of it will flow.—Patent abandoned.

1202 L. GOETZ, Leith, N.B. *Cleansing wool.* Dated April 20, 1869.
This consists essentially in boiling together for about three hours in water the following ingredients in or about the proportions given, namely:—The water, about 250 gallons, is first purified by boiling it with 10lb. to 15lb. of farina for about five minutes. To these 250 gallons of purified water are then added 200lb. of calcined soda or soda ash of a strength of about 90deg. and free from salt, 100lb. of linseed, 72lb. of potash, 72lb. of resin, and 40lb. of caustic soda of a strength of about 90deg. From 40lb. to 45lb. of Olein oil may also be added to increase the washing or cleansing power.—Patent completed.

1203 A. BRADY, Maryland Point, Stratford. *Manufacture of iron.* (A communication.) Dated April 20, 1869.
This consists in mixing and manipulating crude iron ore, ground or reduced to a powder with sulphate of lime, sulphate of soda, sulphate of alumina, or with any alkaline sulphate pulverised, and both articles having been roasted or otherwise assimilated to about equal degrees of temperature. A fusion or smelting of the materials is then to be effected by the usual methods in an ordinary furnace.—Patent abandoned.

1204 F. W. FOLLOWS and J. BATE, Manchester. *Sweeping carpets.* Dated April 20, 1869.
This consists in an improved mode of giving motion to the rotary circular brush forming part of the sweeping apparatus, which is supported on one or two travelling wheels, and on one or two rollers. The travelling wheels are made with an internal toothed wheel gearing into pinions on the end of the rotary brush, or, in some cases, it may be sufficient to make the internal gear in only one of the supporting wheels. Instead of toothed gear as above described, friction surfaces may be used.—Patent abandoned.

1205 N. WILSON, High Holborn. *Sewing machine.* Dated April 20, 1869.
This consists, first, in an arrangement of the mode of obtaining motion for driving the shuttle and feed movement in lock stitch sewing machines. Second, in an arrangement of the several parts for driving and giving motion to the reciprocating radial arm for passing a shuttle from right to left and left to right in lock stitch sewing machines. Third, in the arrangement of a single or chain stitch sewing machine in combination with the improved internal driving wheel and pinion of the same invention for obtaining a more rapid motion to the needle in the same space. Fourth, the arrangement and combination of a silent feed movement as adapted to that class of sewing machines wherein the silent compound feed is driven by a bridle and cam movement in combination.—Patent completed.

1206 F. BARTLE, Pool. *Washing tin ores.* Dated April 20, 1869.
This consists in constructing the "kieves," or vessels in which the washing is effected, of cast iron or other metal, and in forming upon the sides thereof one or more pockets or brackets, in which are placed pieces of wood or other suitable material for receiving the blows of the hammer for producing vibrations.—Patent abandoned.

1207 R. J. ELLIS and C. L. W. FITZ-GERALD, of Laxey, Isle of Man. *Drying chemical and vegetable matters.* Dated April 20, 1869.
The inventors employ a metallic vessel having, at the top, a cover which can be made airtight, and near the top a pipe or nozzle communicating with an exhaust pump; and this vessel they enclose in another metallic vessel, which can be supplied with steam. They place the matters or material to be dried in the inner vessel, then close the door and make it airtight. They now set on the steam, and, as the heat causes vapour to rise from the matters or materials, it is taken off by the exhaust pump, and, in this manner, the matters are thoroughly dried.—Patent abandoned.

1208 R. C. RAPIER, Victoria-street, S.W. *Railway signals.* Dated April 20, 1869.
A signal post is constructed as follows:—First, the inventor makes a base plate, either of iron or timber, of a size proportionate to the intended height of the signal post, and, on this base plate, he makes three or more bosses at equal distances apart, and disposed in the form of an equilateral triangle, a square iron tube or rod, preferably about 2ft. to 4ft. long, and, on to the top of this tube, he screws a diaphragm plate having the same number of bosses as there are on the base plate. Through the next hole of the diaphragm plate the inventor then passes another tube about twice as long as the first tube, and he screws or fixes the lower end of this into the corresponding boss on the base plate. He then tightens it in the boss of the diaphragm plate with a key or wedge. Next, he screws on to the top of the last-named tube another diaphragm plate, and then through the next hole of this diaphragm plate he passes another tube, about three times as long as the first tube, also passing it through No. 1 diaphragm, and fixes it into the corresponding boss on the base plate at the bottom, and so on with any number of tubes or solid bars, the fourth tube in the centre (if so many be employed) being four times as long as the first, and the fifth five times as long and so on.—Patent completed.

1209 W. E. GEDGE, Wellington-street, W.C. *Water meter.* (A communication.) Dated April 20, 1869.
This apparatus is made of bronze, copper, or any other non-magnetic metal or alloy, that is to say, having no influence on the magnetised needle. It is composed of an annular basin, which may be perfectly closed by means of a lid, also annular. The basin and its lid both carry lugs which come opposite each other and are tightened together by bolts. The lid is provided with two tubes or union pipes.—Patent completed.

1210 K. S. MACKENZIE, Gairloch, N.B. *Fences, railings, &c.* Dated April 20, 1869.
The top bar is made of T-iron rolled in any convenient section, but with the peculiarity that the vertical web, projecting downwards from the middle of the other web, is made thicker at its bottom edge than nearer to the other web. Counterpart notches are formed in the tops of the fence standards, and, when those standards are in position, the top bar is applied by threading its vertical web through the notches, and the parts become locked together as by a dovetail joint, whilst the horizontal web of the T-iron bar caps the fence in a neat finished manner.—Patent completed.

1211 H. LEE, Manchester. *Looms.* Dated April 20, 1869.
The inventor uses two warps and four healds. The top warp beam is weighted in the usual way, but the under or back warp beam is weighted in such a manner that, upon the raising of the taking-up catches, it draws the under warp back a certain distance. The healds are worked by means of a well-known machine called the "dobby" or "index machine"; one of the loops of this machine is connected by a cord to a lever, the other end of which, whenever a corresponding perforation occurs in the card which acts on the needle, raises the catches off the taking-up ratchet wheel, and holds them off the wheel for two picks of the shuttle. In gear with one of the carrier wheels of the taking-up motion is a spur wheel mounted on a stud, and having attached to its boss a weighted lever.—Patent completed.

1212 G. GREEN, Aberystwith. *Separating ores.* Dated April 20, 1869.
The inventor uses classifiers in combination with buddles. The classifiers are of graduated sizes, the first in order being the smallest, and the current of water with pulverised ores in suspension flows through them at different speeds, so that, in the first and smallest, the current being the strongest, the largest particles are deposited, and smaller ones in the next, and so on. The matters deposited in each classifier pass off with some water by an outlet at the bottom, and flow thence to buddles.—Patent completed.

1213 W. R. LAKE, Southampton-buildings. *New toy.* (A communication.) Dated April 20, 1869.
The invention consists chiefly in fixing to the interior of any suitable hoop a number of bells of any desired size. These bells may be connected to the hoop by wire or other means of attachment, by preference such as will permit the child using the hoop to remove or replace the bells according to the effect desired to be produced in the hoop.—Patent abandoned.

1214 M. ANDREW, Melbourne, Australia. *Vessels for oil, &c.* Dated April 20, 1869.
A hole is cut in any suitable part of the vessel in the ordinary manner, through which hole the vessel is filled with oil or other liquid. A cap or cover is soldered over this hole, and a central hole is pierced in the cap. In this hole is inserted a tube or pipe slightly smaller in external diameter than the hole, but of sufficient diameter to serve as a tap. The inner end of this tube or pipe is pressed somewhat open for the purpose of preventing its being withdrawn more than a certain distance. Near this end of the tube, a hole is made in the side thereof for the passage of the liquid to be drawn from the vessel. The tube is fitted within a box, tube, or socket which has a cork, leather, or other lining, extending for a short distance from the open end thereof, and made to fit tightly around the tube. In the side of this box tube is a hole which also extends through the cork or other lining thereof, and which corresponds with the hole in the side of the small tube so as to permit the free passage of the contained liquid when the small tube is properly drawn forward.—Patent completed.

1215 W. R. LAKE, Southampton-buildings. *Lamps.* (A communication.) Dated April 20, 1869.
These lamps are constructed with an annular reservoir which surrounds an annular air chamber, and through the centre of the air chamber extends the burning chamber. The latter is connected to the annular reservoir at the bottom by supply pipes, which pass through the air chamber, and at the top by vent tubes, which also pass through the said chamber. At the top of the burning chamber is the burner, which is perforated, the perforated portion thereof being surrounded by a collar, which forms a continuation of the air chamber.—Patent completed.

1216 W. F. REYNOLDS, Commercial-road East, and J. A. MAYS, West-street, Finsbury-circus. *Velocipedes.* Dated April 21, 1869.
The inventors make the framings and supports and the springs of velocipedes so that, as a whole, they may be bent or curved horizontally when they are desired to run out of a straight course.—Patent completed.

1217 W. HOLLOWAY, Lower Clapton. *Making beverages.* Dated April 21, 1869.
On the bottom of a vessel the inventor fixes a spindle which extends nearly to its top. Fitted to the spindle, and free to move thereon, is a tube which also extends nearly to the top of the vessel. On the lower part of the tube, two, three, or more blades are fixed. These are slightly curved and perforated. The bottom edges are flanged, and fit close to the bottom of the vessel.—Patent abandoned.

1218 J. FLETCHER, J. FLETCHER, jun., and W. FLETCHER. *Lubricating wheels.* Dated April 21, 1869.
The inventors apply one or two oil cups which are screwed into the bearings at one or both ends of the axle, and they make a horizontal and one or more radial passages through the axle communicating with the oil cups. The oil is thus conveyed from the oil cup or cups into and through the interior of the axle, and from the interior conveyed by the radial holes or passages into the nave, which is thereby kept constantly lubricated so long as any oil remains in the oil cups.—Patent abandoned.

1219 P. R. HODGE, Adam-street, Adelphi. *Manufacture of cloth.* Dated April 21, 1869.
The inventor takes cotton or linen cloths, known under the name of twilled canvas, or twilled or plain calicoes, and submits it to a chemical process to partially convert the coating of the fibre from which the cotton cloth is made into collodion. This he terms collodionising the cloth. When the cloth is so treated the acid it may have absorbed is neutralised and then washed off perfectly clean. The inventor then takes a pulp made of gelatine and fibre, or it may be made by softening by the heat of steam the parings of skins or hides, and beats them up in an ordinary pulping machine. When this material is so pulped it is worked into and combined with the collodionised cotton cloth before described.—Patent completed.

1220 E. O. CATRIN, Paris. *Bottle cock.* Dated April 21, 1869.
This consists in the application of a key acting as a cock at the upper part of the bottle, the neck of which is traversed by an opening which receives the key.—Patent completed.

1221 B. PICARD, Ivry. *Towing.* Dated April 21, 1869.
The tug is constructed simply for carrying its fuel, mooring ropes, and spare stores, and constitutes the locomotive of the train, consisting of a number of vessels of a uniform and very light build, and greater in length than breadth, so as to draw as little water as possible, exceeding that of the tug only by a few inches. The tow chain is either wound by a windlass or is passed over pulleys arranged in an opening in the centre of the bottom of the tug, from whence it drops to the bed of the river, the point of action of the tractive power being the water level.—Patent abandoned.

1222 J. W. M'CARTER, Londonderry. *Condensers.* Dated April 21, 1869.
The condensation is effected by injecting cold water, and the condenser is made in two compartments. The exhaust pipe from the engine communicates with the top of the first compartment, and this has at its bottom an opening provided with a valve and leading into the second compartment, whilst the other has at its bottom an opening provided with a valve and leading into the waste pipe. The cold injection enters by a rose nozzle projecting into the upper part of the upper compartment. A lip or rim is formed round the opening between the two compartments, and serves to retain some water in the upper compartment, from which the supply for feeding the boiler is withdrawn by a pipe.—Patent completed.

1223 T. C. BULL, Weobley, Hereford. *Boots and shoes.* Dated April 21, 1869.
This consists in applying and attaching outside each of the usual pieces of elastic or side springs a protective piece of kid, leather, or other suitable material, according to the nature and strength of the boot or shoe.—Patent abandoned.

1224 M. HENRY, Fleet-street. *Pyrophosphate of lime.* Dated April 21, 1869.
Phosphoric acid when displaced or replaced in a cold state by certain acids in solution, will itself displace or replace these same acids when the solution has attained a temperature of 90deg. to 100deg. Centigrade. When desiccated under heat the operation becomes more complete. According to this invention this reaction is applied to a solution containing chloride of calcium and acid phosphate of lime. The solution is evaporated to dryness and a dry product is obtained, which, when taken after washing, yields a nearly insoluble phosphate of lime and chloride of calcium. The hydrochloric acid liberated by the operation is collected and concentrated to serve again.—Patent completed.

1225 H. C. MAYER, Craven-street, S.W. *Velocipedes.* Dated April 21, 1869.
This consists in attaching to one or two-wheel velocipedes, and to velocipedes generally when desired, an adjustable supplementary balance wheel or wheels, one or more of them for the purpose of steadying and guiding the velocipede when in use, and also when furnished with only one or two wheels the velocipede may stand of itself.—Patent abandoned.

1226 M. PLETTS, Newcastle-on-Tyne. *Oil feeders.* Dated April 21, 1869.
This consists in making the feeder or vessel of metal with a spout at an angle in the ordinary way, but having a prolongation of the spout or a tube in connection therewith within the vessel; this prolongated spout or tube is at an angle inclined to the bottom of the vessel and made of any size or shape, but preferably of the same capacity as the projecting spout (or nearly so), or so constructed

that it may be adjusted to varying capacities or charges by means of a movable diaphragm or stop, or by other suitable means furnished with suitable perforations to admit oil, and supplied with a ball valve, so that when the handle of the feeder is depressed and the spout raised, the ball falls to the end or bottom, or on the stop of the inner spout. When the latter becomes charged when elevated, the charge is delivered into the outer spout, where it is cut off by the ball valve, and thence to the part desired.—Patent abandoned.

1227 C. D. ABEL, Southampton-buildings. *Mural paintings.* (A communication.) Dated April 21, 1869.

The invention consists in the application of the processes of chromo-lithography for printing the requisite designs upon a paper, which serves subsequently as the medium for transferring the designs to the walls.—Patent completed.

1228 C. M. BARKER, Kennington Park-road. *Steam generators.* Dated April 21, 1869.

The boiler is constructed with an inner and outer shell connected together by an annular base plate. The inner shell, which is riveted to the annular base plate, forms the firebox; the space between it and the exterior shell, which is bolted to the base plate, contains the water and return descending flue tubes. The bolting of the exterior shell to the base plate is effected by means of ordinary bolts and nuts in combination with strengthening or washer plates of a length sufficient to receive three or more of the bolts. Between the junction surfaces of the shell and the annular base plate a seating of sheet lead enclosed in or lapped with copper wire gauze is interposed, the gauze preventing the lead from being pressed out under the pressure of steam or of the bolts.—Patent completed.

1229 W. JOHNSON, Elms, Sketty, Swansea. *Communication between passengers and guard.* Dated April 21, 1869.

The mechanical arrangement is contained in a small box, which can be readily attached to a carriage on the roof or flooring, and consists of two bell cranks placed close to each other somewhat in the form of the letter W, each crank having an upright tongue, to which a wire running from end to end of the carriage is firmly attached. The two central points of the crank support a small block, from which depends a cord passing into the compartment of the carriage. This cord is also connected with another wire running across the carriage at right angles with the one before mentioned, which works a semaphore on either or both sides of the carriage.—Patent abandoned.

1230 C. E. BROOMAN, Fleet-street. *Dressing fabrics.* (A communication.) Dated April 21, 1869.

This consists of one or several cylinders revolving with a rapidity more or less great, and provided with pin plates, combs, fallers, or similar appliances according to the effect desired to be produced acting against the fabric by means of centrifugal force. The pin plates or combs are attached to the cylinders by one of their ends only, the others being left free. As the fabric passes the cylinders these combs strike upon it through centrifugal force with a beating action. In this manner a very superior dressing is obtained.—Patent completed.

1231 W. ROBINSON, Tipton. *Thin sheets of metal.* Dated April 21, 1869.

This consists in manufacturing thin sheets of steel from bars, slabs, or other pieces of steel having on their opposite faces thin layers of wrought or malleable iron.—Patent completed.

1232 J. H. A. BLECKMANN, Solingen. *Firearms.* Dated April 21, 1869.

The breech of the arms constructed according to the invention is opened and closed by a piece worked by a lever or handle attached to the axis of the piece, and placed at the side of the firearm, instead of being actuated by the trigger or by a lever at or immediately near the trigger guard. This closure or closing piece comes against the chamber of the barrel when closing the breech, and it moves on an axis placed in a line or direction at right angles to the direction of the axis of the barrel. Its front edge comes below the level of the muzzle when the breech is opened.—Patent completed.

1233 J. FRANCIS, J. DONALDSON, and G. REAVELY, Galashiels. *Locking railway sidings.* Dated April 21, 1869.

In order to prevent the chock blocks by which the passage of waggons out of a siding on to the main line is checked from being removed by accident or design, the inventors employ apparatus so arranged that when the chock blocks have been placed over the rails, they can only be removed by the passage of an engine or waggon towards the siding, or at least by the use of great force much exceeding the power of one man. They mount the chock blocks on levers, which can move in a horizontal direction, and the blocks are formed by preference in such a manner that a truck in running over it to pass out of the siding would be thrown off the rails on to the ballast, and thus arrested in its onward course to the main line.—Patent abandoned.

1234 J. HOLDING, Manchester. *Looms.* Dated April 22, 1869.

The inventor adapts to the bracket of the "temple" a set screw for securing the "temple" to the "temple rod" on a line with the temple behind the rod, in contradistinction to placing such set screw underneath. By this arrangement the "set screw" is more readily got at for adjustment, and the cloth is kept closer to the top of the lathe.—Patent completed.

1235 G. DANIA, Rochdale, and J., T., R., and S. STOTT, Wardle. *Carding engines.* Dated April 22, 1869.

The inventors support the main cylinders on each side of the middle doffer in fixed bearings, and they support the axle of the middle doffer in bearings that are capable of being raised or lowered or moved laterally by regulating screws or other equivalents; by this arrangement, the piston of the middle doffer can be readily adjusted to the surface of the main cylinders.—Patent abandoned.

1236 H. T. LEWIS and W. WHITE, Handsworth. *Sash frames.* Dated April 22, 1869.

The apparatus by which the inventors carry this invention into effect consists, substantially, of a cog-wheel working on a fixed pin or axis and enclosed in a frame of suitable size and strength, which frame is fixed into the wall plate immediately opposite the bottom bar of the upper sash and the top bar of the lower sash. The side rail of a sufficient portion of the upper sash and a corresponding portion of the side rail of the lower sash is fitted with a rack to correspond with the cogs of the wheel, so that when the lower sash is raised, the upper sash is lowered in the same degree.—Patent abandoned.

1237 J. ECCLES, Black-lane, Radcliffe. *Lessing warps.* Dated April 22, 1869.

This consists principally of two metallic combs or open reeds attached to bars of wood, iron, or other suitable material, which are so hinged together that the points of the teeth of the combs or reeds may be either brought into close contact or separated a certain distance apart. The combs also are so arranged that the points of the teeth of one comb come opposite to the spaces between the teeth of the other and *vice versa*, so that when the combs are brought together, the yarn cannot enter the spaces between the teeth in either of the combs; each tooth, however, has cut in its extreme point a shallow notch sufficient to hold one thread.—Patent abandoned.

1238 G. WHITE, Queen-street, Cheapside. *Movable dam.* (A communication.) Dated April 22, 1869.

This consists of a ship, large boat, or other suitable vessel or hulk provided over the greater part of its length and middle of its width or beam with a longitudinal slit or furrow extending from and through the keel or bottom of the ship to the deck, which slit or furrow is open at the bottom and closed at the sides and top so as to prevent the water which enters freely from below into it from communication with the interior of the hulk or vessel. In the slit is situated a vertical partition, plate, or panel of wood, sheet iron, or other suitable material, which is to serve as a movable dam, and for this purpose may be set more or less inclined in the vertical plane by means of the horizontal trunnions or bolt working in bearings fixed to the kelson or other suitable part of the vessel. To the stern and to the bow are fixed pintles, in which are inserted piles provided at the lower end with an earth screw for screwing the piles in the bottom of the river, for fixing the hulk in any suitable angular position in respect to the current and allowing it to rise or to be immersed as found necessary.—Patent completed.

1239 W. CATCHPOOL, Goswell-road. *Treating straw.* Dated April 22, 1869.

The straw is first steamed, but this steaming separately is considered as not new, and when this has been effected the inventor compresses the fibre, by preference whilst in a heated state, in chambers of convenient form and size, where, by the action thereon of a suitable piston or plunger, it may be reduced into blocks of the form and to the extent desired. When this compression has been effected the fibre is removed from the chamber and allowed to cool, and it will then be found to retain the form given to it.—Protection refused.

1240 J. G. RIDLEY, Newcastle-on-Tyne. *Waste rails, tyres, &c.* Dated April 22, 1869.

The inventor takes crop ends of Bessemer or other similar steel rails, imperfect ingots, tyres, or any scrap of Bessemer steel or waste steel of a similar nature to that known as Bessemer's steel. He proposes, in the case of rail ends, to take them as they are cut at the rolling, to heat and to roll them into a flat bar or other convenient form for piling. He then takes the pieces and cuts them into suitable lengths for piling according to the nature of the required finished article, whether for plates, bars, angles, or other forms. He piles the pieces as closely as possible upon a slab of wrought-iron either formed of a plate or bar (whether puddled scrap or other iron or steel), and covers them with another slab of the same or a similar material.—Patent completed.

1241 M. HILLARY, Andover. *Harrows or drags.* Dated April 22, 1869.

It is proposed to effect a perfect tieing or trussing of the frames of harrows and drags by the aid of longitudinal bars either independent of the zig-zag beams and attached to cross bars or attached to the angles of the beams themselves. By passing these longitudinal bars alternately over and under the cross bars a doubly trussed frame is obtained.—Patent abandoned.

1242 G. G. TANDY, Anerley-road, S.W. *Carburetting air.* Dated April 22, 1869.

The improved apparatus for carburetting air or gas which forms the subject of this invention is divided into two parts consisting of an upper and lower chamber. The upper chamber contains the body of the liquid, and the lower one that portion which is being taken up by the gas or air passing through the chamber. The object of this arrangement is that the gas or air shall be uniformly impregnated with the liquid, which shall be expelled from time to time from the reservoir above.—Patent completed.

1243 A. BORGNET, Swansea. *Paris composition.* Dated April 22, 1869.

The metallic base which is employed in the manufacture of this improved composition or paint consists of globular zinc or grey oxide, otherwise known as "sweeps," and which is a product obtained in the smelting of zinc ores. This substance, in the form of an impalpable powder, is now mixed with boiled linseed oil in the proportion of 66 parts by weight of the grey oxide to 20 parts of the boiled oil. These substances intimately commingled make mixture No. 1. The inventor also makes a siccative mixture by treating raw linseed oil in the following manner. He takes oxide of manganese (in the natural state), say one part, and having broken it up to about the size of small peas, he boils it in (say) four parts by weight of raw linseed oil in an open vessel until the desired consistency is obtained. The manganese he encloses in a strong linen bag, and inserts the bag in a basket or perforated vessel of iron that will allow of the raw linseed oil coming into contact with the oxide of manganese through the bag. This basket he suspends in the oil so that it shall not touch the vessel containing it, and when the boiling is stopped he removes the basket and its contents from the vessel. By this treatment he obtains mixture No. 2. For a third mixture the inventor dissolves India-rubber, or other equivalent vegetable gum, in turpentine or other suitable solvent, the proportions being (say) two parts of the gum to seven parts of turpentine or other solvent. Of these several mixtures the inventor takes (say) 86 parts of No. 1, 5 parts of No. 2, and 9 parts of No. 3, and combines the same by stirring, or by any other proper means while cold, and when completely combined a liquid compound is formed suitable for the purposes of this invention.—Patent completed.

1244 A. BORGNET, Swansea. *Paint.* Dated April 22 1869.

This relates to the preparation of paint, and consists in the employment for that purpose of clays, by preference refractory clays known as fireclays, and more particularly the fireclays occurring in the basin of the river Meuse, in Belgium, and known as Belgian fireclay.—Patent abandoned.

1245 W. R. LAKE, Southampton-buildings, Chancery-lane. *Locks.* (A communication.) Dated April 22, 1869.

The locks to which this invention refers are what may be termed latch locks, as the bolt in each of these performs the duty of locking and of latching, and the general and leading characteristic of this series of locks consists in their having a latch or bolt that can be operated from one or both sides of the door by a knob or its equivalent, when the latch or bolt is not otherwise set or controlled by a key or its equivalent which turns a lever or eccentric hub in the lock, and disconnects the bolt or latch from the action of the knobs, and then the bolt is a locking bolt.—Patent completed.

1246 W. R. LAKE, Southampton-buildings, Chancery-lane. *Communicating in railway trains.* (A communication.) Dated April 22, 1869.

This system is composed of a shaft or axle placed above each carriage. This is supported in any convenient manner, and furnished with traction levers, which give it a rotating movement so as to actuate one of the detents or bent levers, which are fixed on its extremities. Each of these detent levers is bent to act upon the preceding detent, and they are furnished with adjustable balls or counterweights, which can be moved and regulated at pleasure.—Patent abandoned.

1247 W. PALLISER, Army and Navy Club, and T. ENGLISH, Wandsworth. *Armour plating.* Dated April 23, 1869.

This consists in the application of nuts having spherical bearing surfaces to bolts constructed in accordance with the invention for which Letters Patent were granted dated December 6, 1862 (No. 3,281). In employing these screw bolts, it is preferred to reduce the area of the shank by cutting the screw thread (by preference of a rounded form) along the entire length of the bolt, in which case, in place of the ordinary head of the bolt, the inventors provide a separate head or nut with spherical bearing surface screwed on to the end of the bolt. For the seat of such spherical nut or head, the inventors form a corresponding recess with spherical bottom surface in the armour plate, and, for the connection of the nut with the back of the structure, they either form a similar spherical recess in the bearing surface, or they interpose between this surface and the nut a washer having a spherical recess or seat for the nut.—Patent completed.

1248 N. WILSON, High Holborn. *Velocipedes.* Dated April 23, 1869.

The inventor arranges his velocipede so as to bring the legs of the rider into a more favourable position to propel either the forward or hindmost wheel or wheels, and also so arranges the crank movement and seating for the foot of the rider that he may drive on an independent shaft having a pinion thereon, such gearing to be either frictional or with teeth, which will work on the axis of the running wheel of the velocipede, there being a difference of diameters (say) of one-half or one third; so the rider can drive the velocipede up an incline with perfect ease.—Patent abandoned.

1249 G. WHITE, Queen-street, Cheapside. *Motive power.* Dated April 23, 1869.

This consists in causing a ball to circulate rapidly when set in motion by manual or other power in a circular channel provided in a trough, the centre of which latter is connected by a ball socket joint to a fixed circular bearing, the rim of which bearing limits the inclined positions which the trough assumes when, by the rapid circular motion of the ball in the above-mentioned channel, the trough yields to the motion of the ball in such manner that it causes the ball to act as if falling continuously down along an inclined plane, thus allowing the ball to gradually increase its velocity.—Patent abandoned.

1250 W. A. LYTTLE, Hammersmith. *Telegraph batteries.* Dated April 23, 1869.

When the cells of a battery are formed of earthenware the inventor does not glaze the pottery biscuit or have it glazed only on the outside. He renders it both non-conducting and proof against the chemical action of the battery liquids by heating the biscuit and filling it with, or immersing it in, boiling pitch, or other bituminous, fatty, or resinous substances. The earthenware is then drained, and when cold is ready for use.—Patent completed.

1251 G. T. BOUSFIELD, Brixton. *Sheep washing.* (A communication.) Dated April 23, 1869.

A close box or tank is employed which is supplied with water under pressure from a pump or elevated reservoir. The washing jet is connected with the bottom of this box or tank by two metal pipes, which are inserted into holes in the bottom and fixed by nuts screwed on from the inside.—Patent abandoned.

1252 S. SMITH, Derby. *Railway axle and axle boxes.* (A communication.) Dated April 23, 1869.

In the side of the axle-box nearest to the wheel the upper part is bevelled upwards towards the wheel and the lower part bevelled towards the interior of the box, so that should the lubricant in the upper part be thrown upwards by the revolution of the axle it would fall on the lower bevelled part, thus returning into the axle-box and saving all waste. In order further to ensure the prevention of any escape or waste of the lubricant a washer of sheet India-rubber protected at the bottom by an iron plate and at the top or upper part by a plate of zinc or other soft metal is placed on and secured to the outer side of the axle box.—Patent completed.

1253 W. B. DICK, Glasgow, Scotland. *Extinguishing fires.* Dated April 23, 1869.

This relates to the extinguishing of fires by means of a mixture of carbonic acid gas and water. The apparatus comprises a wheeled carriage, the body of which is in the form of a tank made with sheet iron fixed upon angle iron frames, and which is divided into three compartments. Pumps are fitted in two of the compartments and are arranged to be actuated by a beam on a rocking shaft, which is provided with the usual levers for the application of manual power.—Patent completed.

1254 J. WHITTAKER, Oldham. *Moulding wheels.* Dated April 23, 1869.

The machine consists of a foundation plate or frame, at the centre of which is a hollow stud or boss on which a table or face plate revolves which carries a worm wheel such as is used in the ordinary machine for cutting toothed wheels, and is furnished with a worm, and shaft,

and pinions in the same manner. On the table or face plate is placed and secured the moulding-box in which the mould is to be formed. At one side of the foundation plate or frame, and connected with it, is an upright pillar, at the top of which is a horizontal slide.—Patent com pleted.

1255 H. E. NEWTON, Chancery-lane. *Boilers.* (A communication.) Dated April 23, 1869.

The object is to prevent steam boilers from bursting, and the invention consists in the use of a hollow metal cylinder with a valve seat in its head, connected and communicating with a tube extending to the bottom of the boiler. A valve is placed in this cylinder, and consists of a metal spindle and piston (made by preference hollow), and on the spindle above the piston is a projecting bulb or cone.—Patent abandoned.

1256 H E. NEWTON, Chancery-lane. *Puddling iron* A communication.) Dated April 23, 1869.

This consists in reducing the cast iron to coarse granules or pieces, so that they may melt down more quickly than pigs into a fluid state. Granules or pieces varying in bulk from spheres of about 2-10th of an inch to 1in. in diameter, with a small portion larger and smaller than these limits, have been found in practice to work satisfactorily. Care must be taken, however, not to make too large a proportion of fine granules, as in that case they would quickly be decarbonised and rendered infusible, and thus prevented from melting and mixing in a liquid condition with the liquid iron oxide. Such a mixture of the iron (in a liquid state) with the liquid oxide is indispensable to the complete success of the process.—Patent completed.

1257 T. WILSON, Birmingham. *Cartridges.* Dated April 23, 1869.

This consists in constructing cartridge cases by taking a plain metal tube closed at one end for the reception of the powder, and forming separately a rim, and afterwards attaching it to the closed end of the tube either by brazing, sol lering, or otherwise.—Patent abandoned.

1258 E. TATHAM, Nottingham. *Levers and nebs.* Dated April 23, 1869.

This relates, first, to the construction of levers or bars, and consists in making or fitting them with two pins or wires, so that the thread or threads may enter between them when the levers are acted upon or depressed by the motion of the "jacquard." The pins or wires are slightly spread outwards at the bottom to facilitate the entry of the threads. It consists, second, in the construction of "nebs" or thread carriers; they are made with two points, and are employed for dividing the threads when lifted by the mechanism. In this position, the needles are moved towards and passed through between the nebs. On the needles retiring, the nebs are lowered and the threads are laid on the needles.—Patent completed.

1259 E. M. REILLY, New Oxford-street. *Explosive bullets.* Dated April 23, 1869.

The objects are, first, in the construction of explosive bullets, which will by the force of the explosion break into a certain number of pieces according to the formation or shape of the interior of the bullet; and, second, the construction of an improved socket or ring in which the percussion or other explosive medium is placed.—Patent abandoned.

1260 J. MAJOR and W. WRIGHT, Swallow-street, and G. H. JONES, Alpha-road. *White lead.* Dated April 24, 1869.

This consists in the manufacture of white lead in a closed chamber or chambers heated artificially without the employment of spent tan or such like fermenting materials, or earthenware pots, as in the methods now in use. The necessary vapour or vapours and gas or gases, for instance, watery vapour, ammoniacal vapour, acetic acid vapour, pyroligneous acid vapour, hydrochloric acid gas, and carbonic acid gas, which may be provided in any convenient manner, are fed into and through the chamber or chambers containing the lead or compounds to be converted into white lead, these vapours and gases being properly regulated during their course through the same in any convenient manner.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated November 2, 1869.

3173 C. G. Gumpel, Leicester-square. Improvements in ships' rudders and in steering gear therefor.

3174 R. Spice, Cirencester-place, Fitzroy-square. Improvements in the manufacture of artificial stone, and for forcing liquids into porous substances.

3175 G. White, Queen-street, Cheapside, City. An improved metallic central-fire cartridge for breech-loading firearms.

3176 R. Davies, Liverpool. Improvements in mechanism or machinery for transmitting motive power.

3177 W. Connell, Glasgow. Improvements in water-closets.

3178 A. H. Brandon, Rue Gaillon, Paris. Improvements in motive-power engines, and in the means and mechanism for generating such power.

3179 A. Wyllie, Stewarton, Ayrshire. Improvements in the manufacture of Scotch bonnets, and in the material, means, and apparatus employed therefor.

3180 C. E. Cav...y and J. Newton, Manchester. Improvements in tramways, and in carriages to run thereon.

3181 J. P. Hawley and E. E. Hill, Brixton, Surrey. Improvements in apparatus for controlling the flow of water from constant supply pipes.

Dated November 3, 1869.

3182 S. Leoni. St. Paul-street, New North-road. Improvements in apparatus for cooking and lighting by gas.

3183 A. Grothe, Strand. Improvements in apparatus for registering the number of passengers travelling in or on public conveyances.

3184 T. Wright and I. Fox, Nottingham. Improvements in machinery or apparatus employed in the manufacture or production of piles on net or lace or other fabric made on twist lace machines.

3185 F. F. Samier, Rue du Boulois, Paris, and A. Antholne, Rue Corbeau, Paris. Improvements in metallic vessels intended to prevent all liquid or solid inflammable substances from igniting.

3186 H. J. H. King, Glasgow. Improvements in apparatus for measuring, indicating, and regulating the flow or passage of liquids.

3187 T. S. Martin, Plymouth. Improvements in the construction of self-acting stopcocks.

3188 M. L. Winn, San Francisco, California, U.S.A. An improved apparatus for shampooing and washing the head.

3189 N. W. Blanchard, Dutch Flat, California, U.S.A. An improved substitute for curled hair for upholstering and other purposes, and process employed in the manufacture thereof.

3190 E. Snell, City-road. Improved compounds or compositions in imitation of marble, veneer, and other substances to be used in the manufacture of fancy and other articles.

3191 J. M'Dowall, Johnstone, Renfrewshire. Improvements in machinery for sawing and otherwise cutting timber.

3192 W. Gardner, Manchester. Improvements in mechanism or tools for the manufacture of parts of watches or timekeepers, and in the mode of securing the works of watches in their cases.

3193 G. Sinclair, Leith, Edinburgh. Improvements in treating wood and other vegetable fibrous materials for the production of paper pulp, and in the boilers and apparatus employed therefor.

3194 E. Finch, Beaufort-square, Chepstow, Monmouthshire. Improvements in dock gates and caissons for closing the entrances to docks and basins.

Dated November 4, 1869.

3195 J. Booth, Broomhill, Sheffield. Improvements in the modes of rolling or reducing metal, and in the arrangement of machinery for effecting such rolling or reducing.

3196 H. Wilde, Manchester. Improvements in the construction and working of electric telegraphs.

3197 W. E. Gedge, Wellington-street, Strand. A novel vehicle termed the three-wheeled velocimane.

3198 M. Wilson, Wellington-street, Southwark. Improvements in sink traps.

3199 S. Rusk, Pancras-lane. Improvements in bar iron for the manufacture of shoes for horses and other animals.

3200 C. de V. Wells, Marseilles, France. An improvement for regulating the speed of marine steam engines when the screw is lifted out of the water.

3201 F. Armstrong, Paris. Improvements in sewing machines.

3202 A. Russell, Cheapside. Improvements in apparatus for making tucks or plaits applicable to sewing machines.

3203 E. Edmonds, Rockville, Paignton, Devonshire. An improved coffeepot and filler for the same.

Dated November 5, 1869.

3204 C. Crookford, Holywell, Flintshire. Improved modes of treating metallic ores and materials and obtaining metallic and chemical products therefrom, and for utilising some of the waste products from smelting works, chemical works, tin plate works, galvanising works, and paper mills, and for improvements in furnaces and apparatus in carrying out the same.

3205 J. Maiden, Oldham. Improvements in lubricators.

3206 J. M. Stanley, Sheffield. Improvements in furnaces and crucibles for melting steel and other metals, and in furnaces for heating steel and iron.

3207 J. Turnbull, Glasgow. Improved cut-off gears for steam engines.

3208 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in sewing machine needles.

3209 J. K. Northall, Netherton, Worcestershire. Improvements in apparatus or machinery for welding and finishing tubes.

3210 F. Pash, Gracechurch-street, City. The improvement of the construction of bicycles or velocipedes.

3211 A. M. Clark, Chancery-lane. Improvements in boring tools.

3212 R. Douglas and L. Grant, Kirkcaldy, Fifeshire. Improvements in motive power engines.

Dated November 6, 1869.

3213 F. Taylor, Nottingham. Improvements in sewing and embroidering machines.

3214 H. Livesey, Greenbank, Blackburn. Improvements in polycycle rings or circular velocipedes.

3215 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of, and devices for, securing stair rods.

Dated November 8, 1868.

3216 P. and A. Walker, Brougham-road, Dalston. An improved gas meter.

3217 T. Perkins, Hitchin, Hertfordshire. Improvements in apparatus for ploughing or cultivating land.

3218 N. Shaw, Eau Claire, Wisconsin, U.S.A. Generating steam in steam boilers, and protecting the gratebars in the furnaces under the said boilers.

3219 J. C. Heywood, Royal Hotel, City. Improvements in weighing machines or scales.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," November 9, 1869.

1955 G. T. Smith and C. Challenger
1961 W. Blackburn
1963 W. Bartram
1965 R. H. Courtenay
1971 D. Hebson
1972 R. Knowles and J. Lindley
1977 A. Walker
1980 W. Coleman and S. Turton
1983 J. Stringfellow
1986 A. Barclay
1987 L. F. Banks
1994 H. A. Bonneville
2008 A. Foucaut
2018 C. Churchill
2022 F. W. Grune
2031 C. D. Abel
2047 R. Mallet
2054 J. H. Johnson
2062 I. L. Pulvermacher
2076 C. E. Brooman
2083 J. S. Crosland
2174 W. Macgeorge and A. Rigg
2212 J. H. Johnson
2218 G. T. Abbey
2267 E. Ginder
2493 A. V. Newton
2500 P. A. Blake
2590 S. Willis
2622 W. E. Newton
2635 A. V. Newton
2703 W. Tipping
2749 J. Windsor
2847 H. L. Bolger and J. Meekin
2900 J. W. Powell
2930 J. Wallace
2947 C. Wyndham
2951 G. A. Middlemiss
2976 T. Parry and J. M'Hardy
2981 R. J. Ellis
2982 W. J. Bonser
2995 J. Taft and J. C. Edwards
2998 W. Avery and A. Fenton
2999 E. Roe
3009 J. W. Robinson and T. Murray
3023 W. H. H. M'Neight
3048 J. H. Johnson
3054 J. Scharr
3060 J. Howard and E. T. Bousfield
3133 M. Clemens
3137 W. R. Lake

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2850 R. J. Gay
2874 J. H. Johnson
2886 W. Darlow and P. W. Seymour
2895 P. Kirk
2911 R. J. Edwards
2914 T. Horsley and G. Knighton
2917 E. K. Heaps
2920 S. W. Woodroffe
2923 W. E. Newton
2924 W. E. Newton
2941 R. Lakin and J. Wain
2983 T. S. Truss

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2978 J. M'Kean and T. Greenall
2998 J. Petrie and J. Teal
3010 C. O. Heyl
3021 E. Sonstadt

The full titles of the patents in the above list can b ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed November 5, 1869.

1389 E. N. Hudson
1401 E. Seyd
1406 A. J. Murray
1414 R. and G. Cadbury and J. M. Rendall
1417 W. N. Nicholson
1421 C. Lauth
1422 R. Blezard
1424 M. S. Wolfgang
1428 W. B. Smith
1448 A. Henry
1449 C. H. Merritt
1464 E. V. Gardner and P. M. Crane
1499 R., J. J., and L. R. Bodmer
1555 A. L. M'Gavin
1556 A. L. M'Gavin
1677 J. Dockray

Sealed November 9, 1869.

1438 C. Cross, A. Heywood, and G. D. and T. B. Wilson
1440 W. R. Lake
1445 J. B. Payne
1454 J. B. Handyside
1457 J. L. Greatorex
1470 I. and G. Battinson and T. Whitehead
1483 G. F. Henry, I. A. F. Bang, F. R. C. Monestier, and J. P. A. Figuier
1489 C. H. Gardner and J. Bickerton
1523 W. Benson
1529 W. Naylor
1545 W. Mitchell
1597 E. T. Hughes
1618 J. D. Brunton
1640 J. Wilson
1641 J. Wilson
1701 B. J. B. Mills
1762 W. E. Newton
1877 W. Topham and S. Wells
2346 B. J. B. Mills
2599 H. Bridgewater
2615 W. S. Clark
2649 W. Baines
2652 F. Forder and J. Traves
2658 D. Colville
2696 C. G. Hill
2718 T. J. Denne and H. Billingsley
2751 E. Hill

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following uumbers:—

2471	3033	3068	3076	3084	3094	3102	3112
2685	3055	3070	3078	3086	3096	3104	3114
2925	3064	3072	3080	3088	3098	3108	3116
2934	3066	3074	3082	3092	3100	3110	3118

LIST OF SPECIFICATIONS PUBLISHED

For the week ending November 6, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
19a	0 4	836	1 0	899	0 8	946	2 6	965	0 4	992	0 4
659	1 2	837	0 10	904	1 10	947	0 4	968	0 6	993	0 4
795	0 8	847	2 6	917	1 2	948	0 4	969	0 4	997	0 4
798	0 10	848	0 10	922	0 8	949	0 4	972	0 4	999	0 4
805	1 0	849	1 8	923	0 4	950	0 4	974	0 4	1005	0 4
806	1 2	850	1 0	924	0 4	951	0 4	977	0 6	1007	0 4
812	1 4	856	1 6	925	0 4	952	0 4	978	0 4	1009	0 4
818	1 6	868	0 8	927	0 4	953	0 4	979	0 6	1010	0 4
820	1 0	871	0 8	930	0 4	955	0 4	980	0 4	1011	0 4
822	0 10	873	0 10	932	0 4	956	0 8	984	0 4	1013	0 4
827	0 10	879	0 8	934	1 6	958	0 4	986	0 4	1019	0 4
828	0 8	881	0 8	939	0 6	961	0 4	988	0 8	1036	1 0
834	2 6	887	0 8	945	0 4	964	0 10	990	0 4	1077	1 6

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 19, 1869.

LONG SPAN BRIDGES.

AN allusion was made in our leading article of last week to the fact that engineers are not so prone to indulge in the erection of bridges of large spans as was the practice some years ago. Experience has since demonstrated that when the bearings between the piers reach a certain dimension, the superstructure becomes more expensive than the substructure. It is not generally known that but for the fear of introducing an awkward curve in the line, the bridge over the Menai Straits might have occupied the site of the Swilly instead of the Britannia Rock, and its present maximum spans would have been reduced by nearly 100ft. But the engineers of the old school had a mortal dread of steep gradients and sharp curves, and considered their absence cheaply purchased by any other sacrifice incurred in the shape of embankments, cuttings, tunnels, bridges, and permanent works of any description. With their limited ideas of one mile radius for the curves, and one in a hundred for the gradients, what would they have thought of engines being manufactured and almost able to "turn in their own length?" and as for gradients, "going up a ladder" is a mild expression for their climbing capabilities! As with the largest span bridge in England so with that in the sister country. The Boyne Viaduct has a maximum span of 260ft., and carries the Dublin and Drogheda Railway over the valley of that river at some distance from the town. It is now well understood that there was not the slightest necessity for erecting so expensive a bridge, and that the line could have been taken, to more advantage in every sense, nearer the town, where the valley narrows.

There is no disguising the truth that when iron was introduced as a material eminently adapted for the construction of some of the most prominent of the permanent works of a railway, there was a pardonable rivalry among the members of the profession with respect to erecting bridges of large span. Telford led the way both at home and abroad; Stephenson and Brunel followed, and Fairbairn and others brought up the rear. It is clear that every engineer considered it incumbent upon him to prove what he could do with iron, and many structures of that material, hideous in appearance, with proportions in mockery of science, and a distribution of metal betraying an utter and reckless ignorance of the knowledge of strains and strength of materials, attest to the present day the manner in which some of the profession displayed their ability. To such a pitch did their incompetency attain that, after many fatal proofs of it, a Royal Commission was appointed to inquire into the "Application of iron to railway structures." The whole subject was then thoroughly sifted, the aid of the mathematician was called in to supplement that of the engineer, and the result was the establishment of certain laws and regulations which, if they could not instruct the ignorant, could, at any rate, protect the public from the consequences of their ignorance.

Admitting that bridges of large spans have been erected in positions in which it has been subsequently demonstrated there was no absolute necessity for them to occupy, it must not be understood, on the other hand, that the necessity for a bridge of large span may not arise. There are manifestly numerous localities which roads and railways are ultimately destined to traverse possessing physical features incapable of being surmounted by any other means. To be of any value, railway intercommunication between any two points must be continuous. The chain must be perfect. The absence of one link is fatal to the whole. Should a ravine, a mountain pass, a chasm, or a hiatus of any kind intervene along the route, it must be bridged, and the size of the span must obviously depend upon the number of piers or supports that it is possible to erect on the sides and bottom of the gulf. This brings us to the question of the maximum span that it is possible to obtain by any known principle of scientific construction, and just at the present time it has a peculiar interest bearing upon the proposed international bridge over the Channel. We are not about to advocate any particular scheme or discuss the merits of any proposed method for accomplishing the transit between the two shores. Our readers will find full information upon this point in a paper published in our recent numbers.* The only method to which our article has any reference is that of M. Boutet, but were we inclined to advocate the project, we have not the slightest evidence which would enable us to form any opinion of its theoretical or practical feasibility. In the following investigation no notice will be made of stone arches, as their maximum span does not exceed 200ft., although that principle, being the oldest, has the first claim to consideration. It was, in fact, the original principle proposed by Stephenson upon which to execute the bridging of the Menai Straits. There is no necessity to refer to the reasons why that design was abandoned, because it had to do with other considerations, which reflected not the shadow of doubt respecting the practicability of the project. Neither is there any necessity for our present purpose to advert to the scheme in detail. It is sufficient to state that the maximum span in cast iron was 360ft. So far as theoretical construction is concerned there is no limit to the span of an arch or suspension bridge, but, in spite of this, the former type has almost become obsolete for spans exceeding 200ft., and the latter has never yet been successfully applied to railway traffic. By railway traffic we do not mean the drawing of carriages, or the crawling of a locomotive, over a bridge, but the passage of an express train or limited mail, at full speed. Here we notice the difference between theory and practice. Stephenson considered that if he increased his cast-iron arch to a span of 460ft., as he contemplated, the rise of the crown due to expansion and contraction would present a difficulty that he would be unable to provide for. This was no doubt an erroneous impression, as he would have found had not the contingencies imposed by the Admiralty compelled him to abandon the arch principle altogether, and seek for a solution of the novel engineering problem in the adoption of different means. Without inquiring into the relative suitability of cast and wrought iron for the construction of arches, it may be taken for granted that 500ft. will represent the practical limit to the span of an iron arch.

The next type that deserves consideration is that in which the horizontal strains are resisted by the various members of the structure itself, and a vertical pressure alone transmitted to the supports; and the Menai Bridge certainly ought to be mentioned first. The question therefore is, what is the limit to the span of a tubular bridge? All bridges which are self-containing with respect to the strains exerted upon them come under the denomination of beams, and the limit of their spans is based upon the fact that the strength is as the square, and the weight as the cube of their lineal dimensions. The weight of a tubular or any solid-sided girder increases far more rapidly with an increase of span than that of the lattice or open web type, in consequence of the large amount of metal required as stiffening irons. About 21 per cent. of the whole material in the Menai Bridge was absorbed in stiffening the sides. The question of determining the maximum possible span of girders becomes very complicated, because by the employment of steel instead of iron much larger spans could be obtained. At the same time there are no practical examples upon which to base a reliable calculation. It will be safer, then, in the present instance to deduce our conclusions from what has been already accomplished with a material that is trustworthy than to hazard conjectures respecting what might be done with another that has not yet been tried. The ultimate span reached by steel would not probably exceed that attained by iron by more than 30 per cent. A tubular girder would not practically exceed the limit of 600ft. as the maximum span, and if of steel, might reach 800ft. There is very little doubt that, with the exception of Dr. Fairbairn, the great advocate for solid-sided girders, no engineer would ever again employ the tubular system. A glance at the recently erected railway bridges of large spans points out unmistakably that the open web principle has superseded the older and the more cumbrous one. Larger spans would be practicable upon the open web or lattice principle than upon that of its predecessor. A lattice girder would probably reach a span of 800ft. if constructed of iron, and of 1,000ft. if steel were employed. Whatever particular form of horizontal girder might be adopted, it may be safely laid down that the maximum span attainable with any material would not be less than 1,000ft., or, in round numbers, the fifth part of a mile. It must not be considered that we are advocating the economy of bridges of five spans to a mile; we are simply demonstrating their possibility.

The only system to be now alluded to is the suspension, which, so far as mere length of span is concerned, decidedly occupies the first place. Arguing analogically from the size of the existing spans of suspension and horizontal girders, and calculating proportionally, the limit to the span of a suspension girder would be 1,700ft. The maximum limit, under any circumstances, might be put at 2,000ft., or about double that attainable by the other type of bridge. Besides these ordinary principles of construction there are others, such as those of Von Rupert, M. Boutet, and other engineers. With respect to these it should be borne in mind that while on the one hand there are unfortunately no practical data to be guided by, yet there is no valid reason why it may not be possible to achieve larger spans than have hitherto been attempted. The proper line of argument to adopt, and method of testing any of these novel schemes to be employed, is to follow the plan pursued in the case of the Britannia Bridge. Those who believe in the practicability of spans of nearly a mile in length should have a model constructed to an actual reduced scale of the bridge which is to serve the purpose. It should be broken, put together, and broken again, until the best proportions were thus experimentally arrived at. Calculations of the breaking weight and the strains upon the various parts could thus be accurately worked out, and the truth of theoretical formulæ either verified by empirical results or modified as might be necessary. This is the only plan by which to satisfy professional men and judges of such matters. The mere drawing of a design upon paper, and the results of mathematical investigations alone, are not sufficient to justify any confidence in a novel principle of engineering construction.

* *Vide* the paper "International Communication," by PERRY F. NURSEY, read before the Society of Engineers and published in the MECHANICS' MAGAZINE of October 22 and 29.

THE BOILER EXPLOSION ON BOARD THE "THISTLE."

SINCE our last notice of the lamentable occurrence on board the "Thistle," the coroner's inquiry has been concluded. A verdict was returned to the effect that the deceased persons came to their deaths by an accident caused by the escape of steam from the fracture of the crown of the furnace of the steam boiler, resulting from overheating, occasioned by a deficiency of water. The jury add that there is no evidence to show the cause of such deficiency. The jury were also of opinion that the boiler was well constructed and of proper materials. This verdict was based upon evidence given by several gentlemen eminently qualified to deal with the question, but who one and all failed to account absolutely and precisely for the insufficiency of water. Let us glance at the evidence given upon the occasion. Mr. Williamson, the chief inspector of machinery afloat, stated that he had carefully examined the defects in the boiler, with all the mountings attached thereto, and was of opinion that from its general appearance the boiler had been short of water, whether from the feed-cock not being kept sufficiently open, or from excessive priming, he was not able to say. Mr. Scorer was the engineer officer in charge of the boilers, and it was his duty to see that the feed-cocks were kept in proper order, and he had with him in the stoke-hole a first-class petty officer to assist him. There was an indicator, marked with four degrees, to show how far the feed-cock is open, and Mr. Williamson had examined the cock and found that it was one degree open. The other two boilers, which were not at all injured, had only the same opening of the feed-cock, and they were sufficiently supplied with water. Mr. Williamson further stated that he did not think it possible that either a deficiency of water or priming could arise without it being indicated to those in the stoke-hole. Mr. Andrew Murray, C.B., surveyor of factories and consulting engineer to the Admiralty, also gave evidence tending to confirm that given by Mr. Williamson, adding also that the officers and men employed on these trials were so accustomed to them that they had lost all feeling of racing or extreme excitement which would induce them to do anything to incur any risk.

Evidence of a thoroughly independent character was given by Mr. L. E. Fletcher, the engineer to the Manchester Steam Users' Association, who had examined the ruptured boiler. His conclusion was that the explosion did not result from excessive or improper pressure of steam; neither did it result from any defect in the original construction of the boiler, or from any defect in its condition at the moment of fracture; but that it arose solely from the overheating of the furnace crowns, in consequence of which the plates composing them lost their strength, and, being unable to resist the pressure of steam, bulged down at the ordinary working pressure; the left-hand one rending transversely for a length of about 18in., and 2¾in. at the widest part, thus forming an opening through which the steam and hot water rushed out of the boiler, and playing into the engine-room scalded to death the men engaged there. As to the cause of the overheating of the furnace crowns, he had come to the conclusion that the water supply had been overlooked, and thus allowed to run short, when overheating would be inevitable—so that this explosion seems to have been due simply to shortness of water. Mr. Fletcher added that he had met with numerous cases in which furnace crowns had been injured though certainly covered with an ample supply of water; while, in one case, a rupture resulted very similar to that in the boiler under consideration. He could not in this case give any grounds for the shortness, further than by supposing it to have been an oversight.

With respect to the character of the boiler itself we have the evidence of Mr. John Boffey, foreman of boilermakers at Portsmouth. The boiler in question was made under his superintendence at Sheerness. The outside diameter was 6ft. 1in.; the furnaces were 2ft. 4½in. in diameter; the casing or shell was half an inch thick. The plates for the shell were supplied by contract from Messrs. Moser and Son's. The plates for the furnace were from Messrs. Cooper's, and were made with the best Yorkshire iron. The tubes were supplied by Russell and Son. The length of the boiler was 16ft. and half an inch, and of the tubes 6ft. and half an inch. On the completion of the boiler it was subjected to hydraulic pressure to the extent of 180lb. to the inch. The boiler in question was made expressly for the "Thistle," and was sent to her at Woolwich to be fitted in her. By the rules of the service the boilers, after being fitted, would be subjected to a similar test to that made on their completion. The furnaces were made of Cooper's best Yorkshire iron, tested in the Government establishments before being accepted from the contractor. It was tested by hot and cold test. The combustion chamber was of the same description of iron, and the tubes the same, and also the fronts of the boilers. The whole of the materials were subjected to the same test, and everything stood the test satisfactorily. This witness attributed the cause of the fracture to the top of the furnaces becoming red hot from want of water, and thus the strength of the boiler became completely destroyed. Other witnesses were called whose testimony was simply confirmatory of that already noticed, and whose conclusions were invariably to the effect that the accident occurred through shortness of water.

Looking at the whole of the evidence we cannot see how any other verdict could have been given by the jury. The witnesses were unanimous in their conclusions that the water level had been allowed to get too low, so that the plates had become weakened, and ultimately gave way under the pressure of the steam. The latter clause of the verdict, based as it was upon satisfactory evidence as to the soundness of the boiler, disposes of the contingency of overstrained economy to which we alluded in passing last week. But there still remains the mystery to which we then also alluded, and which will probably never be cleared up, and that is, how with a new and well made boiler, attended by a picked staff of engineers, such a catastrophe could have occurred. There is a possibility that the accident was due to a deposit of salt having taken place on the plates, and which might have been prevented by frequent blowing off. But those witnesses who examined the collapsed boiler make no allusion whatever to any appearance which would warrant this conclusion, so that we have not this hypothesis to fall back upon. Mr. Fletcher, however, seems to have had some idea of the kind in his mind when he referred to cases in which furnace crowns had been injured although covered with water at the time. Here such a condition is dimly hinted at. If a deposit of salt really took place, then there is no mystery whatever attached to the occurrence, which would follow almost as a matter of course. Independently of this, the mystery still remains. The evidence taken at the inquest does not throw any sufficient light upon the occurrence to enable us to state definitively and exactly what led to the rupture. The circumstances, however, point to the inevitable conclusion that an oversight had been committed by one or other of those who have unhappily paid the sad forfeit of their lives. Inconceivable as this may appear with men of thorough training and high character, yet such seems to be the only solution offered to the problem. It is one of those circumstances which occasionally arise to prove that man is not infallible.

THE HOLBORN VIADUCT.

THOSE who consider that a bridge over a public thoroughfare ought not to consist of one big hole and two little ones, would probably regard it as a very fortunate circumstance if it should become necessary to remove the structure of that description which has recently been permitted to encumber one of the widest streets in the metropolis. This is not the fault of the designer, but of those who selected and approved the design. It is not impossible that the City authorities, foreseeing, with that wonderful acumen which is ever characteristic of their operations, that some day or other Temple Bar must be removed, conceived the brilliant idea of perpetuating its obstructive features in another locality. It is acknowledged universally to be an intolerable nuisance in Fleet-street, but they may have consoled themselves with the reflection that it might be tolerable, at least for their time, in Farringdon-street. But behold how the Nemesis which watches over the interests of the traffic of a great city revenges herself upon those who violate her laws! The splintered bases and the cracked columns attest the measure of her wrath. Had the whole street been spanned by a single arch, as it should have been, there would have been no columns to splinter, no bases to shatter. Solid abutments would have withstood the thrust of the worst designed arch in the world, and if any columns had constituted a portion of the design, they would have been of a purely ornamental character, and not subjected to the action of strains which they were totally unfit to encounter. We have not, however, to do with the question of what might have been the best design, but with the present design, and more particularly with its present unfortunate condition. Many and ingenious have been the attempts to account for the position in which it is now placed. Enormous pressure, tremendous vibration, sinking of the foundations in consequence of a landslip, brittleness of the material of which the columns are composed, and many others more ingenious but less possible. In fact, the ingenuity of the cause alleged is always in the inverse ratio of its probability. There is no doubt that the traffic over the Viaduct is of a heavy, it may be said, of the heaviest description belonging to roads and streets, but still it is nothing in comparison with locomotive traffic. A bridge very similar in many features to that under consideration carries the South-Western Railway over the South Lambeth-road, close to the Vauxhall Station. The span is about the same, and the angle of skew also, but the two side passages for the foot-paths are spanned, not by small cast-iron, but by brick arches faced with stone. This bridge has been doing duty ever since the formation of the line some fifteen or twenty years ago, exposed to a very heavy rolling load, but it evinces no signs of deterioration or decay. And yet, when the City authorities repeat the experiment on a smaller scale, the result is partial demolition.

The plea of vibration sounds plausible enough, but it is more specious than real. Its effect does not depend, as might be imagined, upon the absolute amount of the rolling load traversing a bridge, but upon the relative proportion existing between that load and the insistent weight of the bridge itself. From the very nature of its construction, Holborn Viaduct bridge is a heavy bridge, and possesses a considerable insistent weight, which has a tendency to destroy any vibration that the passage of heavy traffic would give rise to. It would have been a great deal better for the columns if the superstructure had been made of wrought instead of cast iron, and the massive scrollwork spandrels replaced by light wrought-iron bracings. Unquestionably the cause which must have been most acceptable to Mr. Haywood, and to which the accident has been

attributed, is that which traces all the evil to a landslip. This is very difficult to believe, especially when it is borne in mind that the valley of the Fleet must have become tolerably well consolidated after centuries of traffic. If this were so, why should the effect be confined solely to the bridge? Why are not the foundations of the newly-erected adjoining buildings also affected? It would be almost too much to expect that the sinking should take place only under the Viaduct, although it is the lowest point in the valley. The danger of any settlement in the foundations requires to be especially guarded against where the principle of construction adopted is that of the arch. With a horizontal girder, a settlement that would be fatal to an arch would be productive of no evil effect beyond raising or lowering one end more than the other. The appearance of the structure might not be improved, but the evil would end there. This difference arises from the fact that in the horizontal girder there is no external force developed, except a direct vertical pressure on the supports, whereas in the arch the thrust exerted requires a perfectly unyielding and rigid support. The least settlement of one of them would cause such a derangement of the normal state of the equilibrium of the erection that it would be impossible to tell where the mischief would end.

Admitting the fact that the pillars, from their enormous and disproportionate lateral dimensions, are fully capable of carrying almost any pressure placed uniformly upon them, yet the case assumes a different aspect when the pressure is not placed uniformly upon them. The strength of a pillar when the pressure does not pass through, or nearly through, its longitudinal axis is reduced to one-third of what it is when the line of pressure and the axial line coincide. There are no two opinions about the inequality of the pressure brought upon the columns of the Holborn Bridge. The great difference in the dimensions of the centre and side spans fully corroborates that fact; and from the present visible heeling over of those that are splintered, it is equally manifest that the line of their geometrical axis does not by any means coincide with the line of pressure. Whatever, therefore, may have been their originally calculated strength, if any such calculation were ever made, that strength is now only one-third of what it was—a reduction which cannot be viewed without feelings of grave concern, not to say, apprehension. However large a margin may be left for contingencies, and in brick and stone the margin is frequently almost unlimited, yet when that margin is reduced to a third, it is time to examine very closely into what remains. It is very probable that the expansion and contraction of the metal has played an important part in conducing to the present state of the bridge, but to whatever source it may be traced it is absolutely due to the non-conversion of the external forces exerted by the arch into a uniform vertical pressure coinciding with the longitudinal axis of the columns. In other words, the theoretical conditions governing the stability and equilibrium of columns have been violated, and "hinc illæ lachrymæ." It has been suggested by a contemporary that the skewbacks of the piers should be set upon rollers, which in their turn would rest upon the top of the columns. This would be similar to the arrangement provided for the expansion and contraction of horizontal girders of large span, but there is no necessity for it in the case of iron arches. Their expansion amounts to a simple rising and falling of the crown, and with a properly designed arch, in which it is free to act in this manner, no evil consequences can possibly ensue. But if the arch be not free to follow such a course, it will, in its efforts to accomplish it, produce results similar to those now before us. It is said that "in the multitude of counsellors there is wisdom," and therefore, relying upon the truth of that proverb, we may expect to hear something very sagacious from the report that is in preparation by the gentlemen appointed to investigate the matter. At the same time, we do not expect anything very new or startling, as the subject has been thoroughly well sifted in all its bearings. Our enemies might, unfortunately, truthfully remark, that in London it takes one engineer to make a bridge, and three to mend it.

THE DAW CARTRIDGE SEIZURE.

IT will doubtless be well within the recollection of our readers that in the month of September, 1868, Mr. Daw, the gun and cartridge maker, of Threadneedle-street, was summoned before the Lord Mayor Allen for manufacturing cartridges within 100 yards of dwelling-houses without a licence, for keeping in store cartridges containing more than 5lb. of gunpowder, for not having a brick or stone magazine for the storage of the gunpowder, and, lastly, for having more than 200lb. of gunpowder in the house at one time. These allegations were made under the Gunpowder Act, which it was declared Mr. Daw had contravened. Notwithstanding that it was shown that the maximum of safety was ensured by Mr. Daw's arrangements, which were very perfect, and notwithstanding that it was shown to be the universal practice of gunmakers to fill cartridges very largely, the Lord Mayor convicted and imposed the full penalties, amounting to £40. Upon this conviction, and seeing that he had been singled out from amongst other manufacturers who were doing the same thing and were left unnoticed, Mr. Daw, through his counsel, obtained leave to state a case by way of appeal from the decision of the bench. This appeal came on for hearing last Saturday, when, as will be seen from our legal summary, the Court of Queen's Bench affirmed the convictions. This decision is of great importance to the gun and cartridge trade, inasmuch as every dealer in gunpowder filling cartridges upon his own premises is liable to £10 penalties, upon four counts, for the one operation performed on the same day, viz.:—Firstly, for unlawfully manufacturing ammunition without a licence. Secondly, for unlawfully keeping certain ammunition, to wit, a quantity of cartridges, containing upwards of 5lb. of gunpowder, in an unlicensed place. Thirdly, for unlawfully filling and charging ammunition in a building at a distance less than 20 yards from any other workshop on his own premises. And, lastly, for not having a magazine built of brick or stone for receiving and safely keeping the gunpowder used for the cartridges.

Now the question at issue turns upon the construction to be put upon the 18th clause of chapter 139 of the Act of Parliament 23rd and 24th Victoria, under which the right of gunmakers to fill cartridges exists. It has always been believed in the trade that the liberty of making up cartridges is permissible under this Act, and this belief has been universally acted upon. And we ourselves concur in this belief, subject of course to the degree of safety ensured, which in the present case was in excess of that enjoyed by other makers, inasmuch as Mr. Daw's cartridges, for which the Government had awarded him their premium, are especially safe. However, as a matter of fact Mr. Daw appears to have offended—however unwittingly—against the Gunpowder Act, and as a matter of law he was convicted and fined to the full extent allowed by the law. The proceeding which selected him from amongst many others appears to us to have been harsh and arbitrary, and the infliction by the Lord Mayor of four penalties for what is apparently but one offence certainly merits the expression of "hardship" which we understand was applied by the Court of Queen's Bench to the circumstance. Nevertheless, as the decision was legal, the Court had no alternative but to affirm it. From this decision let all engaged in this trade take warning, for, although they have been carrying on their business during the ten years since the passing of the Act without a single case of official interruption, and although no one has been interfered with during the fourteen months which have elapsed since Mr. Daw was thus visited, they know not how soon they may be. With the present reading of the Act in question, they will know what to expect should they be disturbed in a proceeding which they have hitherto believed to be perfectly permissible.

TELEGRAPHIC NOTES.

A GENERAL meeting of the Société du Cable Transatlantique Français was held on Wednesday, at which a report was presented by the directors. This document states that since the meeting on the 8th December last the cables of the company between Brest and St. Pierre and St. Pierre and Duxbury have been successfully submerged by the Telegraph Construction and Maintenance Company along the course judiciously laid down by Sir James Anderson, who accompanied the expedition. No better evidence of the careful navigation of the "Great Eastern" by her experienced commander, Captain Halpin, can be given, than the fact that the distance run on this occasion by the vessel differs only by four knots from the length of the course as laid down on the chart. The cables are in excellent electrical condition, their insulation has materially improved, and the practical working of them sustains no detriment whatever from the minute defect stated to exist on the section between Brest and St. Pierre. The arrangements made by the British Government for taking over the telegraphs throughout the country on the 1st January next cannot fail to be productive of benefit to this company by opening to it many stations where at present existing treaties with the older cable company exclude it from any portion of the traffic. By the introduction of this enterprise, the cost of a transatlantic message has been reduced to £1 10s., a rate which the directors believe will prove the mean between a judicious consideration for the public and the largest remuneration for the shareholders. The directors feel that it is a subject of congratulation that within the short space of twelve months an enterprise of such magnitude has been successfully carried through the several stages of raising the large amount of capital required, manufacturing and finally submerging the longest cable yet laid; and they feel that the especial thanks of the members are due to the Telegraph Construction and Maintenance Company for the unflagging energy and loyalty displayed by them and their officials in the execution of their important share in this truly international work. The company is also under obligations to the British and French Governments for the aid they have given the undertakings through their dockyards and officers, amongst whom may be mentioned Captain Richards, R.N., hydrographer of the British navy, and Capitaine de Rougeux, of the Imperial marine. The zeal displayed by the officials of the company merits also especial acknowledgment, which is accorded to them by the directors in the report.

Desks for writing telegrams are about to be placed in the lobby of the Cambridge Post-office, which will be enlarged for that purpose. The work of connecting the telegraph wires with the Post-office at Huntingdon is being proceeded with. They will cross the market-place from the summit of the Falcon Inn. The Post-office authorities have taken a house in Guildhall-street, Lincoln, for the purpose of converting it into a telegraph office. Preparations are being made for the impending change at Alford, Lincolnshire, posts being in course of erection between the Post-office and the railway station. The Stamford town council has granted permission for the erection of posts and wires from the railway station to the Post-office in St. Mary's-street, in that town. Mr.

E. Yates has visited Boston for the purpose of making the necessary arrangements in that town.

There is a report current that the Chancellor of the Exchequer will be able to arrange the money necessary for the purchase of the telegraphs without appealing to the general market. If this should in reality prove the case the effect must be encouraging, and the tendency in the rates of discount will again be towards decline. The operators would be glad to be definitively informed on the subject, since this is one of the causes influencing the prices of Government securities.

The directors of the Telegraph Construction and Maintenance Company have decided to convene a special general meeting of the shareholders at the end of the month, to authorise the return of £8 per share of the capital—£4 to be paid this year, and the balance as early as practicable.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

ANTI-CHOLERA TISSUE—PETROLEUM FOR HEATING THE BOILERS OF LOCOMOTIVES—CANDLE LAMPS—THE WORKING OF BRONZE—VOLATILITY OF CHLORIDE OF GOLD—NEW REMEDIES.

THE facts collected in Paris by Dr. Burg, and in London by Dr. Clapton, which seem to conclusively establish that men who work with copper and its alloys are protected from cholera, have led a M. Adeline to produce a fabric in which fine copper wire is interwoven. He calls it "Anti-cholera tissue," and it is intended, we presume, to be made into belts or underclothing to be worn next the skin. The idea is ingenious, and if an outbreak should occur, there would probably be a great demand for anti-cholera tissue.

The heavy petroleum oils have been successfully applied by M. Deville to the heating of the boilers of locomotives. Two engines on the Strasbourg line have been fitted with M. Deville's furnaces, and are employed in the goods traffic. The consumption of oil in the engines drawing heavy trains is stated to have been from three and a half to five kilogrammes for every kilometre traversed, or (say) from 8lb. to 12lb. for every two-thirds of a mile. This result is considered highly satisfactory by French engineers. The oil is said to be very completely burnt, and there is no waste, and consequently no smoke. Another advantage, which should induce the directors of the Metropolitan Railway to look into the matter, is that, there being no sulphur in the oils, the atmosphere of their tunnels would be free from the most disagreeable and obnoxious contamination, sulphurous acid. We shall endeavour soon to give our readers a full description of these furnaces.

Amongst the things likely soon to find, along with flint implements, their only appropriate place in a museum of antiquities are unquestionably snuffers, instruments, we may say, characteristic of the dark ages. We have nothing to say here about snuffers, concerning which, however, a great deal might be written; we only notice now the lingering affection some people have for candles. If they have a gas light, they wish to have it made as much like a candle as possible. To indulge the whims of such people M. Radowski has produced a petroleum lamp in the form of a candle. The reservoir is of copper, painted white; it contains a sponge to absorb the petroleum, and a wick is carried through a tube, as in the small chamber lamps made on the same principle. The worst of these lamps is, that it is necessary to use a light and consequently dangerous oil in them. If, however, care be taken to pour out all the oil not absorbed by the sponge, and they are filled and trimmed by daylight, no accident is likely to happen. If upset, there is nothing to run out, and there is no possibility of fracture. There is little to be said about the light they give; but they are certainly cheap. The inventor of these candle lamps estimates that the cost of oil for each candle will not exceed half a farthing an hour.

An important fact for the manufacturers of chloride of gold is mentioned by M. Debray, whose word may be safely relied upon in all matters of this kind. It is commonly said, and we believe stated in all chemical books, that when chloride of gold is heated, the chlorine is driven off, and spongy gold left behind. According to M. Debray, however, this is an error. At 300 deg. Centigrade the chloride, he says, is volatilised unchanged. This, M. Dumas remarks, will account for the diffusion of gold in quartz in extremely thin veins.

The secret of the manufacture of Chinese gongs seems to have been revealed recently by MM. Jullien and Champion, who have found that bronze which is brittle at the ordinary temperature becomes malleable at a dull red heat. The makers of bronze implements of anti-historic times were evidently aware of the fact, and no doubt also the manufacturers of the bronze lamps found in the buried Italian cities. Lately they have made experiments on this matter at the Paris Mint with the view of determining the conditions most favourable to working the alloy, and it has been found that a bronze containing 20 per cent. of tin, which at the common temperature is as brittle as glass, may at a dull red heat be forged and beaten out as easily as soft iron. These results open up the way to a new branch of manufacture.

We may dispose in a few words of some matters which at a future day may be of great importance to the comfort and welfare of humanity. Dr. Matthiesen, continuing his researches on opium alkaloids, has found that what has been called papaverine is really a mixture of two alkaloids, one of which is a more powerful sedative than morphia.

The discovery of the anæsthetic properties of chloral has induced people to experiment with its chemical analogues, bromal and iodal. They are disagreeable bodies to use, provoking a running at the nose and a profuse flow of tears, but they are said to be powerful anæsthetics, too powerful perhaps to be safely used. Bromoform, the analogue of chloroform, appears to be more powerful than this latter, and may perhaps be safely employed.

ON THE NEED OF FURTHER EXPERIMENTS ON THE STRENGTH OF MATERIALS.

By Mr. C. J. Light.

AT a meeting of the Society of Engineers, held on Monday, the 15th inst., Mr. F. W. Bryant, President, in the chair, the following paper was read:—All sound engineering practice must necessarily be based upon experimental research into the strength of the materials employed, whether these experiments are purely scientific, and conducted with the accuracy and precision necessary to qualify them for supplying data on which to base formulæ for general use, or of a rough and ready character hardly to be recognised as experiments. For even the most ordinary proportions of parts must originally have been based upon trials—very often upon failures. It is with the former class only that the author now proposes to deal, and to point out how far, in some very important branches, it has hitherto failed in answering its proposed end. Two essentials of useful experiment are, that all action whatever that could interfere with the sole development of the strains to be investigated should be carefully eliminated, and that the apparatus used should possess the means of measuring the results with the utmost possible accuracy and delicacy. These points are essential because, where they are neglected, it becomes difficult to say what are even the limits of error, much less what corrections have to be applied to the results obtained. If this be thought too much of a truism, it will be sufficient to refer to the practice, once almost universal, of applying tensile strains by hydraulic pressure, and measuring the force by means of a gauge connected directly with the press itself, when the friction of the cup leathers introduced an element of uncertainty which entirely vitiated the accuracy of the results. When the object of the experiments is to establish formulæ, it is clearly necessary that, besides the above-named conditions of the apparatus, the samples operated upon should be prepared with the utmost care and precision, but the author would suggest that at the same time samples should be prepared from identically the same materials, but under as nearly as possible the ordinary conditions of manufacture, so that a comparison of the two classes might afford data for determining what proportion of the theoretical strength might reasonably be calculated on in practice.

Of late years great numbers of experiments have no doubt been made, especially upon the resistance of iron to tensile and transverse strains, but they have been generally for private purposes, and have not been allowed to become known. A noteworthy exception, however, is the valuable series of experiments in wrought iron and steel carried out by Mr. Kirkaldy for Messrs. Napier, and so fully published, with their permission. Upon the questions of tensile and transverse strains, therefore, it may be said that our information is fairly complete, but on the highly important subject of compressive strains it is admitted on all hands that reliable data are sadly needed. In a recent communication to the Institution of Civil Engineers, a French authority, M. Gaudard, remarks that "the case of a pillar pressed upon its bases is very imperfectly understood. We are almost reduced to the application of formulæ purely empirical, which aim rather at conforming to observed facts than at explaining them." Whether the formulæ we have to rely upon deserve even the modified description of "conforming to observed facts" may well be doubted after a very slight examination and comparison.

It is surely a matter of great surprise that the best series of experiments into the strength of columns and struts dates as far back as the year 1840, when Mr. Eaton Hodgkinson tested a considerable number of small columns of various diameters and proportions with the express object of determining practical formulæ. Since then nothing further has been done in this direction, and the results at which he arrived are still the admitted basis of calculation for columns and struts. It might, therefore, have been expected that these results were so clear and satisfactory as to render further investigation unnecessary, which, however, is very far from being the case. For example, the well-known formula for long hollow columns with both ends fixed, that is, according to Hodgkinson, columns whose length exceeds thirty diameters, is—

$$W = 44{\cdot}34\,\frac{D^{3\cdot55} - d^{3\cdot55}}{L^{1\cdot7}}$$

Where W = breaking weight in tons.
D = external diameter in inches.
d = internal diameter in inches.
L = length in feet.

On seeing so peculiar an index or exponent as 3·55 in a professedly empirical formula, it is natural for the student to suppose that the experiments rendered results at least very closely approximating to the index finally adopted. What, therefore, must be his surprise to find that in fact the indices obtained from the various experiments ranged from 3·922 to 3·412? (see the foot note to page 333 of Mr. Hodgkinson's work). That is, if the external diameter be 12in., the factor to be employed might range from $12^{3\cdot922} = 17082$, according to one experiment, to $12^{3\cdot412} = 4810$, according to another. The same remark applies to the factor $L^{1\cdot7}$, as it appears that the index varied from 1·914 to 1·424.

In the sixth edition (1867) of Barlow on the Strength of Materials, edited by Mr. Humber, a short article on cast-iron columns has been inserted, which is an almost verbatim extract from Hodgkinson's work above referred to, and in which his formulæ are adopted as the best yet known, with a modification suggested by Mr. Hodgkinson, viz., taking the index of the diameter as 3·6 both for columns with fixed and with rounded ends. It is somewhat anomalous that, while adopting this modification, the effect of which is very considerable even in columns of moderate diameter, what may be almost called the affectation of extreme accuracy is retained in the constants of 44·3 for hollow and 44·16 for solid columns, where it is obvious that the decimal part exercises an influence upon the result perfectly insignificant as compared with that of the slightest change in the indices.

Another serious cause of uncertainty arises from the admittedly different kind of resistance offered by very long and very short columns, the one being principally a resistance to crushing and the other to flexure. Mr. Hodgkinson came to the conclusion that his formula for long columns could be adapted to short columns, at least for certain classes of iron, by means of the following expression:—

$$\text{Breaking weight of short column} = W' = \frac{W \times C}{W + \frac{3}{4} C}$$

where C is the crushing force in lbs. belonging to the material employed × the sectional area of the column. As, however, C will in all ordinary cases be very large in proportion to W, the expression practically resolves itself into $w = \frac{4}{3}$ W.

Now it is obvious that this is a most unsatisfactory solution, for it cannot be supposed that there is any point at which a sudden change of so

considerable an extent takes place. Or, to bring the question to the test of an example, let it be supposed that the column whose breaking strength is sought is 30ft. long, 12in. external, and 12in. internal diameter, is it to be classed as a long or a short column? In the former case, its ultimate strength would be, according to Hodgkinson's formula, 442 tons, in the latter 589. Nor, if it be admitted that there are two such distinct classes as long and short columns, is there any certainty as to the proportion at which the change occurs, other authorities placing it as low as five diameters in the case of cast iron.

Leaving for a time the consideration of Hodgkinson's formula, the next that claims attention is that given by Professor Rankine:—

$$W = S\frac{f}{1 + \frac{l^2}{c r^2}}$$

Where S = sectional area of a column, l = its length in inches, r the least radius of gyration of its cross section, f and c two coefficients depending upon the material, and appearing to have relation to its powers of resistance to compression and tension. It will be seen that no comparison can be made between this formula and Hodgkinson's, but it is evident that Rankine's bears a more purely theoretical character, and that it involves the fourth power of D, in which respect it agrees with that originally laid down by Euler, which Hodgkinson thought could only be reconciled with practical results by modifying the index as before noticed.

Besides these formulæ, there is also one quoted by Molesworth, though from what authority it was derived the author has been unable to ascertain. It is given on the 19th page of his Pocket-book, and called an "Approximate Rule for the Strength of Iron Struts," without any limitation as to the proportions between their length and diameter. For the case of hollow columns of cast iron this rule gives—

$$W = S \times 36 \div 1 + \frac{l^2}{400\ D^2}$$

$$\text{or} = S\ \frac{36}{1 + \frac{l^2}{400\ D^2}}$$

Rankine's formula adapted to a similar case would be

$$W = S\frac{80{,}000}{1 + \frac{8\ l^2}{3{,}200\ D^2}} \qquad = S\ \frac{80{,}000}{1 + \frac{l^2}{400\ D^2}}$$

so that the forms are identical, while the difference of the coefficient is, in this case, but trifling, as Rankine's formula gives the value of W in lbs., and 80,000lb. = 35·715 tons. When, however, the material of the column is wrought iron, the similarity of form continues, but the coefficients differ so greatly as to cause great discrepancy between the results, a discrepancy varying with the relations between the length and diameter. The same remarks apply to the formulæ given for columns of a hollow square and a cruciform section. To assimilate the formulæ for wrought iron to those of Rankine, they must be altered thus:—

For cruciform section, $16 \div 1 + \frac{l^2}{1500\ D^2}$

For hollow square section, $16 \div 1 + \frac{l^2}{3000\ D^2}$

For hollow cylinder section, $16 \div 1 + \frac{l^2}{4500\ D^2}$

In order to show how great is the variance between the different formulæ, and therefore how uncertain any calculations of the strength of columns must be, it will now be desirable to give the results in a few practical instances. First, let the case be that of a cast-iron column 30ft. long, 12in. external and 10in. internal diameter, with the ends flat. Hodgkinson's formula will give its breaking weight, if it be considered as a long column—

With index 3·55 . . . . . 442 Tons
With index 3·6 (said to be sufficiently near for practice) . . . . 505 „
If taken as *short* column . . . 589 „
Or the same with index 3·6 . 631 „
According to Rankine's formula, taken as long column . . . 380 Tons
According to the formula on page 19 of Molesworth . . . . . 383 „

Which of these results, the extremes being as 5 to 3 very nearly, is to be taken as the true breaking weight of the column?

Again, take the case of a column, also of cast iron, 30ft. long, 24in. external and 20in. internal diameter, with the ends rounded, or, what is the same in effect, jointed. Hodgkinson's formula gives, with what he considers the true index for D, viz., 8·76—

Breaking weight . . . . 3,080 Tons
With the index 3·6 ("quite near enough for practice," let it be remembered!) . . . . 1,797 „
Or, if it be taken as a *short* column, which at the proportion of 15 diameters to the length, we have a right to do . . . . 4,107 „
Taken as a long column, by Rankine's formula . . . . . . 1,519 ,
By formula page 19 Molesworth . 955 „

In this case, the extreme values obtained for W are to one another as 43 to 10, very nearly. How is it possible to arrive at any idea of the real strength of such column, which is yet one of very probable dimensions. If, however, wrought iron be the material employed, the discrepancies become still more startling. Assuming the case of a similar column to the one first instanced, only in wrought iron—

Hodgkinson would give . . . 771 Tons
Rankine . . . . 463 „
Molesworth . . . . . 170 „

The first result is based on the statement that the relative strengths in long columns of wrought and cast-iron are as 1745 to 1000—an hypothesis which must be entirely erroneous, for the ultimate crushing strength due to the area of this column, without any consideration of its liability to flexure, is only 586 tons (calculating at 88,000lbs. on the square inch).

The uncertain results of Mr. Hodgkinson's experiments must, there is no doubt, be chiefly attributed to the small size of the columns operated upon, and not to any want of skill or care on the part of the operator. The largest solid column tested was only 5ft. long and 2in. diameter, and in hollow columns the greatest length did not exceed 7ft. 6in. with a diameter of 3¼in. The more powerful means of testing now at the command of engineers would allow of experiments being made upon a much larger scale, and, it is reasonable to anticipate, with far more uniform results.

Before leaving this part of the subject it will be well to notice a remark of Mr. Hodgkinson ("Phil. Trans." 1840) respecting cases of imperfect casting in hollow columns, where the metal on one side was considerably thinner than on the other. He says, "It is gratifying to find that a matter which would seem to destroy all confidence in a pillar does not produce a great reduction in the strength." This apparent anomaly he explains by supposing that by some natural law the thinner side always takes up the compressive strain, and the thicker the tensile, and the instances that accidentally occurred among his experiments certainly confirmed this supposition. This will be an important point for future observation.

In reference to wooden pillars or columns, it will be sufficient to remark that the best established formulæ give results which differ from each other in a similar manner to those for iron, though not to quite the same degree.

Enough has probably now been said to show how impossible it is, with our present information, to determine within anything but the roughest approximation what load any given column ought to bear before breaking. It is true that even if strict accuracy were attainable in this respect, there would yet remain the variations of material and workmanship to be allowed for, besides the important question of the factor of safety that should be adopted. But the author would urge that we ought not to be content until a theoretical basis has been established as certain and rational as that upon which calculations of transverse strains are now based.

Another class of experiments, much more readily to be made, and of a much simpler character, would yet be of great practical utility. Their object would be to determine the resistance to transverse and compressive strains of wrought-iron L and T bars of various sections, and to deduce therefrom practical rules. It is very probable that ample materials already exist in private hands for compiling such information, and, if not, the necessary experiments could be easily and cheaply made. This is not a case requiring extreme accuracy, especially as it would be the actual full-sized bars that would be operated upon, but every engineer ought to have the means of determining at a glance what load any given bar will properly bear. Such tables would be the means of saving many a ton of metal in roofs and flooring, &c., and would afford the designer an assurance of the efficiency of his structure, which he cannot at present be said to have.

The next series of experiments to the need of which the author desires to call the attention of the society would require very great care and skill, both in arranging and in carrying out. They refer to the true proportioning of the eyes of links. It is now many years since attention was first directed to the necessity for providing, not only a sufficient shearing area in the bolts or pins securing links, tie rods, &c., but also a sufficient bearing area of the link or tie itself upon the bolt, a point which appears to have been overlooked, at least in civil engineering, until the rapidly extending use of iron roofs, and the desire to reduce every part to the lightest possible form, brought it into prominence. And even now there is great difference of opinion as to the extent of such bearing area, some authorities contending that the crushing strain so induced ought not to be allowed to exceed (for wrought iron) 5 tons to an inch, while others would extend the limit to 7 or 8 tons. The correct proportions for the eyes of links, whose thickness is small in proportion to their breadth, as in those of bridges, still present a vexed question; and it is not easy to determine how far they are affected by the unavoidable irregularities of manufacture.

Experiments appear to show that the proportions at present adopted in the best practice, though greatly modified from those at first used, are even yet insufficient to secure the fracture of the link through the body in preference to the eye. The author submits that it would be highly desirable to arrange and carry out a series of experiments on links of graduated cross sections, from the thin link, as employed in the lower members of bridge girders, to one of a square section, with a view to determine the proper proportions for the eyes under these varying conditions. It is, however, quite probable that a large amount of information already exists suitable for such a determination if it could only be brought together under such conditions as to permit of a fair comparison of results.

Upon the strength of timber as a material of construction there have been made so great a number of experiments that it may be doubted whether fresh ones would add much to our knowledge of the subject. It may be remarked, however, that the greater part of these, also, are open to the objection before referred to of having been made upon exceedingly small pieces. It is also true that with timber so very much depends upon the age, the growth and the place of growth of the tree, that it can never be expected that calculations for this material can be brought within the same limits of accuracy which may be fairly looked for in the case of iron.

Further experiments are probably desirable on the strength of combinations of timber and iron, such as trussed beams, keeping in view the consideration that the timber must necessarily yield to a considerable extent before any appreciable strain is brought upon the iron tie. This objection is of much greater force in the case of the flitch girder, in which the timber ought only to be looked upon as giving lateral stiffness to the iron plate.

In reference to the important question of the strengths of stone, brick, cement, and artificial stone, there is still room for a well-arranged series of experiments, especially if made upon much larger samples than those which have hitherto been operated upon. Another interesting subject for fuller experiment is that of glass, as laid in sashes both of wood and iron. In the latter case observations should be made under varying temperatures. Several other branches of the inquiry will doubtless be suggested in the course of discussion, and the object of this paper has been, not so much to call the attention of engineers to a want which the author is well aware is already known and admitted as to elicit from all who take an interest in the subject such information as they can contribute to the common fund and such suggestions as may lead to a practicable remedy for a state of things which cannot be considered creditable to the present position of engineering science.

If the foregoing fairly represents the present state of our information upon this important subject, it remains to consider what means can be suggested for satisfactorily supplying the defi-

ciency, and obtaining data upon which reliable formulæ might be based. The best course would probably be for an adequate series of experiments to be carried out covering the whole field of inquiry on any one branch of the subject—say that of columns and struts—to be conducted under the direct superintendence of two or more engineers of such standing as would give weight and authority to the results at which they might arrive. But this course would necessarily involve a very heavy expense, such as no individuals, and probably no body of engineers even, would be inclined to bear. The author would therefore suggest that the same desirable result may be attained by organizing a system of co-operation, whereby the expense may be so spread as not to be felt a burden. To this end three things appear to be essentially necessary. First, that all the experiments should be conducted according to a pre-arranged form, and by means of one and the same testing machine. Secondly, that with each experiment on strains of compression a piece of a standard size from the same melting as the castings to be experimented on should be subjected to the test of crushing, so as to furnish a datum of comparison with other cases, and similarly of course with other materials and other classes of tests. Thirdly, that there should be a central body or committee to which all information should be sent, and by which it should be analysed and sifted, all that might be thoroughly reliable classified and tabulated, and finally its results carefully formulated.

The author would suggest that the Society of Engineers might well take the initiative, and appoint, through its Council, a small committee to act as such a centre; that any member of the society holding the position of engineer to works of sufficient magnitude should use his influence to have a small sum set aside, either by the principals or the contractors, for the purpose of experiment, the special object of which should be arranged with the central committee; and that the co-operation of engineers not connected with the Society should be invited for the same object. The objections anticipated are, that where testing is resorted to in connection with public or private works of construction it is generally for the private purposes of the parties concerned, and that there might probably be great disinclination to allow the materials used to be experimented on if the results were to be made public. Again, it may be feared that the engineers most qualified to form the proposed central committee would not be able, assuming that they would be willing, to devote the necessary time to the work of arranging and formulating the information sent to them.

The author would meet these difficulties by the consideration that if the first-named condition, ensuring uniformity in the mode of conducting the experiments, be secured, the time over which the inquiry might be spread would become of less moment. At the same time he is sanguine enough to believe that if the object be found to be really important there are plenty of qualified men who would be ready to give a portion of their intervals of leisure for the furtherance of an inquiry which should give a complete and satisfactory answer to questions of daily importance to our profession and to all connected with the arts of construction.

CONTINUOUS RAILWAY BRAKE.

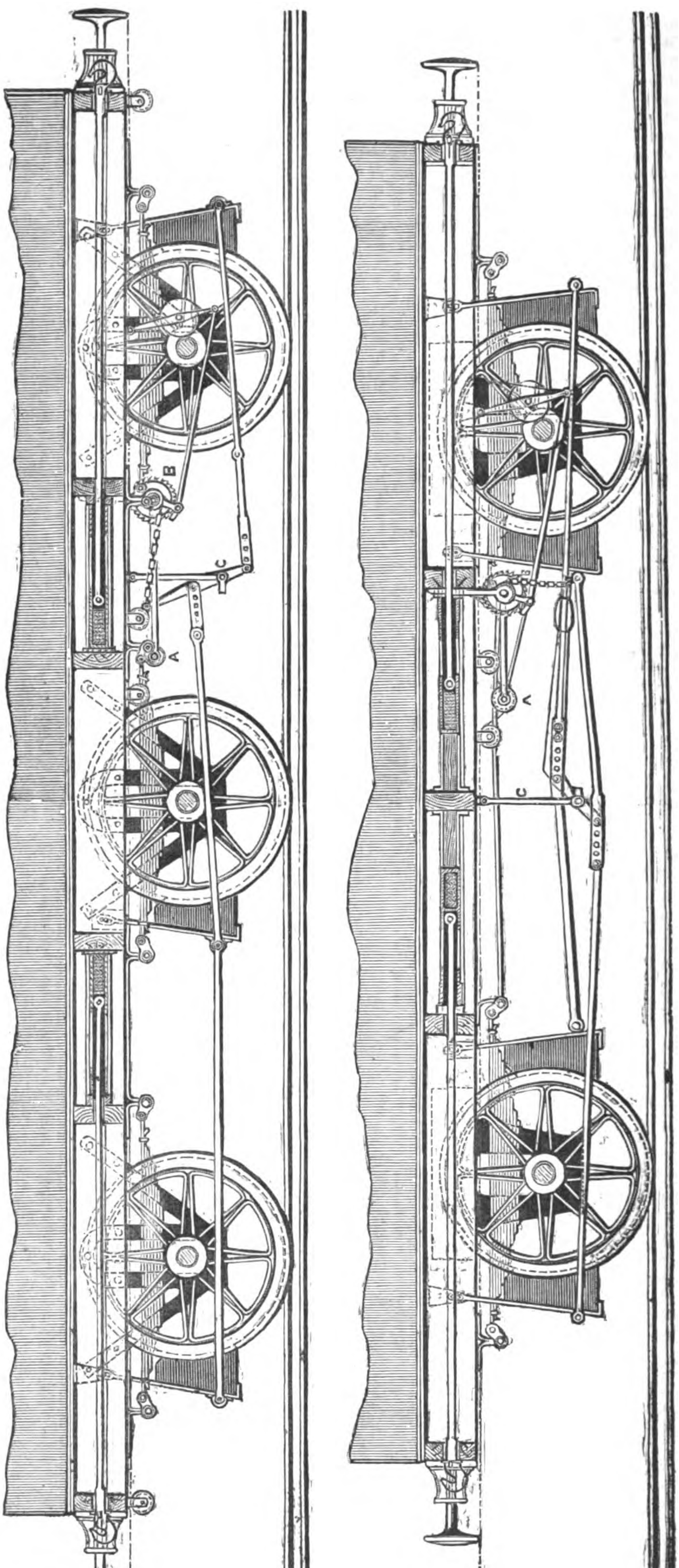
In the annexed engraving we have represented a very efficient self-acting railway brake, as applied to carriages on the Midland Railway, and the invention of which is due to Messrs. Wilkin and Clark, 10, South-street, Finsbury. This brake was first introduced into practice on the Metropolitan Railway some two and a half years since, by Mr. Burnett, the locomotive superintendent of that line. Subsequently to that time, and when the brake had proved to be a practical success, the officials of the Midland Railway saw the invention, and forthwith introduced it on thier line. The difference between the application of the principle on the Metropolitan and on the Midland lines is, that on the latter the brake is self-acting, whilst on the former it is not. The fundamental principle, however, remains the same, the difference being that on the Midland Railway the line is slackened when the brake is applied, whereas on the Metropolitan it is wound up.

In this apparatus, as adopted on the Midland line, we have first a small (3-16in.) chain, which is carried on sheaves fixed to the carriage framing. It is placed in the centre line of the train, so that the carriages may be turned end to end without affecting its operation. The chain is simply hooked together on making up the train. The chain is carried under a pulley in a weighted operating lever A, and while the train is running the chain is kept taut by a counterbalance weight in the van, and keeps the several levers suspended. When the guard wishes to apply the brake he turns a small hand drum and overcomes the frictional resistance of the chain (for both weights act as a counterpoise), and the chain is slackened throughout the train. On the framing a spindle 2¼in. in diameter, carrying a ratchet wheel B, is fixed. The ratchet wheel is not fast upon the spindle, but is carried in frictional clutches. When the operating lever, which is loaded to 35lb. weight, is dropped, these clutches bind the ratchet wheel; motion is given to the ratchet wheel by the revolutions of an eccentric wheel running upon the revolving axle. Attached to the spindle is a ½in. chain, which being wound up operates the levers and blocks in the usual way. The brake levers are carried by a sling C to equalise the pressure of all the blocks. The wheels are, as a rule, not skidded, but nearly so, which is the best result both for practice and tear and wear of stock. When the brake is out of gear the eccentric wheel is held clear of the axle, so that there is nothing in operation till the brake is wanted.

It will be seen that the principle of this brake differs from others in so far as the guard has to keep it from working till he requires the brake, when he slackens the operating chain, and the

CONTINUOUS BRAKE—MIDLAND RAILWAY.

BY MESSRS. WILKIN AND CLARK.



brake is then allowed to act of itself. One important point of this positive or self-acting arrangement is that so long as the train is coupled together, and the guard with it, he can keep it out of gear. But if by accident the train breaks away on an incline he has no longer power to keep the traffic off, and it then becomes self-applied, without any direct human agency whatever. This point was very efficiently tested by the Midland Railway before the train to which the brake is fitted was put on passenger service. The driver was ordered to run down a gradient of 1 in 90, and after attaining a speed of thirty miles per hour the train was parted from the engine precisely as if by accident, and the train came to rest on the bank in 200 yards, or fifteen seconds of time. A similar experiment, but at fifty-five miles per hour, was next tried. Another train stopped in 330 yards, or twenty-seven seconds. As a further test of its power, the driver was ordered to get up full speed and keep on full steam; the brake was then applied, and, without shutting off steam, the train was stopped in 1,220 yards. The engine was a four-wheeled coupled engine, with 16in. cylinder, working up to 140lb. The train has since been working regularly for the last ten weeks on the Midland Railway, and is giving very favourable results. The action of the brake is so uniform and steady that it is not possible to tell when it begins to bite. At a speed of forty miles per hour the train was stopped in 25 seconds, or 280 yards in regular work. The lower figure in our engraving shows a modification of this brake, the principle, however, remaining the same. We understand that the system is now being fitted to the whole of the Metropolitan Railway rolling stock.

THE SOCIETY OF ARTS.

On Wednesday the 116th session of the above society was inaugurated by an opening address from Lord Henry G. Lennox, M.P., Chairman of the Council. After a reference to matters pertaining to the conduct of the society's affairs, the Chairman alluded to the committees appointed by the council to examine great practical questions, foremost amongst which was the Food Committee, which had given its attention to the supply of meat, fish, poultry, milk, and grain, together with their distribution. The great problem at present was the means by which meat could be brought to this country from our colonies and other countries in a raw state, unsalted and uncured. The committee had examined many processes for this purpose, and had put them to the test, and only a few days ago Lord Granville had forwarded some packages of preserved meat from the colonies in order that the Food Committee might ascertain whether the meat was in a fit state to be supplied to our soldiers and sailors. At present the plan which held out most prospect of success was that which presented the least novelty of conception—namely, the preservation of meat by means of ice, and the practical conclusion to which the committee were brought appeared to be that as yet an increased supply of meat to the people of this country depended upon the success of scientific chemists in producing artificial ice at an economical rate.

The council intended this session to appoint a Mechanical Committee, composed of professional men and amateurs, who would discuss subjects relating to progress in mechanical inventions, and who may, it is hoped, be enabled to turn their attention to the subject of the best steam or other roller for macadamised roads. Intimately connected with mechanical inventions was the Patent Law, upon which Sir Joseph Whitworth had promised to read a paper, and which was about to be discussed in the French Legislative Chamber. As an instance of the difficulty thrown upon the judges at present in deciding what is and what is not new, the Chairman said he was informed that on a recent occasion the Master of the Rolls, being otherwise unable to decide between two opposing litigants, ordered the erection in the yard adjoining his court of two elaborate models of the machines which formed the subject of dispute.

The Chairman observed that art-workmanship was still encouraged by the society, which offered for the present session a large number of prizes for productions in most branches of art workmanship, additional prizes being offered for specimens of the application to industry of prescribed art-processes. Passing to the subject of cheap postage, the Chairman stated that it would be the duty of the council to collect information bearing on the expediency of allowing printed matter and parcels to be conveyed through the post at a cheap rate. The council had good reason to believe that the attempt in Switzerland to combine a cheap parcel post with a cheap letter post and cheap telegraphy had been successful, and that in Switzerland and some parts of Germany the substitution of a half-penny rate for the transmission of printed matter as well as newspapers had produced receipts equal to the old penny rates which they had replaced. With regard to the acquisition of telegraphs by the Government, it would be the duty of the society to watch scientific improvements, to see that they had a fair trial, and if possible to promote cheapness in the transmission of messages. The Channel passage was the next subject passed under review. The Society of Arts had offered a premium for improving the communication between France and England, and 17 models of boats had been sent in, which would be examined by a special committee. The Chairman's opinion was that a line of powerful steamers like the new Holyhead and Dublin boats, and doing the passage in about an hour, would meet every reasonable want, and the Dover Pier, which had cost £750,000, could easily be made available for such boats if the French Government would construct a corresponding pier at Calais or Boulogne. One of the schemes for making a tunnel under the sea would be unfolded before the society in about a fortnight. Then came the schemes for a bridge across the Channel, especially that of M. Boutet, which was reported to be favourably looked upon by the Emperor Napoleon, and which was well deserving of the notice of our engineers. In concluding his address, the Chairman reminded members that the library had been re-arranged, and a reading and news-room attached to it, with every convenience for members coming up from the country who wished to conduct their correspondence there.

After the address, Mr. W. J. Wilson was called up to receive from the Chairman the Prince Consort's prize of 25 guineas.

APPARATUS FOR WEDGING FACING-POINTS.

After the meeting of the Institution of Civil Engineers on the 9th inst., Mr. Harrison (V.P. Inst. C.E.) explained a model and two drawings, illustrating plans which had been successfully tried on the North-Eastern Railway, with a view to provide the means of preventing accidents at facing-points. These accidents had arisen from various causes. In some well-established cases, a blow from a waggon or carriage on the heel of the switch rail had sprung the point sufficiently to throw a carriage off the line. A piece of coke or stone getting behind the points, which would stop them from entirely closing, might not prevent the lever worked by the signalman from apparently coming home, without any defect being detected, owing to a certain amount of elasticity in the lever. Signalmen were frequently in the habit of putting up the danger signal before a train had quite passed, and, with the jerk, sometimes disturbing the facing-points. When the Queen's train passed over the North-Eastern Railway, it was the invariable practice to wedge up all the facing-points on the line; and it was believed a similar plan was adopt d on the Brighton and South-Eastern Railways before express trains passed. This had led him to the adoption of the present plan. The first idea was to employ a separate lever to work the wedges distinct from the points. This had been in use at the Pensher Junction for some months. It was afterwards thought that the turning of the points and the wedging might be done by one motion of the lever. This was accomplished by giving a double action to the wedges; but the segment movement, as shown by the model, was in practice the best, and had been in use for some time at Gateshead, on the Team Valley Line. Experiments had been made by putting an obstacle between the points and the rail; but in this case the wedges could not be forced home, the danger-signal could not be lowered, and intimation was at once given that something was wrong. The slide motion for moving the points was worthy of attention, independent of the wedges, as no slight or even considerable motion of the lever could move the points, and practically this motion in itself wedged them up. The cost was rather under £15 per junction, and the same handle was used which before worked the points.

In carrying out these arrangements, Mr. Harrison stated that he had been assisted in all the practical details by Mr. Simpkin, who had the charge of this department on the North-Eastern Railway; and he was so satisfied with the additional safety to be obtained by this plan that it was to be at once adopted at all facing-points on the main line of the North-Eastern system, and in some cases facing-points would be introduced where heretofore all trains had been back-shunted to avoid them. In all cases this arrangement was used in conjunction with a locking apparatus for the signals, &c.

Mr. R. Price Williams (M. Inst. C.E.) also exhibited and explained a new arrangement of switches for railway junctions. The main object of these switches was to do away with facing-points and their attendant evils, and to enable a train when passing through a junction to pass over a continuous and fished main line, or a continuous and fished line leading to the branch, according as circumstances might require. The switches were formed of lengths of rails, of the same section as the rails used at other parts of the road, with fishes at both extremities, at one end the bed-plate admitting a slight play, while at the other they were capable of being moved laterally on the removal of the fish-plates. Each length of what might be termed the main line switch rail was firmly attached to the corresponding length of branch line switch rail, so that the two mutually supported each other, thus giving the necessary lateral stability. At the ends of the switch rails, capable of being moved laterally, sliding double fishes were employed. These moved on the fixed rails, and were so formed that when moved forward they held the switch rails firmly between their jaws, and thus ensured that the switch and the fixed rails were maintained fairly in line with each other.

TRIALS OF H.M.S. "ROCKET."

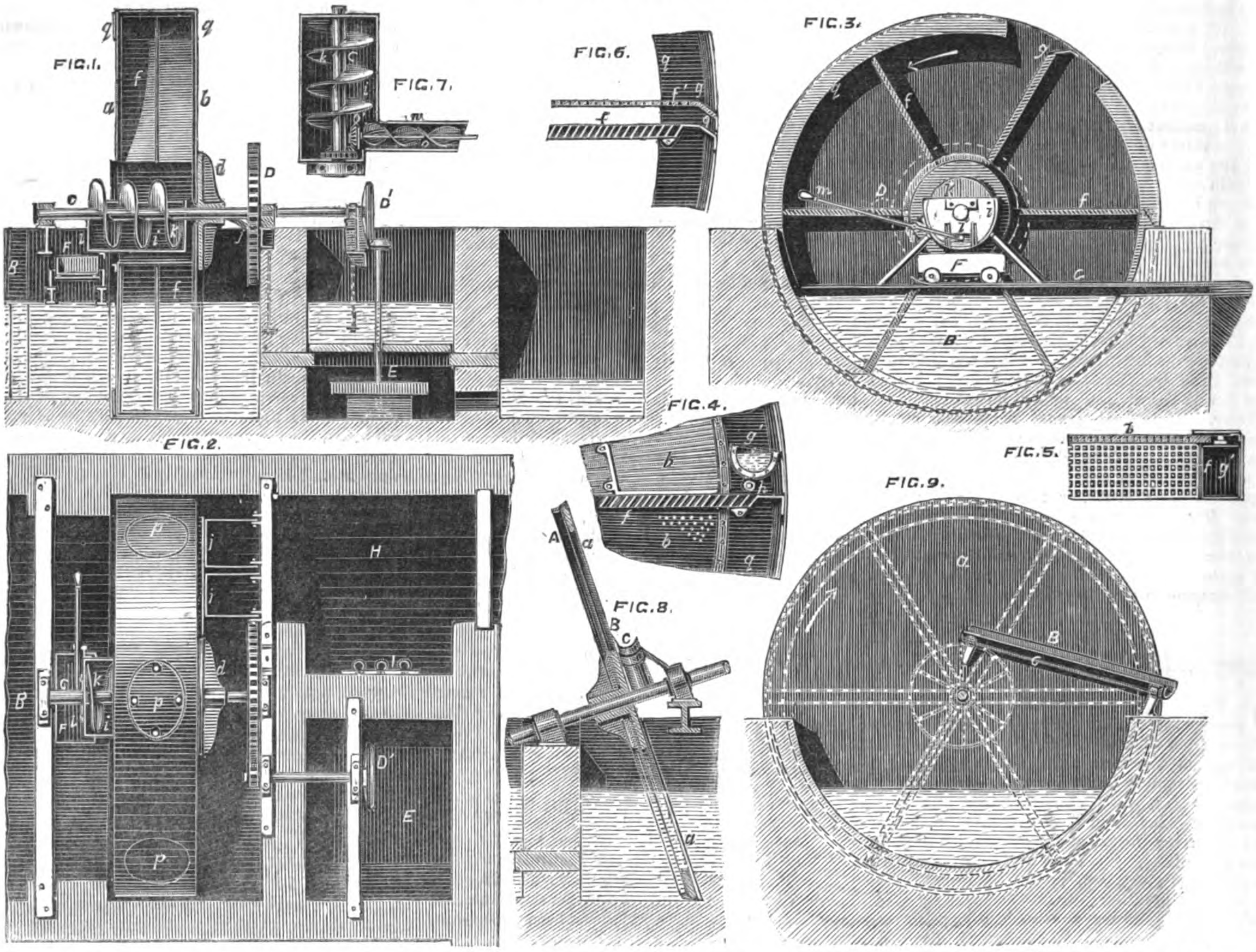
On the morning of this day week the gun vessel "Rocket" was taken out for the second time to the measured mile at the Maplin Sands, to try her boilers and machinery, the first trial having been very unsatisfactory. Upon this occasion the "Rocket," which is sister ship to the "Thistle," being of the same dimensions, steam power, and tonnage, and carrying the same number of guns, had an exceedingly narrow escape from an explosion. The trials were conducted by the officers of the Steam Reserve, and while the vessel was going at full speed on the mile the boilers primed to such an extent as to blow nearly all the water out of them, rendering it necessary to draw the whole of the fires. The alarm on board, especially in the engine-room and stokehole, was, as may be supposed, very great, being naturally heightened by the remembrance of the calamity on board the sister vessel. Some of the men became so unnerved as to be obliged to go on deck; but others manfully remained at their duty, and by their exertions prevented another catastrophe. Various rumours are current as to the cause of the priming, but nothing positive has been made known. The fires were subsequently got up again, and the ship completed some of her trials.

PASSAGE OF THE MISSISSIPPI.

Grave complaints are again made of the shallowness of the water on the bar at Southwest Pass, the mouth of the Mississippi. On October 24 there were nearly twenty large vessels lying outside the bar, waiting to be lightened. Nearly all of them were from foreign ports, and all had heavy cargoes of goods sadly needed in New Orleans and the Southern States, while the inability of vessels to get in interfered with the export of cotton. The "New Orleans Picayune" is anxious to have some good system adopted for lightening vessels over the bar, and is sure it will prove detrimental to the commerce of New Orleans when ships drawing over 17ft. water are compelled to lie out in the gulf until some unusually high tide will carry them over the bar. The New Orleans press generally despair of any permanent relief being obtained. There have been many projects and experiments about deepening the water, but nothing substantial has been realised, and the suggestion is now made that the Government dredge boat be used in towing vessels through the mud, since her ability to clear it away has proved a failure. The volume of water on the bars varies considerably, there being a greater depth of water when the river is from 12ft. to 15ft. below high-water mark than when it is at a high stage. In the former case the tides flow further in, and on their return carry out large quantities of deposit, while in the latter the bulk of the river water breaks the force of the tide from the gulf on the bars and causes a large deposit. No dredging system is able to remedy the evil.

APPARATUS FOR FILTERING AND STRAINING SEWAGE.

BY MR. BALDWIN LATHAM.



APPARATUS FOR FILTERING AND STRAINING SEWAGE.

At the conversazione of the Institution of Civil Engineers in May last, we met with a model of a machine for extracting the solid matter from sewage, the invention of Mr. Baldwin Latham, of 6, Westminster Chambers, and Croydon. This apparatus was then being constructed for use at Croydon, and was briefly described by us at the time. We now purpose to describe this invention in detail, as it is of great importance in connection with sanitary engineering. The invention—which has been patented by Mr. Latham—consists in causing the sewage to be filtered to pass through a combination of screening surfaces arranged at right angles to the flow of the fluid, whereby the sewage as it passes through deposits its solid matter upon the screening surfaces, which in travelling along carry the matter away to a point where it is removed from the surfaces, and these then again pass into the stream of sewage to intercept fresh matter. The apparatus adopted by Mr. Latham in practice is illustrated in the accompanying engraving, where fig. 1 is a sectional side elevation, fig. 2 a plan, and fig. 3 a front elevation. A is a drum, the circumference of which is of sheet metal, and which is open at the front face *a*, which is presented to the stream of sewage flowing in the direction of the arrow through the culvert B. The back face of the wheel is closed by a screen *b* formed of perforated plate. If requisite a second screen *c* formed of gratings with larger apertures than *b* is fixed in the middle of the wheel to intercept the coarser portion of the solid matter. The wheel is carried by the shaft C, to which it is secured by the strong cast-iron boss *d* and ribs *e*, and it receives a slow rotary motion in the direction of the arrow by means of gearing D D¹ from a turbine at E driven by the head of sewage water flowing through the apparatus. Inside the wheel A are fixed a number of radial screens *f f f*, formed as a step grating, as shown at the enlarged detail section and part plan at figs. 4 and 5, the inclined transverse bars being intersected by longitudinal bars so as to form apertures of a small size. In place of step gratings, perforated plates or even solid plates may be employed, or an arrangement may be advantageously used, as shown at fig. 6, where a screen *f*¹ of perforated plates is fixed immediately above the step grating *f*.

This construction of step gratings is also applicable irrespective of its combination with the screening wheel for separating solid from liquid matter. Thus they may be fixed in an inclined position and the liquid in which the solid matter is held in suspension be made to flow down them. At the outer ends of the screens are formed either fixed troughs *g*, as at figs. 3 and 6, or a tumbling trough *g*¹, as at figs. 4 and 5, turning on pins *h*, which troughs take up fluid as the wheel revolves, and when the screens have been raised to a certain angle the fluid flows out of the troughs and down the screens, flushing the solid sewage deposited thereon into the central trough *i*. At the same time the solid matter deposited upon the vertical screen *b* (as also on the intermediate screen *c*, when this is employed) by the passage through it of the sewage water also passes down on to the screens *f*. To facilitate this brushes *j* carried by hinged arms may be kept in contact with the outer surface of the screen *b*, or jets of water are directed against the screen for this purpose; but in practice it is found that the rushing back of the sewage water through the apertures of the screen on the descending side of the wheel as it dips into the fluid is generally sufficient to flush the deposited matter off the vertical screen so as to be taken up by the radial screens.

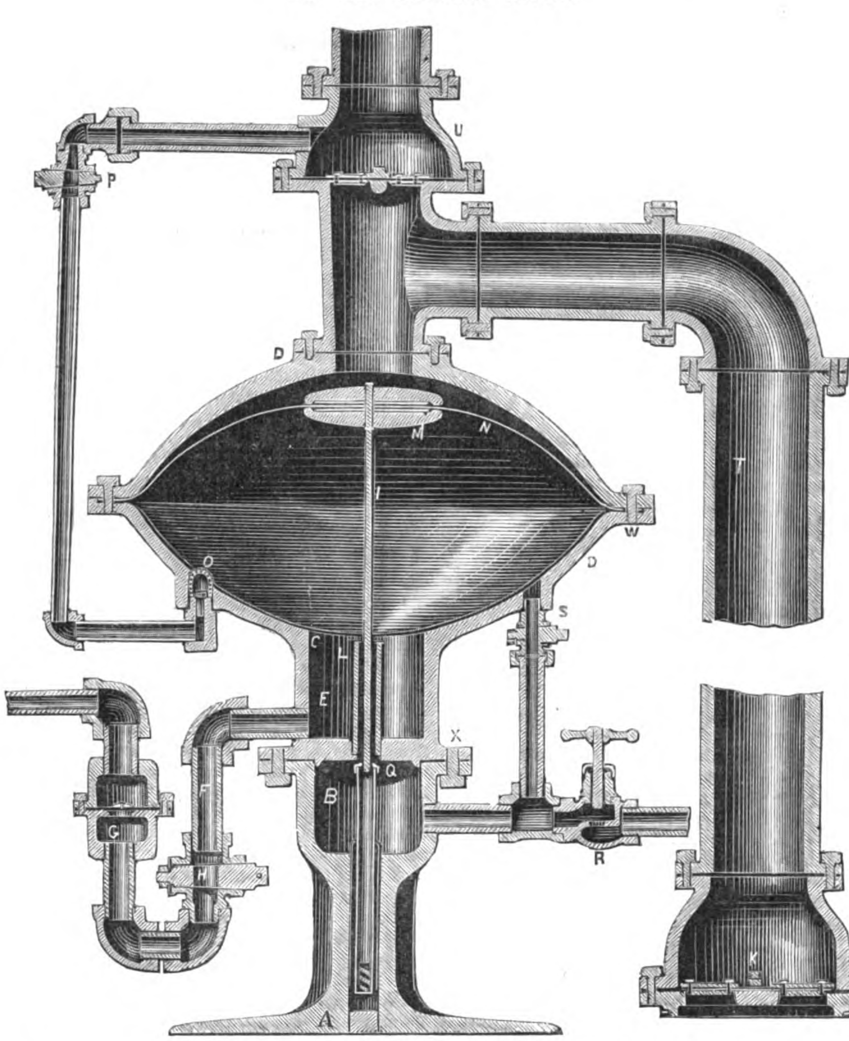
As the separated solid sewage passes into the central trough *i* it is carried forward in it by the revolving screw blade *k* fixed on the shaft C, so as to fall either into trucks F run upon rails G underneath the trough, the front end of which is provided with a sliding door *l* for this purpose actuated by a handle *m*. Or the trough *i* may be made to deliver continuously into a second trough, as shown at *n* in part plan at fig. 7, in which it may be carried forward either by another revolving screw blade *o*, driven by gearing *o*¹ from the shaft C, or by chain buckets. In order to gain access to the radial screens for cleansing them when required, man-holes *p* provided with covers are formed in the circumference of the wheel. Both faces of the wheel are provided with shroudings *q* for the purpose of catching and retaining sand passing in with the sewage, and to strengthen the wheel, and which also serve to close the ends of the troughs *f*. The sewage water, after flowing through the screening apparatus, passes through the channel H and sluice I to the turbine chamber E, whence it flows down the aperture K to the low-level culvert L.

Should it be required still further to strain the sewage after passing through the apparatus already described, it may be caused to flow through a second wheel or disc covered with canvas, which may be arranged as indicated in transverse section and front elevation at figs. 8 and 9, where A is an inclined revolving wheel covered at *a* with canvas, through which the sewage is made to flow in the direction of the arrow, and upon which the solid matter yet contained therein is consequently deposited. As the straining surface revolves it carries the deposited matter round to the fixed scraper B in contact with the straining surface, which removes the deposited matter and causes it to pass into the trough C, in which it is conducted wherever required.

This apparatus is intended to be used in the preparation of sewage before its application by irrigation to land. Hitherto the solid matter of sewage has been removed by tanks, but these tanks have been the only blot upon the system of sewage irrigation. The machine occupies a very limited extent compared with the area required for tanks, the motive power for driving being the sewage itself. The whole of the solid matter is removed in a fresh state before decomposition takes place, and, therefore, this solid matter is much more valuable as a manure than the solid matter taken from tanks, which can only be removed after decomposition has set in. The liquid not having to flow

AUTOMATIC PUMPING ENGINE.

BY MR. THOMAS SHAW.



through a mass of decomposing fœces is much sweeter, and there is no likelihood of the sewage so treated producing a nuisance when spread over the fields of an irrigation area. The apparatus is inexpensive in its cost, and as it performs all the work that has hitherto been performed by manual labour, the great expense of this labour will be saved.

The apparatus is found to be most effective in practice, and we understand that Mr. Latham is putting up a large number. It is very perfect in its working, and will remove from the sewage not only the whole of the solid fœcal matter, paper, rags, sticks, stones, &c., but the fine sand brought down the bed of the sewer, and which often proves a serious source of mischief. It can be applied in any position, as it will work quite as efficiently at any depth below the surface as upon the surface.

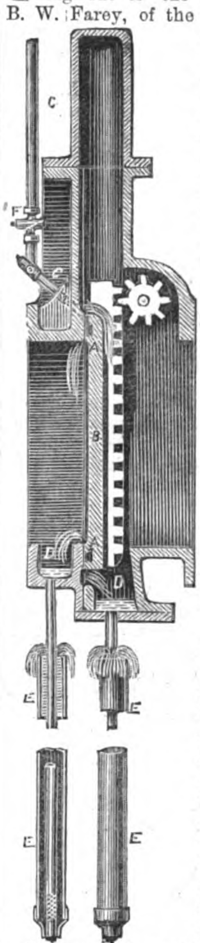
AUTOMATIC PUMPING ENGINE.

THE accompanying engraving illustrates a pumping engine which has recently been invented and introduced in America by Mr. Thomas Shaw, of Philadelphia, whose gunpowder pile driver we described and illustrated in the MECHANICS' MAGAZINE for the 1st of October last. The present machine consists mainly of a spheroidal chamber of cast iron, composed of two equal globular segments united by flanged edges forming a perfect joint, and grasping also the circumference of a circular diaphragm or curtain of stout cotton cloth of several folds, the cloth and the inner wall of the chamber being coated with vulcanite as a non-conductor of heat. This diaphragm has a sufficient diameter to follow the curve of the chamber throughout, and is made to alternate from top to bottom of the same by means of a finely finished steel valve stem, clasping it exactly in the centre by a metal disc on each side. The stem also opens and closes the tubular valve by which the steam enters the chamber from the steam chest. In our engraving, A is the base; D the chamber; N the diaphragm; M the clasps of the diaphragm; E the well for condensed steam; F the escape pipe for condensed steam; I the valve stem; J the tubular valve; Q the valve seat; V the steam pipe leading from the boiler; S the steam entrance for starting; T the inlet water pipe; K valve for same; U the outlet water pipe; and P the cold water pipe for the injector nozzle at O.

The special points of the invention are its simplicity of parts and direct application of power. Watt's great achievement (in the steam-engine) gained its first celebrity as a pumping agent; but Mr. Shaw's machine is a pump which dispenses with the principal contrivance of his truly illustrious predecessor. The communication is nearly direct between the boiler and the pump, the spheroidal cavity serving virtually as steam cylinder, condenser, and pump chamber; and the reciprocating movement almost indispensable to the pumping process is accomplished without any traversing of air-tight surfaces, except by the fine central rod already named, and none of its parts come in contact with the open air. Mr. Hector Orr, of Philadelphia, who has favoured us with these particulars, informs us that this pump has worked without a fault for weeks together without any personal attendance save that necessary for opening and closing the steam cocks. Its stroke is meant to be slow (from five to ten per minute); but the form of the chamber admits of great capacity. The column of water is lifted by the simple thrust of the steam, and the chamber is filled with water by atmospheric pressure attracted by the condensation of the same steam at the right moment. The diaphragm being an elastic partition vibrating between balancing pressures, its comparatively frail nature is fully equal to its office, and after several months' wear (it has worn *ten* months under the eye of the inventor) it can be replaced at a trifling cost. These characteristics entitle the apparatus to the attention of all requiring such machines in England, and who will shortly have the opportunity of judging of the merits of the invention for themselves.

FAREY'S GAS VALVE.

THE gas valve represented in the accompanying cut is the patented invention of Mr. B. W. Farey, of the firm of Messrs. B. Donkin and Co., of Bermondsey. The object is the prevention of any escape of gas between the seatings or faces of the valve. To this end a groove is formed in one or both of the seatings or faces of the valve, into which groove is introduced water or oil, at a pressure exceeding that of the gas for which the valve is employed to regulate or stop the flow. Should the seatings or faces of the valve not be tight a leakage of the fluid will take place, thus effectually preventing all escape of gas between the seatings or faces. Any fluid so leaking through can be taken off by syphons, one on each side of the diaphragm or slide of the valve. When gas valves are used to divide pure from impure gas, pure gas at a greater or lesser pressure than that of the gas in the pipes may be used as a lute instead of a liquid, when at a greater pressure being supplied from a gasometer, when at a lesser pressure the pure and impure gas from the pipes leaking into a gasometer, the object in keeping valves perfectly tight in this case being to prevent any flow whatever of impure into pure gas. While the valve is open the flow of water, oil, or gas into the groove is stopped by self-acting means within the valve.



Our engraving represents an adaptation of this invention to one of Messrs. B. Donkin and Co.'s gas valves. A groove A is formed in the slide B of the valve, into which the fluid is introduced by means of the pipe C at a pressure exceeding that of the gas. Any leakage flows into the recesses D D, one on either side of the diaphragm of the valve, whence it is taken off by means of the syphons E E. The cock F is of course closed when the valve is open, open when the valve is closed.

ON THE MECHANICAL FIRING OF STEAM BOILERS.*

BY MR. JOHN DAGLISH.

THE first part of this paper contains the result of a series of experiments that were arranged and carried out by the writer at Rainton Colliery, chiefly for the practical determination of the question of the utility and economy of side water boxes in connection with Juckes' furnaces, and incidentally to ascertain the advantage derived by covering boilers, and the best materials for that purpose. A second series of experiments are then given that were conducted at Seaham Colliery for the purpose of practically ascertaining with certainty the advantages obtained by the use of mechanical apparatus as compared with firing by hand, and the comparative advantage of various systems of mechanical apparatus. Incidentally, attention was drawn to other points, and experiments were made to ascertain the best rate of motion for the bars, thickness of fire, and distance of boiler from fire-grate. A third series of experiments is then given that were conducted at Silksworth Colliery for the purpose of determining the relative advantage of the Cornish boiler for colliery purposes as compared with the plain cylindrical boiler, prior to erecting a large number for the extensive new coal-winning which is now proceeding at Silksworth. Incidentally, the experiments were carried out with different qualities of coal, for the purpose of ascertaining their comparative economic effects.

Tht first series of experiments were made at the pumping engine at Rainton Colliery, which is well adapted for experiments of this kind, as the engine

* Institution of Mechanical Engineers.

is going continually at a uniform speed. The boilers are in one range, are all of the same size and description, and the temperature of the water was taken alike throughout. They are fitted with Juckes' mechanical fire-grate, consisting of an endless chain of short longitudinal bars, traversing forwards with a slow continuous motion, and thus conveying the fuel from the hopper by a self-acting operation. Nos. 1 and 2 were covered with one description of boiler-covering composition, and were fired by Juckes' mechanical furnaces, 4ft. broad; while two wrought-iron pipes, 2in. in diameter, were placed on the inner end, 1½in. above the bars. These pipes were necessarily exposed to the action of the furnace heat, and, in order to prevent them from being burnt, were constantly kept filled with water; Nos. 3, 4, and 5 boilers were also fired by Juckes' furnaces, to which were added Coulson's water boxes. These are the full length of the furnaces, 7in. square, made of ½in. wrought iron; on the inner end they are connected with the boiler by pipes, and have at the outer end a sludge pipe, to remove any scale from the boiler. Nos. 3 and 5 boilers are covered with different kinds of boiler-covering composition, whilst No. 4 is not covered at all. The height of the bottom of the boilers above the fire-bars was 2ft. in three of the boilers, and 1ft. 6in. in the others. The quality of coal used was "peas" or screened small steam coal; the same quality being used in all the experiments, and the exact quantity of coal used was carefully noted. The time taken in consuming the coals was also noted, together with the number of gallons passed through the special feed pipe; all connection with the other boilers being shut off. The strokes of the engine were also taken during each experiment by means of engine counters. The result of these experiments may be generally stated to be:—

	lb. of water evaporated per lb. of fuel.
1st.—With boiler covering, without water boxes, and with boilers 2ft. above fire-grate	4·83
2nd.—Without boiler covering, with water boxes, and boiler at 1ft. 6in. above fire-grate	4·66
3rd.—With boiler covering, with water boxes 1ft. 6in. above fire-grate	5·02
4th.—With boiler covering, with water boxes 2ft. above fire-grate	5·38

The advantages of water boxes in increasing the evaporative power of a boiler, as well as in the increased economy of fuel, are therefore very considerable; but those advantages are to a great extent neutralised by the difficulties and increased expense in upholding those boxes. There might be circumstances, however, when their use would be attended by ultimate economy. The advantage of having the boilers at a distance of 2ft. above the fire-grate, as compared with 1ft. 6in., is also shown by these experiments. With 1ft. 6in. distance the effect was 5·02, as compared with 5·38 with a distance of 2ft., showing an advantage in the latter of more than 6 per cent. It is also found in practice that the boiler is much less injured by the action of the heat at the greater distance. The second series of experiments was made with the range of boilers of the Seaham winding engine, and they are under cover of a boiler-house. The boilers are all of the same dimensions, being ordinary egg-ended cylindrical boilers, with a straight flash flue going into the main flue. No. 1 boiler was fired by hand; the heated air, after passing along below the boiler, returns by a side passage, and travels all round the boilers before entering into the chimney. After the wheel flue experiments were made, the flue of this kind was made into a straight flash flue. No. 2 boiler was first fired by hand, with a straight flash flue running direct into the main flue, and was afterwards fitted up with Stanley's self-feeding mechanical furnace. No. 3 boiler was fired with Vicar's self-feeding furnace. Nos. 4 and 5 boilers were fired with Juckes' furnace, of the same description as those already experimented on at the Rainton Colliery pumping engine.

From the experiments the following deductions may be drawn:—First, with hand firing the quantity of water evaporated per pound of coal, with a flash flue, is 6·66lb., as compared with 5·22lb. with a wheel flue; and the total quantity of water evaporated is 441 gallons per hour, as compared with 433 gallons per hour, showing the marked advantage of the flash flue over the wheel flue, not only in economic effect of fuel, but also of boiler space. It is probable, however, that this amount of economic effect (6·66) is considerably higher than that obtained under ordinary circumstances, as the fires were more regularly attended to than is usual with hand firing. Secondly, Juckes' furnaces. This apparatus, invented for firing steam boilers, has been in operation for some time in this district, and has lately been adopted very largely at many collieries in the North of England. The advantages of this furnace are, perfect combustion of smoke and great regularity in raising steam; the saving, in common with other mechanical appliances, in the wear and tear of boilers, and in manual labour in stoking, the latter amounting probably to £200 per year per boiler. In comparison with hand firing, it does not seem to possess any great advantage in economy of fuel, the comparative economic effect being 5·90 as compared with 6·66 for hand firing; but the latter is probably a much higher result than what is usually attained in practice. Like all other mechanical appliances, it requires a certain amount of care and attention in its use, but on the whole it may be said to be successful and economic in application. It is not well adapted for using Duff coal, although this is done in some instances when the Duff is washed.

Thirdly, Vicar's furnaces. Of all the mechanical apparatuses for firing steam boilers, none seem to be so successful as Vicar's, as arranged at Seaham Colliery—though this apparatus erected elsewhere seems not to have worked satisfactorily—which was probably owing to the improvements recently made in the apparatus. These now consist of three distinct appliances. The traversing bars, intended to give progressive motion to the incandescent fuel, by a slow alternate and intermittent longitudinal motion; secondly, the pump feeders, which alternately press a regular supply of coal from the hopper to the bars; thirdly, the water troughs in which the firebars are immersed, and which are absolutely essential, as no ordinary firebars can withstand the intense heat of the fire. This furnace was in constant operation at Seaham Collieries for nine months without requiring any repairs, and in all respects it has been most successful and economic. When using the same class of coal (peas) as in the hand-firing experiments, the economic effect was 7·14, as compared with 6·66; but the maximum results of this furnace have probably not yet been obtained, nor the best condition as to thickness of fire ascertained — the high amount of 8·78lb. of water evaporated per lb. of coal being in one instance obtained. This furnace is very efficient in its action in avoiding the formation of smoke. The great advantage, however, attending the use of the furnace is its applicability to the use of Duff coal, or dust coal, with high economic effect. It will be observed that with dust coal the economic effect actually reached 6·84lb. of water per lb. of coal. Taking the consumption of fuel in one of these experimental boilers at six tons per day of twenty-four hours, and taking the comparative price of peas and Duff coal at 3s. and 1s. per ton at the pit, the commercial economy effected by the use of these furnaces over any other mechanical apparatus not adapted to use Duff coal will be £200 per year per boiler. The evaporative power of the apparatus does not appear by these experiments to be equal to that of Juckes' or hand firing, although this may arise, as before stated, from the fact of its maximum power not being yet perfectly developed.

A somewhat interesting circumstance may be observed in these experiments. The firebars used in this special fire are 5ft. 4in. in length, whilst those in Juckes' apparatus are 6ft. 6in. in length; but although the heat of the fire in Vicar's grate was much more intense than in the Juckes', the pyrometric observations in the flue beyond the boiler invariably showed much lower temperature from the former than from the latter. It would seem, therefore, that the heat developed on the Vicar's grates is of a considerably higher intensity than that of the Juckes, and as effectual in its action on the exposed surface of the boiler, so that the absolute heat remaining on arriving at the flue is then reduced below that of Juckes. The experiments with Stanley's apparatus give very irregular results, showing that a lengthened series of experiments as to speed of dispersers, thickness of fire, &c., would be required before the maximum effect could be regularly attained. In this apparatus the coal falls through crushing rollers on to two dispersers or rapidly revolving discs with radiating ribs, which scatter the coal uniformly through the fire by centrifugal action. The advantages of this furnace are that it permits of the use of Duff or dust coal, and a comparatively large amount of fuel can be consumed per square foot of firegrate surface. As compared with hand firing, a much lower economic effect is exhibited, being 4·74 against 6·66; but it is more than probable that this arises from the Stanley apparatus not being in all respects arranged to obtain its maximum effects. A few experiments were made with this furnace after the addition of Whittaker's traversing bars, but not sufficient to yield any reliable data. The third series of experiments with single tubular boilers were made with two boilers erected at Silksworth Colliery for temporary purposes, which were fortunately of exactly the same size, and were constructed with a single tube. They had been previously in use at the Londonderry blast furnaces blowing engine, and were then set over the firegrate, the draught returning through the tube and thence round each side of the boiler. At Silksworth, one of these boilers is set in a similar way, the other having a firegrate fitted up in the tube and used as a Cornish boiler.

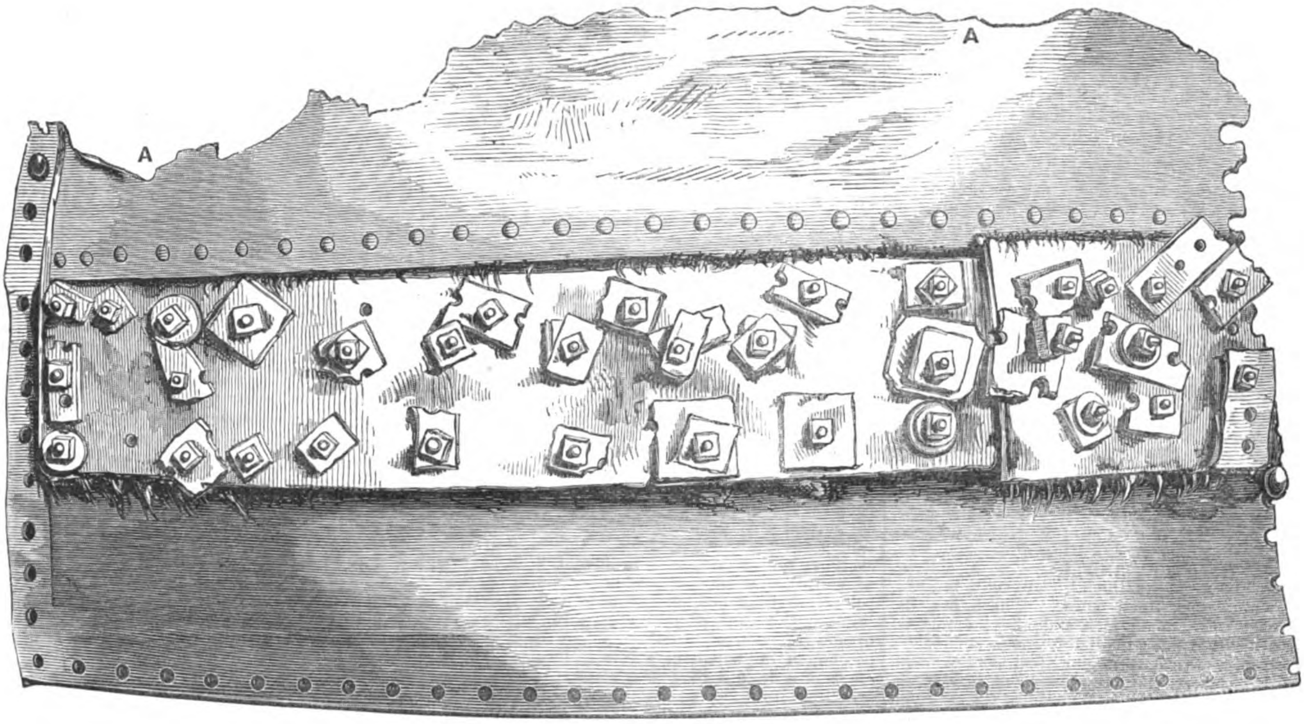
This series of experiments was intended also to show the useful effects of external heating surface, and, by an arrangement of dampers, the smoke could either be taken at once up the chimney or made to pass all round the outside of the boilers by the external wheel flue. The following are the chief deductions to be drawn from these experiments:— 1. The advantage, in No. 1 boiler, of using the wheel flue, overtaking the smoke direct through the tube to the chimney, is as 5·51 to 4·87. 2. There is a slight disadvantage in No. 2 boiler using the return tube through the boiler and side flues, instead of taking the flame direct from under the boiler to the chimney—being as 4·72 to 4·94. The general results of these experiments tend to show the advantage of flash flues having the usual large heating surface. The most important point, however, to be deduced from the experiments was the small evaporative power of the boilers when fired through a single tube, as compared with the result of firing underneath the boilers, being only 604 and 690 gallons evaporated by the former as compared with 1,344 and 1,243 by the last method, the economy of fuel being about the same in each case. The chimney, however, used for these boilers was only temporary, and not capable of producing a draught sufficient for the wheel flues. This fact renders it impossible to make any comparison between these experiments and those made at Seaham Colliery. It must be borne in mind that these boilers are by no means fair specimens of the Cornish boiler; and arrangements are being made to carry out a series of experiments to ascertain the evaporative power and economy of the Cornish boiler as compared with cylindrical boilers. These experiments will be made with boilers recently erected at Hetton Colliery on improved construction.

PRODUCTION OF SUGAR.

MR. ALFRED FRYER, of Manchester, who it will be remembered has introduced some important improvements in sugar-producing apparatus, has recently patented some improvements which extend from the apparatus used in the transport of cane or beetroot from the field to the factory up to and including that used for the extraction and subsequent treatment of the juice. Mr. Fryer's improvements in transport have for their object the combination of the loading of the canes or beets at once upon the cart which shall convey them to the crushing mill or rasp with the use of tramroads of narrow gauge, and therefore of comparatively small cost. For this purpose he constructs a truck of metal, and furnished with only two wheels keyed fast upon their axle. This axle projects through the wheels on each side, and at each end of it is placed a bracket resting in a bearing upon it and hanging down nearly to the lowest part of the circumference of the wheel. Each of these brackets terminates on the outer side in a flange or step, which is prolonged in such a manner that by slightly inclining the bracket its edge comes in contact with the ground. When in this position the wheels of the cart containing the canes or beetroot can be drawn on to these flanges, where when the brackets are again brought to a vertical position they rest, and the carts thus freed from the ground and resting on the trucks are drawn along the tramway. Several of these carts are formed into a train, the fore part of the one being supported by the hinder part of the adjoining one.

When canes are being operated upon by a mill the pressed cane or megass contains a consider-

CORRODED BOILER PLATE AND BOLTED PATCH.



able percentage of unextracted juice. In order to obtain as much as possible of this saccharine matter, Mr. Fryer subjects the megass to repeated pressure under water by means of an apparatus which he calls the affusor. This consists of a series of rollers revolved synchronously and arranged in an upper and an under row. The megass is passed between these rows, and is pressed as it passes between each roller and the one adjacent to it. These rollers are fitted into a vessel containing water, which is heated. The rollers and water level are so arranged that the greater number of the points of contact between the rollers are under the water level, whilst a smaller number are above it, so that the megass is first squeezed under water and then as much as possible of the moisture is wrung out from the affused megass. Water is introduced into this vessel near the end from which the megass emerges, and the sweetened water is drawn off at the opposite end, where it contains the greatest proportion of sugar.

As the megass is now divested of most of its sugar, and as it still contains a considerable quantity of moisture, it is next taken by means of a megass carrier of the ordinary construction to a megass drying oven, where the moisture is removed sufficiently to admit of the megass being used at once with advantage as fuel. This oven consists of a lofty chamber, constructed of brick or stone. The megass is delivered by the megass carrier upon the top of this chamber, and there falls upon trapdoors, which are opened at intervals, and thus permit the megass to slip down upon another series of trapdoors placed immediately below them, which on being opened in their turn permit the megass to pass down into the oven. As one set of these trapdoors is kept shut whilst the other is open no current of cold air is drawn into the oven. The megass thus admitted to the oven falls upon shelves, each of which is suspended by its two ends in such a way that it can easily revolve or reciprocate so as to allow the megass to slip or fall off on to the next lower shelf. The megass thus falling from shelf to shelf, resting for awhile upon each, falls at last upon the bottom of the oven, whence it is taken by a travelling belt to the several furnaces, where it is to be used as fuel. In the oven the megass is dried by means of the waste products of combustion from the furnaces of the factory being drawn through it.

In order to use to the best advantage for steam raising purposes the long clear flame of dried megass Mr. Fryer makes use of a long boiler of small diameter, which is placed at an inclination in such a way that for a great part of its length the whole of the circumference of the boiler is exposed to the flame, while at the same time no flame is allowed to play upon the boiler above the water level. In cases where Mr. Fryer's patent concretor* is the apparatus used for concentrating saccharine juice, and where more than one concretor is employed, so that a common chimney is used for several furnaces, the air heating chamber is constructed in such a way that the products of combustion after ascending through a certain number of the tubes of the air heater as at present arranged are caused to descend through another certain number, and are then conducted into an underground flue leading to the common chimney. In some cases, chiefly where only a single concretor is used, and where megass is the fuel employed, a boiler such as already described is placed underneath the trays of the concretor in such a manner that the waste heat of the boiler furnace after heating the boiler will pass through the air heater of the concretor. The top of the boiler thus placed forms a part of the bottom of the flue of the concretor, thus utilising to this extent heat which would be otherwise radiated and lost. In other cases the boiler is placed at the side of the trays instead of underneath them.

* For an illustrated description of this apparatus see the MECHANICS' MAGAZINE for January 19, 1866.

REPAIRING BOILERS WITH BOLTED PATCHES.

It has occasionally fallen to our lot to expose the unskilful manner in which boilers are sometimes repaired, but never have we come across such a gross outrage upon boiler repairing as in the instance we are about to notice. Indeed, so flagrant is the case that one might almost be disposed to accept it as a caricature were it not authenticated by Mr. Fletcher, the Engineer-in-Chief to the Manchester Steam Users' Association. The explosion which exposed the wretched piece of patchwork occurred at a small steam forge on the 16th of July last, and resulted in the death of one person, as well as in serious injury to four others. The boiler in question was of the plain cylindrical, egg-ended, externally-fired class, and measured about 21ft. in length by 4ft. 6in. in diameter, while the thickness of the plates was as nearly as may be three-eighths of an inch, and the ordinary working pressure about 50lb. on the square inch.

It appears that about a year before the explosion, the attendant had discovered a flaw on one side of the boiler, which he repaired in the following unsatisfactory manner. Instead of having the defective part cut out and a new plate securely riveted to the boiler, he laid a patch about 4ft. 8in. long by 9in. wide on the outside of the boiler over the defective part and in a horizontal direction, while he laid another patch of very similar dimensions inside the boiler immediately under the outer one, passing a number of bolts, amounting in all to 37, through the three thicknesses, and laying between each of the patches and the boiler plate a layer, about half an inch thick, of hemp, or felt, or something very similar, in order to make the whole steam and water tight. To accommodate the length of the bolts to the three thicknesses of plate and two thicknesses of padding, 49 rough and irregularly shaped bits of iron were put under the nuts as washers, so that the whole presented the most unmechanical and clumsy appearance, looking far more like a relic from the scrap heap than a portion of a boiler worked at a pressure of 50lb. on the square inch, and on the integrity of which the safety of life and limb depended. Such a patch, or rather plaster, proved, as might be expected, anything but effective. The boiler kept on leaking, and the water trickled down upon a longitudinal seam of rivets just below, eating the heads off on its way, and also thinning the plate a few inches lower down, where it was covered by the brickwork forming the top of one of the side flues, until it was reduced for a length of upwards of four feet to the thickness of a sheet of paper, in consequence of which the boiler burst, simply from loss of metal.

No description, however, can do justice to this corroded plate and bolted patch. They must be seen to be realised. But we have appended an engraving made from Mr. Fletcher's drawings which may give some little idea. The padding used for making the joint steam-tight may be seen in this cut oozing out at places from between the patch and the boiler, while there may also be seen at each side of this patch a long groove eaten into the boiler by the persistent leakage, the jagged line A A representing the primary horizontal rent where the plate was reduced to the thickness of a sheet of paper. It is scarcely necessary to point out that had this boiler been under inspection such a piece of patchwork, and such a dangerously-wasted plate, would have been at once condemned, and the explosion prevented.

AT the meeting of the Common Council held yesterday Mr. Deputy Lowman Taylor, chairman of the Markets' Improvement Committee, will present a report from them, recommending that they be authorised to prepare and prosecute a Bill in Parliament for extending Charterhouse-street into Aldersgate-street, through Charterhouse-square, and also to take powers to widen Long-lane on the northern side, the cost of such improvements to be charged upon the tolls of the Metropolitan Meat and Poultry Market, and also for authority to apply to Parliament for the toll at the market to be increased at once, instead of at the end of four years from the present time, and to give the necessary notices accordingly.

THE BRITISH NAVY.

On the 1st inst. we had 258 vessels in commission, including coast-guard ships and their tenders. Among the steam vessels were 23 armour-plated ships, 1 floating battery, 5 Indian troop ships, 5 ordinary troop ships, 31 rated vessels, 1 block ship, 19 sloops, 31 gun vessels, 15 gun boats, 3 Royal yachts, 4 vessels employed on surveying service, &c. There were also 39 sailing vessels, principally employed in harbour service. The whole of these ships and vessels were manned by 35,932 men, and an armament of 2,230 guns. The total nominal horse-power was 56,235 and 313,076. These vessels were stationed as follows:—One at Woolwich of 1,069 tons, mounting 42 guns, having a complement of 67 officers and men, 23 marines and 1 boy, making a total of 91. At Sheerness there were 3 ships with a total of 2,109 tons, armament 25 guns and a nominal horse-power of 352, having a complement of 393 officers and men, 179 marines and 5 boys; in all 577. At Portsmouth there were 19 ships, 23,219 tons, armament, 112 guns, and nominal horse-power 1,835, having a complement of 1.501 officers and men, 435 marines, and 91 boys; in all 2,027. At Devonport there were 13 ships, having a tonnage of 17,245, armament 203 guns, and nominal horse-power 260, with a complement of 988 officers and men, 366 marines, and 63 boys; in all 1,417. At Pembroke there was 1 ship, the "Nankin," of 2,049 tons, having a complement of 59 officers and men, and 3 marines. At Queenstown there were 4 vessels, mounting 40 guns, of a total nominal horse-power of 1,120, and 4,307 tons, with a complement of 246 officers and men, 68 marines, and 1 boy; in all 315.

The total tonnage of the 3 Royal yachts is 2,834, with 800 nominal horse-power. There are 123 officers and men, 27 marines, and 6 boys employed on board these yachts; in all 156.

The 8 ships which form our Channel Squadron mount 161 guns, the total tonnage is 41,211, and they have a nominal horse-power of 8,850. The total complement of all the ships' companies is 4,674, viz., 3,497 officers and men, 828 marines, and 349 boys.

On the Australian station we have the smallest, and on the China station the largest squadron, as we shall presently show.

In the Mediterranean we have 17 vessels, of 6,020 nominal horse-power, an armament of 141 guns, and 28,772 tons; with a complement of 2,970 officers and men, 659 marines, and 323 boys; making a total of 3,952.

On the North America and West India station there are 21 ships, having a nominal horse-power of 5,370, an armament of 216 guns, and tonnage of 27,979; with 2,380 officers and men, 563 marines, and 282 boys; making in all 3,230.

In the Brazils it will be seen that we have not only considerably reduced the squadron, but placed it under the command of a captain; heretofore it has been a flag officer's command. On the station there are 5 vessels, having a nominal horse-power of 670, carrying 34 guns, and a tonnage of 4,418, and manned by 428 officers and men, 94 marines, and 54 boys; making a total complement of 576.

In the East Indies there are 6 vessels, with a nominal horse-power of 1,710, having a tonnage of 7,575, and an armament of 55 guns; the complement of officers and men is 961, marines, 194, and boys, 128; in all 1,283. On the Cape of Good Hope and West Coast of Africa station we have 13 vessels, of a total tonnage of 12,022, nominal horse-power 1,934, and an armament of 64 guns, with a complement of 1,066 officers and men, 237 marines, and 121 boys, making a total of 1,424.

In the Pacific there are 10 vessels, having a nominal horse-power of 2,680, mounting 97 guns, and tonnage of 12,240, with a complement of 1,401 officers and men, 361 marines, and 201 boys; in all 1,963 hands. On the China and Japan station there are 27 vessels, having a tonnage of 20,871, nominal horse-power 4,180, and an armament of 123 guns, with a complement of 2,177 officers and men, 378 marines, and 202 boys; making a total of 2,757. On the Australian station we have only 4 vessels, with 1,120 nominal horse-power, 4,462 tons, and an armament of 33 guns; there are 558 officers and men serving in this squadron, as well as 109 marines and 108 boys; making a total of 775.

In the flying squadron, troop service, store service, &c., including the "Galatea," which latter is commanded by his Royal Highness the Duke of Edinburgh, we have 18 vessels in commission, with a total tonnage of 38,035, and 8,170 nominal horse-power, carrying an armament of 232 guns. In these services there are 4,011 officers and men, 713 marines, and 463 boys, making a total of 5,187. There are 4 vessels employed on the surveying service, having a nominal horse-power of 462, and 1,988 tons, mounting 17 guns, with a complement of 269 officers and men, 115 marines, and 19 boys; in all 326. In the Coast-guard service there are 55 vessels, including cruisers, manned by 3,597 hands, 2,391 of which are officers and men, 885 marines, and 321 boys. The total tonnage of the Coast-guard ships is 37,276, having a nominal horse-power of 7,620 and an armament of 307 guns. There are also 10 drill ships for the naval reserve, with a tonnage of 10,403, horse-power 120, and an armament of 138 guns, having a total complement of 29? officers and men. In addition to these there are 14 flag officers, who with their retinues make up a total of 219. Also 3,103 supernumerary commissioned officers, engineers, warrant officers, &c., and 18 marines in reserve and gunnery ships; 19 supernumerary officers and men, and 4 marines in flag ships abroad, and 243 kroomen. In our iron-clads alone we have 11,514 officers and men. By the above it will be seen, by taking the different ports and stations, that we have 30,876 officers and men, 6,553 marines, and 5,887 boys (exclusive of the officers and men employed in the Indian troop service, and about 3,500 supernumerary petty officers, seamen, and boys, borne on the books of the receiving ships at the home ports for disposal).—"Standard."

AN INVENTIVE PEOPLE.

Yankee origination is universal and ubiquitous. Fourteen thousand patents will, it is estimated, be granted by the United States office this year, and two applications are rejected for every one granted. Over forty thousand specifications lodged in a year, and this in the States only! Take up the patent journals of any country in the world, says the "Gentleman's Magazine," and you will find a good percentage of inventions of American origin. In that country of geniuses everybody invents. Said a patent commissioner, the other day, "Our merchants invent, our schoolmasters invent, our soldiers and sailors invent, our professional men invent—aye, even our women and children invent." True; and wonderful schemes some of these amateurs propound. One man claimed protection for the application of the Lord's Prayer, repeated in a loud voice, to cure stammering; another applied for the envied parchment on behalf of a new and useful attachment of a weight to a cow's tail, to prevent her switching it during the milking operation; another proposed to cure worms by fishing for them with a delicate line and tiny hook, baited with a seducting pill; while a lady patented a hair-crimping pin, which she specified might also be used as a paper cutter, as a skirt supporter, a child's pin, a bouquet holder, a shawl fastener, or as a book mark. These were cases cited by Mr. Fisher, the commissioner aforesaid, in a recent address to the American Institute. Since this was delivered, I have read of patents for a "horse-refresher" (a hollow bit, perforated with holes, and connected by a flexible tube with a water reservoir in the vehicle, so that the driver can give his animal a drink without stopping), and a luxurious contrivance called "The Snorer's Friend," a device to be attached to church pew backs, to form a comfortable head-rest, enabling the owner to sleep through the dullest sermon in peace and quietness.

ROGERS' PATENT PROJECTILE ANCHOR.

As a proof of the very great attention which the present Board of Admiralty devote to inventions which might be useful, not only for the purposes of war but for saving life, we "Hampshire Telegraph," may mention that Mr. J. Banting Rogers, of 70, Andrew's-road, Hastings, wrote to their lordships on the 7th of July, asking that he might be allowed to make experiments with models of his patent projectile anchor, non-choking block, and rove rope, in the perfection of which he has been long engaged. A reply in the affirmative came on the 10th (three days following), and on the 20th and 21st of the same month experiments were made at Sheerness in the presence of several naval captains and other officials, and proved very successful. On the 12th of August Mr. Rogers received instructions to put himself in communication with Captain Henry Boys, of H.M. gunnery ship "Excellent," and to make an anchor and block in Portsmouth dockyard of the same size as that intended by the invention, all expenses being defrayed by the Admiralty, except Mr. Rogers' personal expenses, as no terms at present could be made. Acting upon this intimation, no time was lost in getting to work, and we understand that in a very short time an experiment will be made on board the "Excellent" by the authorities. The anchor, which, besides the use to which it may be applied in navigation, is doubly valuable as a means of saving life from wrecked vessels, consists of a tri-fluked hinged or folding anchor, weighing about 112lb., so contrived that it can be fired from a mortar or other piece of ordnance. Attached to the anchor is a block of a peculiar make, which will not choke with sea-weed, and will allow knots and kinks to pass freely through it. Through the block passes a "rove rope," or double line, the two ends of which being attached on shore are used to haul out a similar double line of cable of sufficient strength. By means of this arrangement the anchor may be flung into the sea with the rope attached, the lifeboat may be drawn through the surf, and her crew thus enabled to pull her to the ship without the exhaustion of getting her off, a process often found impossible, even in cases where the lifeboat could be managed with ease were she once outside the shore surf. A cone and block may also be thrown across the ship with the almost unerring aim of the mortar, carrying with it the double or endless rope, by means of which instant and continuous communication is established to the shore, life belts, &c., conveyed to the crew, and by which they may be drawn to the shore without exertion on their part. The contrivance will be found equally serviceable to those on board ship, for the anchor can, of course, be fired as well from the ship to the shore as *vice versa*, so that in the case of a ship stranding facilities would be afforded for the men on board to make communication with very much more certainty than at present. The rope attached to the anchor block is protected from being injured by the charge in the mortar by a metal cap, while to prevent the rope becoming entangled, it is "paid out" from boxes, in which it has been previously arranged according to another of Mr. Rogers' inventions. Each of the numerous experiments made with models of the apparatus hitherto has been eminently successful, and the inventor has received various medals and presents from philanthropic societies, together with the sensible prize of £50 from the Shipwrecked Mariners' Society for experiments with the anchor at the Crystal Palace in June of last year.

MICA BROCADES—A NEW PRODUCT OF ART

No doubt all of our readers are acquainted with the mica which is so extensively used in doors of stoves. But it may be stated that under this term a whole group of minerals is comprised, either occurring massive or disseminated in rocks. They have all a more or less foliated structure and pearly lustre. They are elastic, transparent or translucent, and have a specific weight of 2·7. In Germany mica has recently found application for the production of bronze-like colours which bear the names "brocades," "crystal colours," and "mica bronzes." The mineral is to this end well crushed, boiled in hydrochloric acid, then washed with water, and assorted according to the size of the laminæ. Mica scales thus obtained exhibit a glass-like lustre combined with a silver-white appearance. The advantages of these brocades (which by the way may be coloured) over the ordinary metallic brocades, are stated in the "Scientific American" to be the following:—1. They do not contain any ingredient injurious to health. 2. They possess metallic lustre like the ordinary brocades, and some surpass them even in liveliness of colour. 3. Brown, black, blue, green, and rose are obtained in remarkable beauty, which is not the case with the metal bronzes. 4. They comport themselves with perfect neutrality toward sulphurous exhalations. 5. Their specific weight being very slight, their yield is consequently correspondingly great. In the application they may be fixed upon all kinds of articles of metal, wood, glass, plaster-of-Paris, and paper board. They are consequently well adapted to the preparation of artificial flowers, fancy papers, sealing-wax, in tapestry, furniture-making, and painting. Theatres may employ them for imitating gold rain and snow, for which purpose they recommend themselves on account of their lightness and cheap price. In short, they may be used for almost all the purposes to which the ordinary bronze powders have been applied.

In fixing these brocades upon articles of any kind it is advisable to paint them first with a colour similar to that of the bronze; for silver, a ground of white lead is suitable; for blue, one of ultramarine, &c. They are equally suitable for oil and glue colours, which latter are fixed with a mixture of four parts of glue and one of glycerine. Upon this coat, when hard, the binding material for the brocade is spread, and after one quarter of an hour this latter is sifted over. As binding material a paste, consisting of four parts of boiled starch and one of glycerine, is recommended. If desirable, the powder may be finally pressed down with a roller. If the ground is formed by an oil paint, the binding material for the brocade should be constituted of a dammar, or pale copal varnish, upon which, when only pitchy, the powder is sifted over. When finally coated with a suitable spirit, dammar, or copal varnish, the so-prepared articles assume a lustre which, in beauty and durability, far surpasses any heretofore obtained with the common bronzes. When small particles of mica-silver are spread over articles coated with asphalte varnish, the result is a good imitation of granite. The crystal colours are also suitable for calico printing, and fabrics upon which they are applied surpass in brilliancy the heavy bronze and glass-dust fancy fabrics from Lyons. Employed between or on coloured gelatine plates, they give rise to superb crystallizations, which are used as inlayings for buttons and various other articles. They may be spread over finished porcelain and glassware, if these are heated again to the fusing point of their glazing.

According to Dr. C. Cech and L. Schneider, in Prague, these brocades may be coloured with the following dye-stuffs:—Rose, with a decoction of cochineal; cramoisin, with the bluish magenta red; bright red, with fuchsine and Havana brown; violet, with Hofman's violet. A solution of Prussian blue in oxalic acid serves for producing a bright blue, and Girard's violet for deep blue; light and dark

green are imparted by aniline green and curcuma gold with curcuma, dark brown with a proper bark extract, and black with litmus and hæmatoxylin or logwood extract. Silver needs no colour. According to Dr. L. Feutchwanger's (vide his popular "Treatise on Gems"), mica is found at Williamsburg, Mass., Hartford, Conn., and many other places. The green mica, which is of a beautiful grass-green colour, is found in Brunswick, Me. The rose-red mica, which is also a very beautiful mineral, is principally found at Goshen, Chesterfield, Mass., Acworth, N. H., Bellows' Falls, Vt., &c. Mica, according to the above-named mineralogist, when of good colours, may be used for jewellery and other ornaments.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, November 18.)

THE vitality displayed in the chemical market of late shows no signs of abatement, and prices are very firm: the alkali trade shares to some extent in the increased business, though prices are not remunerative. In minerals somewhat more activity has been felt, and values in a few instances have advanced. In the metal market a considerable trade has been done in pig iron, and prices during the week advanced, but have closed weaker. All other metals are stationary, with a moderate demand, excepting tin, in which a reduction has taken place. Soda: in soda ash and caustic soda a considerable business has been done at prices ranging from £7 to £7 5s. per ton for the former for 48; and at £13 5s. to £13 10s. per ton for the latter for 60. Crystals inactive, at £3 15s. to £4. In bi-carbonate there has been little doing, at £9 10s. Nitrate of soda: falling to 15s. per cwt., and slightly under during the week, is held at 15s. 6d. to 16s. for the present. Potash: muriates are still wanted, and obtain £7 5s. to £7 7s. 6d. for 80. Saltpetre: no business done, and values unaltered. Alum: meets with a steady sale at £6 5s. for loose lump, £7 in export barrels, and £7 for ground. Ammonia: sulphate has reached the highest point it is likely to obtain, £17 10s. for finest white, and is somewhat more plentiful. Grey obtains a ready sale at £16 to £17. Copperas: no great business reported in green, at 52s. For dry there is a steadily increasing demand at 50s. Chloride of iron obtainable at 52s. Pyrites: in ordinary request, at 6½d. to 7½d. per unit. Calcined still sells at 44s. R.C. Lime: a fair business in phosphates at 52s. 6d. for 65. Bleaching powder in continued brisk demand at £8 5s. to £8 7s. 6d. for 35. Disinfectants find an active market at 5s. 3d. per cwt. for the best quality. Manganese: is still rather dull. Prices unaltered, at 95s. for 70. Acids: tartaric in request at 1s. 1½d. for foreign; English ground, 1s. 2½d.; citric, 2s. 5d.; oxalic, without much sale, at 7½d.

METALS.—Iron: Scotch pigs selling freely at 54s. 4d. to 54s. 6d., closing steady. Cleveland advanced to 45s. 6d. for forge, and 50s. 6d. for No. 1. Welsh bars, £6 10s. to £6 15s.; Staffordshire, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: is rather firmer. English tough, £72 to £73; Chili Slab, £68 to £69. Tin: prices are quite nominal. English ingots, £122 to £123; Straits, £118 to £120. Lead: in good inquiry, and prices have advanced. P.G. best English soft pig lead, £19. Spelter: quiet. English, £20 10s.; Silesian, special brands, £19 15s. to £20; Hard spelter, for export, £16 5s. to £16 10s.

Legal Intelligence.

COURT OF COMMON PLEAS.

NOVEMBER 13.

(Sittings in Banco, before Lord Chief Justice BOVILL, and Justices WILLES and KEATING.)

TATHAM v. DANIA.

THE plaintiff in this case was patentee of an improvement in machines for tearing and opening textile fabrics, which are popularly known in Lancashire as "devils." The action was to recover damages for an infringement of the patent, and at the trial before Mr. Justice Lush at the last spring assizes at Manchester the verdict was for the plaintiff upon all the issues; subsequently a rule was obtained to show cause why the verdict should not be entered for the defendant, or why there should not be a new trial upon various points, but the principal contest between the parties was whether the plaintiff's invention was such as could form the subject of a patent. The mode in which the cotton waste and other materials were torn up so that they could be spun and woven again, was by passing them under rollers set with teeth, the substance being carried on from one roller to another until the operation was complete. The essence of the plaintiff's invention was, that he had contrived a chamber or recess between each two rollers, in which chamber the material was collected, accumulated, and condensed prior to being passed on to the next roller. The rollers were in use prior to the patent, but it was said that the condensing chamber was a very valuable improvement in the machines.

On the present occasion cause was shown against the rule being made absolute. The case occupied the best part of the day, and was concluded on the 16th.

Mr. Holker, Q.C., and Mr. Aston showed cause against the rule, and Mr. Manisty, Q.C., and Mr. Edwards appeared in support of it.

The Lord Chief Justice, in delivering judgment, said that the specification was too wide. It sought to claim both what was new and what was old; and what it claimed as new, even if the subject of a patent, was not distinguished from the claim for that part of the patent which was admitted to be old. The only novelty consisted in running a pair of rollers formerly in use, at a greater velocity than certain other rollers. It appeared to him that it was very doubtful whether this, as claimed, was the subject of a patent, as it was a process perfectly well known, and in use in many kinds of machines.

Mr. Justice Willes and Mr. Justice Keating concurred, and judgment was given for the defendant.

COURT OF QUEEN'S BENCH, WESTMINSTER.

NOVEMBER 13.

(Sittings in Banco, before the LORD CHIEF JUSTICE, Mr. Justice MELLOR, and Mr. Justice HANNEN.)

DAW v. CARTER.

THIS was a question under the Gunpowder Act (23 and 24 Vict., c. 139) as to what is "ammunition" within the Act. It arose thus:—The appellant, Mr. Daw, the well-known gun-maker, had been convicted for keeping more than 5lb. of ammunition at a time at a place half a mile from his shop in Threadneedle-street without a licence for it. He kept powder there for the purpose of making cartridges, and he had more than 5lb. of cartridges at the store, for which he was convicted of having more than 5lb. of powder in cartridges. There were several convictions for the offence. There was a clause that a cartridge manufacturer might keep 200lb. of cartridges.

Mr. Archibald was in support of the conviction; Mr. Metcalfe was against it.

The Court affirmed the convictions.

VICE CHANCELLOR'S COURT.

NOVEMBER 17.

(Before Sir R. MALINS.)

POUPARD v. FARDELL.

IN this cause, which was noticed by us last week, the plaintiff by his bill sought for an injunction to restrain the defendant from infringing his patent, which he obtained for the manufacture of a skid or shoe for vehicles, and which article was largely used by omnibuses and other carriages. The case has lasted several days, several witnesses on each side having to be cross-examined.

The Vice Chancellor now said, at the conclusion of the arguments, that the evidence was very conflicting, but, looking at the length of time that the plaintiff had enjoyed his patent, he was of opinion that he had shown that his "skid" was a novelty, and that his specification was sufficient, and his Honour granted a perpetual injunction, with damages and costs against the defendant.

Mr. Glasse, Q.C., and Mr. Bovill were for the plaintiff; and Mr. W. W. Mackeson, Q.C., Mr. Stevens, and Mr. W. W. Cooper were for the defendant.

Correspondence.

CAZAL'S ELECTRIC MOTOR.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Can you or any of your readers kindly favour me with particulars of M. H. Cazal's electric motor for sewing machines?—I am, Sir, yours, &c., F. E. B.

THE HOLBORN VIADUCT BRIDGE.

SIR,—You will have seen what curious ideas the daily press is propagating about cracks in the piers under the girders of the new Viaduct bridge. The cause is very plain. The engineer has committed a great error in not placing an iron entablature along the top of the piers for the compound girders to rest on. The centre girders being long, and set on the top of each pier, the contraction would at once draw them inwards, and the next expansion would push them out and at once cause the cracks. There is no doubt the piers are strong enough to carry the weight, but when any sudden change of temperature arises, the sudden shocks will be too much for them. I am very sorry, for Mr. Haywood's sake; for, in all the years that I have superintended large works myself, I never remember to have seen better brickwork than that in the Viaduct. It is very clear that if the three spans had been equal, the top stone would in all probability have been split. An entablature of iron, with a roller under each end, however small, appears to me to be the only means of making it secure for the future.—I am, Sir, yours, &c., J. WALKER.

43, Mansell-street, November 15.

TRANSACTIONS OF THE INSTITUTION OF NAVAL ARCHITECTS.

SIR,—I was unaware of the trick which had been played upon me in making the despatch of the volumes of our "Transactions" an advertising medium for a comic periodical until I saw it exposed in your columns. I have taken measures which I hope will prevent this unfair practice in future.

The illustrations at the end of the volume are chiefly copper plates.—I am, Sir, yours, &c.,

C. W. MERRIFIELD, Hon. Sec.

9, Adelphi-terrace, London, November 15.

[We were very certain that the circular in question was not inserted with the knowledge of the executive of the Institute, and we are equally certain that they will visit with their displeasure the printer or binder who had the bad taste thus to puff some other job in which he is interested.—ED. M. M.]

NAVAL ENGINEERS.

SIR,—A friend of mine has recently received a letter (of which the enclosed is a partial copy) with a desire of the writer that it should be published, as showing some of the difficulties engineers have to contend with at sea, and how necessary it is that seagoing engineers should be practical men. If you can find a place for it in the MECHANICS' MAGAZINE, I shall be glad, as a subscriber since 1850, to see it there.—I am, Sir, yours, &c.,

ROBERT SHENTON.

9, Maria-street, Millwall, November 15.

The Telegraph Construction Company's steam ship "Investigator," Captain Knox, left Melbourne on June 16 at 10 a.m., steamed through Bass' Straits on the 18th, got under canvas and proceeded on her voyage for the United Kingdom, ran down to the 46th parallel, and had a prosperous voyage up to July 18, when, in consequence of heavy squalls and a heavy sea running, she broke her tiller about 7 p.m. The engineers fitted the spare tiller on at 9 p.m., and got her on her course again, and, on the following day, with furious squalls, a heavy sea struck her aft, and carried away rudder, after rudder post, and also the propeller, in which condition she lay helpless to the wind and waves for some days. Captain Knox rigged a spar over the stern until the engineer could make a temporary rudder. On July 28, the engineers went to work with a good will to weld together two stanchions about 3in. diameter, with a forge 2ft. square, and to rivet several pieces of plate iron together to make the rudder, which was finally shipped on August 8 after incredible labour on the part of the engineers. They had to contend against a heavy sea which was running all the time, and the ship at that date was 2,900 miles from the coast of Chili. The vessel was afterwards navigated with it, although the chief mate said he would rather be six months getting to port than the engineers should make one, and he would try all he could to carry it away. On Sunday, August 15, we made the land, but a thick fog coming down, the ship was put off shore until the weather might clear up. On the evening of the 16th, the ship was about 40 miles to north of this port (Valparaiso), and the steam ship "Zeta" passing at the time, Captain Knox went on board and arranged with Captain Walter to tow his ship into port, where she arrived on the 17th inst. at 5 p.m.

[We insert the above as showing what engineers are capable of doing when called upon in an emergency; although we hold it to be no more than an engineer—worthy to be so called—ought to be able to do. As to the statement about the chief mate wishing to carry the rudder away, we think no seaman would be such a flat, and we, therefore, give Mr. Shenton's friend credit for having mistaken the officer's meaning.—ED. M. M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

RECEIVED.—T. and C.—J. H.—R. B.—D. C. L.—J. P.—H. J.—R. T.—L. and P.—W. B. D.—T. E. F.—O. C.—J. W. R.—J. D.—T. C.—R. F.—C. P. and G.—S. A.—G. E. P.—S. A.—R. S.—H. R.—G. W. B.—J. W.—R. M.—F. S. L.—C. G.—E. R. and Co.—F. P.—E. A.—J. W.—R. L.—H. M.—G. H.—R. J. T.—H. J. E.—B. M. W.—J. R.—T. G.—G. H. L.

Meetings for the Week.

TUES.—Institution of Civil Engineers.—Discussion upon M. Gaudard's paper on "The Strength and Resistance of Materials," and also on "The Public Works in the Province of Canterbury, New Zealand," by Mr. Edward Dobson, A.I.C.E., at 8 p.m.

Naval, Military, and Gunnery Items.

THE Pacific steamship "Magelican," from Liverpool for Valparaiso arrived out on the 25th of September, having accomplished the passage in 32 steaming days with a heavy cargo.

AN iron-clad frigate, the "Minine," was launched at Cronstadt a few days back in presence of the Emperor of Russia, the Cesarewitch, the Grand Dukes Alexis and Constantine, and the Prince of Oldenburg.

HER Majesty's iron-clads "Prince Consort" and "Royal Oak" ran ashore off Port Said on Monday last, but were got off without any damage whatever. The place where the occurrence took place was a bank of soft mud which has been formed outside the harbour by the excavations for the canal, and which is not marked on the chart.

THE Board of Trade have awarded a gold watch to Captain John Hawson, of the ship "Carlos," of Buenos Ayres, in acknowledgment of his humanity in receiving on board his vessel the master and crew, 31 persons in all, of the ship "Treasure Trove," of Liverpool, which was burnt at sea in lat. 6.48 N., and long. 22.48 W., on the 7th of September, 1868.

AN additional number of iron shipwrights have just been entered at Chatham Dockyard for employment on board the armour-clad double turret ship "Cerberus," which is being rapidly brought forward for sea. She has had an additional iron deck placed on her, in order to enable her to be navigated to Australia, and she will also be masted. On her arrival at Melbourne she will have her temporary iron deck and bulwarks removed.

THE *fetes* in inauguration of the Suez Canal commenced on Saturday last by religious ceremonies in the open air, which were performed both by the Ulemas and the Catholic priests. The latter was concluded by a speech and a benediction from Monsignore Bauer, the almoner of the Empress Eugenie. Monsignore Bauer congratulated those present upon the completion of the work, and thanked the Khedive who had immortalised his reign by co-operation in one of the greatest undertakings that any century had produced.

THE work of attaching the 10in. armour-plates to the sides of the "Glatton," turret-ship, building in No. 2 dock in Chatham Dockyard, has been resumed, after some short stoppage from want of plates. A number of plates have been attached on the starboard side, and a few on the port side. The work of building has gone on well, in spite of the men being exposed to the weather—sometimes very inclement of late—as there is no roof over the dock. The next dock, in which the "Sultan," broadside iron ship, is building, has a temporary roof.

THE death is announced of Rear-Admiral Warden, C.B., senior officer on the coast of Ireland, which occurred on the 12th inst. at Queenstown, after a short illness. The deceased Admiral entered the service at an early age, and obtained his commission as lieutenant in September, 1828; was promoted to commander in 1838; and obtained post rank in July, 1845. He was commander of the "Medea," serving on the coast of Syria, in 1840; and was engaged on active service during the Russian war. He obtained the rank of Rear-Admiral on the 12th of September, 1863.

FURTHER trials for endurance, range, and accuracy of the first of the new class of 12in. 600-pounder rifled guns were made during last week at Shoeburyness. The 9in. rifled howitzer also had further trial after an alteration in the arrangement of the hydraulic buffer which is fitted to it to check the recoil. The Maxwell Indian bronze rifle field gun also had a very interesting trial for range and accuracy. After upwards of 2,600 previous rounds with service charges, the shooting made by it was very good, especially considering that the endurance this gun had sustained was equal to about half a century of active warfare.

A NEW iron ship of war, the "Audacious," has arrived at Pembroke from Glasgow. The "Audacious" was built by Messrs. Napier and Co., with engines of 800-horse power by Ravenhill and Hodgson. She has been sent to Pembroke for the purpose of being entirely sheathed over with teak wood to prevent the action of the water on the iron. She is a fine vessel, and is a sister ship to the "Iron Duke," now nearly ready for launching, of 3,464 tons burthen. The "Audacious" is on the twin-screw principle, and has two pairs of engines. On her passage to Pembroke, in a strong gale of wind, she averaged 11 knots.

THE "Sin Nanzing," a new paddle, built and engineered by Mr. J. Elder, of Glasgow, for the North China Steam Navigation Company, has made a favourable trial trip. The dimensions of the "Sin Nanzing" are:—Length between perpendiculars, 225ft.; beam, 32ft.; depth of hold to spar deck, 23ft. 3in. Her engines are on the compound principle, for which Messrs. Randolph, and Co., of Glasgow, have long been distinguished; they are diagonal and have four cylinders. Messrs. Randolph, Elder, and Co. have now made 73 sets of these engines, 22 being for paddle and 51 for screw steamers.

THE question whether Krupp or Armstrong guns are to be adopted for the Austrian navy is not yet settled, but it has been decided that the iron-clad "Lissa" shall be armed with a new 9-inch cast steel Krupp gun by next February, if the experiments now being made with it in the "Steinfeld," near Vienna, should prove satisfactory. This gun weighs 246 cwt., and is specially provided with an iron carriage for use on board ship. The projectile is a cast iron shell, which weighs when filled 244lb. The cartridges contain prismatic gunpowder, made in the Government factory at Wollersdorf, which is said to be equal to the productions of the best foreign manufacturers.

THE Committee of Inventions, which was established in the Royal Arsenal, Woolwich, on the abolition of the Ordnance Select Committee, has been amalgamated with the Director-General of Ordnance Department in the Arsenal. The officers constituting this department, to whom everything which formerly came under the cognizance of the two former committees, including all inventions and patents relating to the art of war, is referred, now consist of the following:—Major-Gen. J. H. Lefroy, Royal Artillery, F.R.S., Director of Ordnance; Col. T. W. Milward, C.B., Royal Artillery Aide-de-Camp to the Queen, Deputy Director of Ordnance; Col. E. Wray, C.B., Royal Artillery; Lieut.-Col. H. Heyman, Royal Artillery; Capt. T. A. J. Harrison, Royal Artillery; Capt. W. H. Noble, Royal Artillery, members; and Quartermaster H. Behenna, Royal Artillery, commissary.

Miscellanea.

THE Euston Terminus of the London and North-Western Railway, at Euston-square, is to be enlarged and considerably improved. The works will commence about the latter end of this month.

A SCHEME for a Canadian Pacific Railway appears in tee newspapers of the Dominion. The length of line is 2,500 miles, and the capital £200,000,000.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending November 13, was 1,833. Total number since the opening of the Museum, free daily (May 12, 1858), 1,680,292.

THE St. Petersburg Exhibition for 1870 will be confined to Russian produce and manufactures; it is national and not international, as has been stated in some publications. It is to open on the 27th May, and close on the 27th of July.

THE Minister of Finance in France has recommended that a gold coin, of the value of twenty-five francs, corresponding with our English sovereign, should be issued by the French Mint, and the Emperor Napoleon has approved of the proposal.

IT is now understood in the parliamentary profession that neither of the three rival Brighton schemes, about which so much has been said, will be proceeded with during the forthcoming session, but will be deferred till next, owing to circumstances over which the several projectros have no control.

AS the next meeting of the British Association is to be held in Liverpool, a meeting of Liverpool gentlemen, principally connected with the local learned societies, was recently held in the mayor's parlour, the mayor, J. Hubback, Esq., in the chair, to arrange for the formation of a local committee. It is probable that the meeting will be held next September in St. George's hall.

A MEETING of the thick coal masters (their district embracing Tipton and West of Dudley) was held in Birmingham on the 11th inst., and in consequence of the recent rise in the price of finished iron it was resolved to raise the wages of the colliers 6d. per ton; the price of coal to be raised 1s. per ton. This change to take effect in a fortnight from the date of the meeting.

THE London and North-Western Railway Company recently constructed a branch line running from their central station at Lime-street, Liverpool, to Bootle, running through the principal eastern suburbs of the town. This line is shortly to be opened for passenger traffic, and a notable feature will be the running, morning and evening, of workmen's trains at the uniform rate of one penny for any distance.

THE following is a return of the quantity of coal exported from Grimsby during October, 1869:—To Belgium, 722 tons; Denmark, 1,826; Egypt, 3,528; France, 5,509; Hanseatic Towns, 723; Holland, 612; India, British possessions, 533; Prussia, 3,017; Russia, 655; Norway, 211; Spain, 591; total, 19,444; coastwise, 2,218; total, 21,662 tons. Corresponding period, 1868, 26,081; coastwise, 3,234; total, 29,315. Decrease, 7,653 tons.

THE number of visitors to the South Kensington Museum during the week ending November 13, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 10,687; Meyrick and other galleries, 998; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,702; Meyrick and other galleries, 81; total, 13,468. Average of corresponding week in former years, 9,878. Total from opening of Museum, 8,944,764.

AT the opening ordinary general meeting of the Royal Institute of British Architects, session 1869–70, held on Monday, November 1, 1869, the President (Sir William Tite, M.P.) in the chair, the following gentlemen were balloted for and declared to be duly elected:—Edward Augustus Grunning (Associate), of 9, Gresham House, E.C., as Fellow; Ernest W. C. F. Schmidt, of 30, Great George-street, Westminster, as Associate.

THE Berlin-Potsdam-Magdeburg Railway Company has during the summer instituted a number of experiments with the pneumatic telegraph, as a means of enabling passengers to stop trains in case of necessity, and these have been so successful that all mail-trains on that line will henceforth be furnished with an apparatus of the kind. Should they realise the expectations formed of them, they will probably be employed on all North-German Railways.

AT the last weekly meeting of the Board of Works a report from the Works and General Purposes Committee stated that a constant supply of water to the metropolis was most desirable, and recommended that the chairman of the board should seek an interview with the Home Secretary and ascertain whether it is the intention of the Government to bring in a measure founded upon the report of the royal commission. The question was briefly discussed, but was subsequently adjourned to the 26th inst., it being agreed that the report should in the interim be printed and circulated.

THE first series of notices for various railway Bills in the next session, which were issued on Saturday, are remarkable for the large number of applications they contain for the abandonment of proposed lines. The South-Eastern Railway ask for power to abandon the construction of the extension line to Cranbrook, which was authorised five years since, and also the whole of the railways between Tenterden and Appledore, and Appledore and Snargate. The Great Northern Railway Company wish to abandon the Watford and Edgware line, an undertaking which was also authorised five years since, and similar powers are asked by the Lancashire and Yorkshire Railway Company with respect to a portion of the Ripponden branch.

ONE of the most successful meetings of the Royal Horticultural Society this season was held on Tuesday, in the Council-room, South Kensington. The chrysanthemums were extremely good, and cut specimens of the gigantic dahlia imperialis, from the gardens of the society at Chiswick, attracted much attention. Fruit and growing plants of macadamia ternifolia, a proteaceous plant from Australia, were sent by Messrs. E. G. Henderson and Sons. The nut was found to be peculiarly good, and free from all rancidity. Mr. W. Wilson Saunders, F.R.S., presided, and the following candidates were elected fellows:—Carlo Brunetti, James Cowell, Major-General Henry Charles B. Daubeney, Adam Forsyth, Mrs. Munt, &c.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1288, 1290, 1291, 1316, 1321, 1327

BUILDINGS AND BUILDING MATERIALS—1293, 1301, 1329

CHEMISTRY AND PHOTOGRAPHY—1277

CULTIVATION OF THE SOIL, including agricultural implements and machines—1266, 1272, 1273, 1318

ELECTRICAL APPARATUS—None

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1267, 1280, 1292, 1295, 1308, 1328

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1268, 1271, 1275, 1276, 1309

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1264, 1270, 1282, 1283, 1289, 1296, 1298, 1302, 1302, 1305, 1306, 1307, 1312, 1313, 1314

GENERAL MACHINERY—1261, 1263, 1274, 1284, 1294, 1325

LIGHTING, HEATING, AND VENTILATING—None

METALS, including apparatus for their manufacture—1317

MISCELLANEOUS—1262, 1265, 1278, 1297, 1304, 1310, 1311, 1320

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1269, 1279, 1281, 1286, 1299, 1300, 1322, 1323

SHIPS AND BOATS, including their fittings—1289, 1303, 1315

STEAM ENGINES—1291, 1316, 1324, 1326, 1330

WARFARE—921

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921 J. MACKINTOSH, North Bank, Regent's Park. *Working guns.* Dated March 27, 1869.

The object of this invention is to obtain protection when working guns, and the invention consists in mounting guns on hinges or jointed frames connected with springs which balance the gun, so that when the gun is fired it recoils to a lower position, taking with it the frame for loading, and is retained by a stop which, when removed, the action of the springs brings up the gun to its firing position.—Patent completed.

1261 J. THOMPSON, Great Nelson-street, Liverpool. *Motive power.* Dated April 24, 1869.

This consists in a machine composed of an endless chain of vessels rising in water on the one side and falling in air on the other side, thus producing the revolutions of the wheels or shafts.—Patent abandoned.

1262 H. REED, Edgbaston. *Distending bags.* Dated April 24, 1869.

When it is desired to expand the bag, the closed end of the latter should be placed downwards in a tube, the open end stretched over the open or uncovered end of the tube, when, by exhausting the air or creating a sufficient vacuum therein, the bag is distended.—Patent abandoned.

1263 A. MUIR, Manchester. *Stocks and dies.* Dated April 24, 1869.

The inventor makes the stocks with rectangular projections, between which the dies fit, and he makes the screw for regulating the position of the movable die to screw into a swivel block jointed to the stocks. When this block is raised, the dies can be taken out, and when down, the head of the regulating screw holds the movable die in its place.—Patent completed.

1264 WEIGEL BROTHERS, City-road. *Shirt studs.* Dated April 24, 1869.

The stud or solitaire as the case may be consists of two parts, or, in other words, the head is movable. To the bottom plate is soldered a small hollow, oval-shaped tube, having a sort of club-shaped opening for the reception of a pin soldered to the head plate; this pin is provided with two small projections, and forms the key by which the upper and lower plates are connected.—Patent abandoned.

1265 R. FOSTER, Liscard. *Crushing and pulverising.* Dated April 24, 1869.

This consists in machinery for crushing or reducing the mineral or other substance to coarse powder. This consists in the employment of edge runners and a pan, or of plain, fluted, or roughened rolls, or of a roll and stationary plate, or of stampers, or of sneezers, or of any one or more of these, of any convenient construction, working in combination or in a conjoined operation with novel mechanism, which also forms a portion of the invention. The substance or material to be ground may be supplied to the crushing mechanism either in a dry or wet state.—Patent completed.

1266 J. HEAD, Axminster. *Harrows.* Dated April 24, 1869.

This consists in forming at the upper end of the tine or harrow a mortice joint, into which a flat bar of iron or other suitable material is tightly fitted and secured, the rein by a bolt and nut, this bolt passing through both the mortice and the bar.—Patent abandoned.

1267 S. BROOKE, Brighouse. *Carding wool.* Dated April 24, 1869.

This consists, first, in the employment of a doffer clothed either with card, filleting, or parallel rings as heretofore, also of an ordinary card stripper to work in contact with the doffer; and to the under angle formed by the said doffer and stripper the inventor applies a roller on which are a series of circular knives or flanges fixed at suitable distances apart according to the required width of the strips to be performed.—Patent abandoned.

1268 J. CRABTREE, Sheffield. *Cutting shives or bungs.* Dated April 24, 1869.

This consists in the application and employment of one or more slides, moving in a groove of a V or other suitable shape cut in the front part of the spindle of an ordinary turning or other lathe, or in a front piece screwing on or otherwise attached to such spindle.—Patent completed.

1269 C. D. ABEL, Southampton-buildings. *Velocipedes* (A communication.) Dated April 24, 1869.

The invention consists in placing upon the axle of the hand wheel as a fulcrum a double ended forked or double lever. The two ends or prongs on one side of the fulcrum of this lever pass down in a slanting direction beyond the circumference of the hind wheel where they are connected by a transverse bar, and are furthermore provided with small rollers.—Patent abandoned.

1270 P. JENSEN, Finsbury-square. *Sewing machines.* (A communication.) Dated April 24, 1869.

This consists in the peculiar construction of the spoolhook. The Wheeler and Wilson spoolhook is of a shape similar to a crescent, and the needle passes close behind it, and is then, to some extent, guided by it during part of its rotary travel. But while the open part between the two horns of the spoolhook passes the needle, the latter is not guided by it as now made. That part of the inner circumference of the spoolhook which guides the lower part of the needle just before the latter approaches, the next following projecting horn of the spoolhook is extended or prolonged so as to afford the desired guide for the needle, and prevent its catching against the spoolhook or scratching the bobbin or spool.—Patent completed.

1271 D. A. S. MACKINTOSH, Glasgow. *Cask spile.* Dated April 24, 1869.

This consists of a chamber or vessel in which two tubes are fixed. The chamber is formed with closed ends, and in each end an opening is made. Into the opening at the lower end of the chamber a tube is inserted, being soldered or otherwise fixed therein. The part of the tube which is situated inside the chamber extends upwards to very nearly the top of the chamber, and the portion of the tube which is situated outside the chamber is that by which the improved spile is fixed into the cask. In the upper end of the chamber a hole is formed, and to it a tube is connected, the tube extending to very nearly the bottom of the chamber.—Patent abandoned.

1272 A. JACK, Maybole, Ayrshire. *Reaping machines.* Dated April 24, 1869.

This consists in so arranging the joints or couplings between the main frame of the machine and finger-bar that they are concentric with the crank or longitudinal shaft, being attached thereto by eyes or bearings which surround the crank shaft.—Patent completed.

1273 A. CLARK, Chancery-lane. *Reaping and mowing machines.* (A communication.) Dated April 24, 1869.

The invention consists in making the finger-bar, that is to say, the bar to which the fingers are secured, of one single piece, and in extending it in an elevated position backward along the inner side of the driving wheel, so that it will support the box in which the driving wheel has its bearings, and also the pole and all the other mechanism connected with the driving of the cutting and raking apparatus and reel.—Patent abandoned.

1274 J. CUDBIRD, Hingham. *Motive power.* Dated April 24, 1869.

This consists in employing a circular rotating lever in combination with wheel work in the construction of machinery for obtaining motive power. This circular rotating lever operates upon the same principle as the lever of the first order (a poker, for instance), with this difference the poker has a vibratory or up and down motion imparted to it, whereas the lever employed, instead of being formed of a straight bar or rod of iron, is formed as a wheel with a circular rim.—Patent completed.

1275 O. ENGHOLM, Edinburgh. *Preservation of food.*

This consists in the simple process of stirring or mixing and spreading semi-liquid substances, such as the whites and yolks of eggs, either separately or combined, in thin layers over surfaces such as plates of metal, glass, porcelain, wood, or other non-injurious substance which would not be chemically acted upon by the matters, and there and then subjected to or acted upon by a current or blast of pure and dry air, or otherwise air heated to such a low temperature as would carry off all the watery matter or moisture, and useless or unimportant volatile odours or gases given off therewith, so as thereby to thoroughly dry or desiccate the useful solid matters in a granular state.—Patent completed.

1276 O. ENGHOLM, Edinburgh. *Preserving food.* Dated April 24, 1869.

This consists in drawing the salt water from a closed cistern, or from tanks in which the fish are being transported, and forcing it through a pipe or pipes, or it may be a close chamber with a set of pipes leading from it, through which the water is forced; the other end or ends of such conducting or inducing pipes convey the water into the same or other cisterns again, by preference down through the lid into the body of water.—Patent abandoned.

1277 J. SCHARR, Leith. *Liquid soaps.* Dated April 24, 1869.

The mixtures are as follows:—No. 1. Wheat bran, 6lb.; linseed, 58lb.; caustic soda, 32lb.; potash, 80lb.; calcined soda, 95lb.; ton natron, 95lb.; glaubers salt, 25lb.; sal ammoniac, 7lb.; pitch, 57lb.; tallow, 1½lb. No. 2. Oleine, 20lb.; olive oil, 10lb.; butter, 5½lb.; rape seed oil, 5lb.; glycerine, 4lb.; turpentine, 6lb.; benzine, 1½lb.; sal ammoniac spirits, 7lb.—Patent abandoned.

1278 T. FORSTER and P. B. COW, Streatham-common. *Indiarubber compounds.* Dated April 24, 1869.

The inventors make a new compound by combining with indiarubber a substance called coorongite, and which has just been imported into this country for the first time.—Patent completed.

1279 W. R. LAKE, Chancery-lane. *Axle boxes.* (A communication.) Dated April 24, 1869.

This consists in certain improvements in the construction of the axle boxes of railway rolling stock and other vehicles and journals for the purpose of obtaining a constant and uniform supply of lubricating material where required. This purpose is accomplished by the admission of air into an airtight vessel or chamber containing the lubricating fluid in connection with the axle box or journal, at such times, and to such an extent, as to permit a sufficient quantity of the lubricating fluid to flow into the desired position.—Patent completed.

1280 G. WHITE, Cheapside. *Carding tow.* (A communication.) Dated April 26, 1869.

One of the principal features of this apparatus consists in the size of the main carding roller, which in this apparatus replaces the large carding drum hitherto made use of in low carding engines, and which main carding roller in this improved apparatus is of a much smaller diameter than the carding drum of ordinary low carding engines. Another important part of the invention consists in the use of two pairs of feed rollers which deliver the material to the main carding roller and at the same time act as drawing or stretching rollers on the tow, before this latter reaches the said main carding roller.—Patent completed.

1281 L. FARREL and W. TURNER, Dublin. *Velocipedes* Dated April 26, 1869.

This consists in the utilisation of the weight of the body to be thrown alternately upon a saddle or seat bar, and upon a footboard to be supplied for the purpose as a substitute for the muscular action of the legs on a crank as at present performed. Also in attaching a T-shaped rod or bar to a saddle or seat bar or to a lever handle, or to both, so that when the lever handle is pressed down it may act on the top of the T-shaped bar, which being connected with the saddle bar or lever handle causes or assists in causing the cranked axle of the machine attached to the saddle bar to revolve; and in applying a brake by means of a bar of metal attached to the outer end of the lever handle of the guide wheel.—Patent completed.

1282 A. WATSON, Newington Green-road. *Sleeve links* Dated April 26, 1869.

The inventor employs a front plate, to which a bar or back plate is pivoted or pin jointed so as to turn around such pivot or pin joint in a plane parallel, or nearly so, to the plane of the front plate. This bar or back plate has a stud or studs projecting therefrom to enter a recess or recesses formed in the back of the front plate, or, if desired, such recesses may be dispensed with, in which case the pivot or pin joint will be made to work somewhat stiffly.—Patent abandoned.

1283 J. CUNNINGHAM, Harpford. *Bread slicer.* Dated April 26, 1869.

This consists in constructing a square or any other suitably shaped box, case, or trunk, either of wood or metal, with a screw or racks and pinions, and a thrust operated or worked by cams or spur gear and screws, giving the necessary feed for the thickness of bread or meat required. Attached to the side of the box, case, or trunk is a horizontal shaft fitted with a revolving knife at either end, which is worked by a handle or by the foot by means of a treadle, thus leaving the hands free to pick up with a fork or otherwise the bread and meat, which are cut in slices and placed in separate compartments.—Patent abandoned.

1824 H. HALL, Burton-on-Trent. *Motive power.* Dated April 26, 1869.

This consists in the employment of rollers comprising wheels, drums, or cylinders carrying some flexible material, one of which being caused to revolve presses against another and imparts rotary motion thereto, and so on for as many wheels or rollers as are required to be driven. The rollers are made, by preference, with flanges, so that the flexible material may be effectually retained on the surface or surfaces, but they are also made without flanges.—Patent completed.

1285 This application is still under the consideration of the Attorney General.

1286 J. SMITH, Dublin. *Railway signals.* Dated April 26, 1869.

The inventor proposes to construct on any line of railway an insulated conductor broken or interrupted in such lengths as may seem most suitable, such conductor being connected, by means of metallic rollers or other convenient arrangement, with one of the poles of a battery attached to the train, the other pole of such battery being connected electrically with the earth.—Patent completed.

1287 A. V. NEWTON, Chancery-lane. *Parasol.* (A communication.) Dated April 26, 1869.

This consists in so arranging the ribs, the stretchers, and the cover of parasols, that when in the spread or expanded condition, the ribs will project at right angles to the stalk, forming for the most part a flat top with a central conical extension on one side of the top to be capable of adjustment on the stalk, so that the conical extension may project above or below the flat part of the top or parachute formed by the projecting ribs.—Patent completed.

1288 W. E. NEWTON, Chancery-lane. *Steam generators* (A communication.) Dated April 26, 1869.

This consists in constructing a steam generator or condenser of main and branch pipes or pipe, like structures arranged to occupy right-angled or cross positions, and forming tiers and rows of tubes connected so as to form but a single structure yet independent as regards separate expansion and contraction, and allowing of free circulation between or around as well as through them in various directions.—Patent completed.

1289 R. STERNE, Cork. *Anchors.* Dated April 26, 1869

The stock is constructed in a curved or crescent form and is made heavy at the centre in order to give the anchor unstable equilibrium when it is dropped in the wrong position. When the point of the stock rests on and bites the ground in that position, it becomes a power lever which cants the anchor over immediately any strain is brought on the cable, and thereby causes one of the flukes to bite or enter the ground.—Patent completed.

1290 S. OAKMAN, Boston, U.S.A. *Furnaces.* Dated April 21, 1869.

This consists in combining with a smelting or other furnace a vacuum chamber, in which the exhaust is produced by mechanical means, the chamber being connected to the furnace by suitable flues so that a proper draft may be maintained. This vacuum chamber has inlets over

the ports of the furnace so that the flame and heated products of combustion coming from the ports may be drawn into the vacuum chamber, and thus away from the workman.—Patent completed.

1291 G. HAWXHURST and J. POLLOCK, San Francisco. *Preventing corrosion in boilers.* Dated April 26, 1869.

This consists in mingling with the distilled water within the boiler, or upon its way thereto, a strong solution of caustic lime in such quantity and at such intervals of time that the water contained in the boiler will be a weak solution of the same.—Patent completed.

1292 W. PROWETT, Southwark. *Knitting machines.* Dated April 26, 1869.

In constructing a knitting machine the inventor employs bearded needles similar, or nearly so, to ordinary hosiery needles, and he mounts them on slides which are actuated in such a manner as to give to the needles an endway traverse. The slides are arranged side by side in suitable guides. Their number depends on the width of the work the machine is required to make, and on the gauge of the machine. The slides are worked by cams, which act upon them in succession and progressively from side to side of the machine. Each pair of needles, as its slide is drawn back, passes under a stationary bar, called the presser bar, which, by bearing on the boards, closes them down to the stems. Beyond the presser bar is another stationary bar having teeth upon it, and the needles pass between the teeth. This bar the inventor calls the comb bar. The heads of the needles, when they have passed behind the presser bar, enter between the teeth of the comb bar. —Patent completed.

1293 W. R. LAKE, Chancery-lane. *Locks.* (A communication.) Dated April 27, 1869.

This relates to locks provided with a set of circular plates or tumblers, which, by their position in relation to each other and to certain parts of the mechanism, prevent or permit the actuation of the lock by a handle or knob outside the door wherein the lock is placed, and which handle furnishes the only means of communication with the interior of the lock from the outside of the door, the lock having no keyhole or other aperture through which such communication could be effected. The handle is connected to the tumblers by a spindle, and is furnished with a graduated scale, the position of whose numbers in relation to a fixed point or points on the lock case form the only means for ascertaining in what manner the lock must be manipulated to allow the door to be opened. —Patent completed.

1294 J. P. COOPER, Bow, E. *Nuts and bolts.* Dated April 27, 1869.

This consists in forming a recess in the face or other part of the nut, and in fitting a rail in the recess. The bolt is made with a series of grooves or channels for the entire length of its threaded portion, into one or other of which grooves the pawl is caused to take. A spring or other appliance may be employed to act upon the pawl. —Patent abandoned.

1295 B. DOBSON, Bolton. *Carding engines.* (A communication.) Dated April 27, 1869.

The radial arms and cam wheels are made as usual, and discs with projections and recesses on their circumferences are employed to govern the order of succession in which the top flats are lifted. The slides are made in two parts, and to the upper part of one of each of them is jointed a weighted elbow lever, the lower end of which forms a catch.—Patent completed.

1296 R. FLOWER and M. CROWLEY, Durrow, Ireland. *Organs.* Dated April 27, 1869.

This consists in the construction of an instrument containing but one row of keys capable of detaching the ordinary lever board, so as to act on a single or double set of palets at pleasure, and thereby instantly producing on this one row of keys the effect of two or three. In organs of the ordinary construction, the lever boards are made in one piece and are fixtures, but, according to this invention, the lever boards are divided, one being a fixture and the other movable.—Patent completed.

1297 J. CANE, Kew. *Fusee cases.* Dated April 27, 1869.

This consists of a tube made by preference of metal. In the interior is a bed or cup free to slide therein, motion being imparted to it by a stud attached to a pin connected to the cup free to travel in a slot in the case.—Patent abandoned.

1298 J. H. SAMS, Aberdeen. *Sewing machines.* Dated April 27, 1869.

The inventor uses a circular disc, thick at the centre, and tapering to the edges. This disc is pierced obliquely through its centre, and then keyed on or otherwise fastened to a rod or shaft, which is driven by suitable gearing from the hand wheel of the seed-sowing machine, so that the plane of the disc is inclined at any required angle to the shaft. The disc is arranged to work on a flat or round-bottom hopper, and, in its alternating right and left motion, in each revolution sweeps the grain or seed over the discharge hole, through which it falls into the pipes.—Patent completed.

1299 J. ANDERSON, Londonderry. *Velocipedes.* Dated April 27, 1869.

In one modification with two wheels, the front wheel is arranged in a swivel for steering and for supporting the front end of the reach or frame, whilst the propelling action is applied to the hind wheel, the axle of which is formed with two cranks having their pins in line and not on opposite sides of the axis. The cranks are acted upon by connecting rods jointed to the arms of a propelling lever, centred upon the reach at a point near the front of the hind wheel. The propelling lever has arms projecting forward, to which stirrups are suspended for the feet, and a handle is carried up from it in front to be taken hold of and have the action of the arms applied to it. The saddle or seat is hinged or otherwise connected to the frame so that it can oscillate vertically, and it is connected to the propelling lever behind the fulcrum of the latter so as to communicate the action thereto.—Patent abandoned.

1300 R. MARSHALL, Burnley. *Wheels.* Dated April 27, 1869.

This consists in a novel and peculiar combination of a metallic nave or boss with spokes or arms of wood and a felloe or rim either of the ordinary construction or of a single piece of wood bent in the form of a circle and surrounded by an iron hoop or tyre.—Patent abandoned.

1301 H. W. HART, Fitzroy-road, W. *Ovens.* Dated April 27, 1869.

This consists in constructing ovens of a closed metal chamber provided with a door or doors at one or both ends or sides, such door being by preference made of sufficient width to allow of a table or false bottom to the oven being drawn in and out through the same. This chamber is surrounded by a metal casing so constructed as to leave a space between it and the chamber on every side, in which space is contained water.—Patent abandoned.

1302 T. ASPDEN and E. H. LAMBERT, Leeds. *Boots and shoes.* Dated April 27, 1869.

The inventor fixes between the "insole" and the out sole of the boot or shoe an air tube or channel. This tube passes longitudinally through the heel and the "waist" of the boot or shoe, and has at its upper side a longitudinal slot or opening. A series of holes is formed in that part of the "insole" which is over the opening in the air tube, and air enters the tube at the heel end thereof and passes up into the boot or shoe through the said opening and holes.—Patent abandoned.

1303 J. H. SIMPSON, Bolton-street, Piccadilly. *Propelling by currents of air.* Dated April 27, 1869.

Hitherto the pneumatic emotive power for pneumatic propulsion has been obtained only by putting a certain volume of atmospheric air into motion by means of a pump, fan, jet, or otherwise, regardless of density incidental thereto. The inventor proposes to utilise the contracting and expansion of air due to forced changes of temperature in conjunction with fans, pumps, blowers, or already applied means of putting the air into motion in order to obtain an increased effect and a quicker transit of trains or supply of air for ventilation without having to increase the dimension or the validity of the blowing machine.—Patent abandoned.

1304 O. MOSELEY, Covent Garden. *Smoking pipes.* Dated April 27, 1869.

The inventor constructs an outer case of wood earthy or other suitable material or compound, in which he inserts the true bowl of the pipe, and, although the external or false case may be of any ordinary form, it is preferred to make it spherical or globular, and to colour it in imitation of a billiard ball; it is bored through for the insertion of the true bowl and for the application of a cylinder of chalk beneath the bowl.—Patent completed.

1305 T. A. HABERKORN and B. RUDOLPH, Berlin. *Sewing machines.* Dated April 28, 1869.

The main shaft is put in motion by means of the handle and the flywheel, either by hand or treadle in the ordinary manner. The working of the machine is effected by the eccentrics set on the main shaft in the following manner:—The leading or feed rod is set in reciprocating motion by the eccentric upon which it is fixed. The former then acts upon the leading prism or feed cylinder joined to it by one end, and this again transfers its movement to the needle bar, so that the latter is obliged to perform with the needle applied to it an alternating horizontal motion. The eccentrics actuate the two alternating levers in such a way that one of them rises whilst the other descends.—Patent completed.

1306 I. J. J. LEWIS, Manchester. *Hat ventilating.* Dated April 28, 1869.

This consists principally in applying the system of a single shaft or tube divided by a partition or "brattice" into upcast and downcast shafts (such as is frequently used for ventilating mines) to the ventilation of hats or other coverings for the head.—Patent abandoned.

1307 J. B. KROLL and A. FROMENT, Paris. *Percolators.* Dated April 28, 1869.

This consists, first, in having the bottom of the upper cylinder solid, with a central aperture or valve worked by a key from the outside; second, in adapting a tap thereto; third, in the employment of an inner recipient or smaller cylinder (which is placed in the interior of the first named one), at the bottom of which the filter is fixed, and below and round it a number of circular openings are made for the passage of the filtered liquid.—Patent abandoned.

1308 G. HEYES, Radcliffe, and E. BARLOW, Little Leven, Lancashire. *Winding yarn.* Dated April 28, 1869.

This consists in improved arrangements of mechanism for enabling the yarns to be wound on the bobbin or pirns at a uniform speed, and placed regularly side by side. The spindles of the bobbins are driven by bands on the tin drum in the usual manner, but, instead of giving the drum a uniform speed as at present, it is given a continually varying speed, according to the varying diameters of the parts of the bobbin where the yarn is received, and the heart wheel for working the traversing guides has a varying speed, corresponding with that of the tin drum.—Patent completed.

1309 N. VOICE, Handcross, Sussex. *Cask tilts.* Dated April 28, 1869.

This consists in the employment of a tube, band, or length of indiarubber or other suitable elastic material suspended between two points across the back part of the stand. When a full cask is placed upon the stand its back end bears upon the indiarubber and forces it down upon a curved bar below, but as the weight of the cask and contents becomes gradually lighter as the contents are drawn off, the indiarubber is able to gradually overcome the weight and to resume its normal position, thereby gradually lifting the back end of the cask.—Patent abandoned.

1310 H. A. BONNEVILLE, Paris. *Concentrating caloric.* Dated April 28, 1869.

This consists in concentrating the degree of heat which is deemed sufficient and in preventing the radiation and loss of the caloric contained by the water poured into vessels, such as baths, intended to hold warm water by enclosing them in an envelope or covering made of felt, or felted stuff, or any other material enjoying the property of preventing the radiation of heat.—Patent completed.

1311 J. PIM, Finsbury Circus. *Ventilating.* Dated April 28, 1869.

The apparatus is preferably made somewhat in the form of an umbrella, in order that it may be expanded and raised to the upper part of the apartment and be moved about therein, whereby the vitiated air in the upper part of the chamber becomes broken up and dispersed, fresh air at the same time taking its place.—Patent abandoned.

1312 L. ISAAC, Tottenham. *Folding table.* Dated April 28, 1869.

This invention is designed to enable tables, stands, or stools to be closed up within a small compass so as to occupy very little room when not required for use, and in some cases so that the the top and base framing of a small table or stool can be packed up within a tube which then serves as a walking stick (made to carry an umbrella if desired), arranged in such a manner that when the parts are opened out and placed in position, the tube or a part of it shall serve as the leg of the table, stand, or stool. —Patent completed.

1313 E. COOPER, Laurence Pountney-lane. *Ventilating hats.* Dated April 28, 1869.

This consists in adapting to the inside of hats, and by preference at that part thereof where the head lining is situated, a piece of cork or other suitable waterproof material or fabric, so made as to leave a series of vertical or diagonal channels or passages for the admission of cold air and emission of perspiration or heated air from the inside of the hat when placed on the head of the wearer thereof.—Patent completed.

1314 T. BOSTOCK, Stone, Staffordshire. *Elastic shoes.* Dated April 28, 1869.

This consists in the application of the elastic fabric or spring beneath the same portion of the upper, so that it is wholly or partially concealed, and will yet have sufficient play or action as to allow of the boot or shoe being readily put on or taken off the foot.—Patent completed.

1315 R. B. FORBES, Boston, U.S.A. *Rigging vessels.* Dated April 28, 1869.

This consists, first, in bending the sails by battens, jack stays, or other convenient and usual attachments to the yards at their foot instead of to those at the head of the sails, thus rendering the largest and longest side of the sail, which is most difficult to subdue or furl in strong breezes, permanently and constantly furled or subdued. Second, the yards above the lower yard, excepting sky sails, are slung and parallel or secured so as to brace very sharp and above the eyes of the standing rigging and back stays, and they do not hoist and lower but are permanent. The lower yard is as usual permanent, but is also slung just above the eyes of the rigging.—Patent completed.

1316 J. FROLICH, Barnes. *Gas generators.* Dated April 28, 1869.

This consists of two firebrick chambers connected at the bottoms by a short flue. The first chamber contains the fuel in a powdered state, such as small coal, coal dust, saw dust, or peat, and must be fed from time to time at the top. The fuel descends by gravity, and is burnt by the aid of fan blast entering through a number of tuyeres near the bottom of the chamber. The gaseous products of this combustion pass through the flue into the second chamber, which is supplied from time to time by a door placed at or near the top with coke or large pieces of non-bituminous coal, so that all the gases resulting from the combustion in the first chamber are forced to ascend through a column of red hot coke. The gas is thus converted into carbonic oxide, and is then ready for use, and the carbonic oxide gas thus produced may be burnt by either hot or cold blast, as the process to be carried out requires a higher or lower degree of heat.—Patent completed.

1317 A. MEREDITH, Newgate-street. *Iron and steel.* Dated April 28, 1869.

The inventor raises the temperature of the iron to a very high degree before beginning to force the blast through it by means of a refinery fire in the usual way of making refined iron. In this preliminary process the impurities are in part separated, whilst at the same time the metal is raised to the heat necessary for the successful action of the blast passing through it. When the metal is at the highest heat attainable in the refinery the metal is at once run into the Bessemer vessel and treated by the Bessemer process, which is conducted in the usual way and regulated according to the appearance of the flame, as is well understood. In carrying this invention into effect the iron may advantageously be run directly from the blast furnace into the refinery furnace.—Patent completed.

1318 D. GREIG, R. BURTON, J. GOZNEY, and T. ATKINSON, Leeds. *Cultivating land.* Dated April 28, 1869.

The first part of this invention relates to improvements in the construction of cultivating implements to facilitate twining at the ends of the louts. When giving motion to cultivating implements by means of hauling ropes actuated by a stationary engine or engines, the inventors connect the hauling ropes to a bar or lever mounted on the implement so that the point of draught shall be behind the centre of the steerage wheel. When the direction of draught is changed the bar or lever to which the hauling ropes are connected swings round, passing over the top of the steerage, and after swinging past a certain point it acts on the steerage wheel and directs it so as to assist in turning the implement.—Patent completed.

1319 W. E. GEDGE, Wellington-street, W.C. *Stringed instruments.* (A communication.) Dated April 28, 1869.

The object sought is the rigidity of and the maintenance of an invariable distance between the head bar or pin plate, in which are fixed the ends of the pins and the lower bar; and the construction of this new system of barring or framing is intended, in the first place, to oppose any drawing together of these two parts by the interposition of rigid metallic bars of any shape, flat, square, or T-shaped, and even of hollow iron; and, in the second place, to prevent the head bar or pin plate from being drawn by the traction of the strings from its primitive vertical position, and inclining towards the action of the strings. These objects are attained by the use of an arrangement of cramps applied in the face opposite that on which the strings are placed.—Patent abandoned.

1320 H. BRAY and H. ADAMS, Nottingham. *Graining in oils.* Dated April 28, 1869.

A composition of glue and treacle, or other agents or equivalents, is prepared and placed in a mould, upon which the inventor places a board or other covering which fits within the mould. They then press this board or other covering on the composition within the mould, which he next uncovers, and removes the composition. They then employ soap and soda with raw linseed oil and vegetable lampblack or other equivalents or agents, and boil them together over a fire or heated surface until the water therein has evaporated.—Patent abandoned.

1321 W. R. LAKE, Chancery-lane. *Generating steam.* Dated April 28, 1869.

This relates to a furnace which may be used in a steam generator, or for many other analogous purposes, and it

consists in placing within the firebox of such furnace a chamber opening above the grate bars through which the coal is fed, which coal, before falling upon the grate bars, is exposed to the action of the heat evolved within the firebox while retained in the chamber, above which is a cover for preventing the escape of the gases distilled from the coal, which may be utilised either by bringing them down in a pipe or pipes and discharging them below the incandescent coke through which they will pass, or they may be conducted away in pipes to be utilised in another place.—Patent completed.

1322 M. WILKIN, Paddington, and J. CLARK, South-street, Finsbury. *Radiating axles.* Dated April 29, 1869.
The inventors construct the carriage longer and lighter than usual, and mount it upon six wheels instead of four. The several pairs of wheels are fitted to bogie frames, which have movement under the framing of the carriage, the centre pair having lateral movement to the extent of the versed sine of the curve, and the fore and aft pairs, which are fitted with central fulcrum pins, move or radiate round them so that the line of the axles, if produced, meets in the centre of the curve. The bogie fitted to the centre pair of wheels is furnished with an elongated pole extending on each side to half the wheel base, and the fore and aft bogies are furnished with corresponding poles on the inside to meet the aforesaid pole.—Patent abandoned.

1323 R. GRIFFITH, Aberdeen Park-road, N. *Bicycles.* Dated April 29, 1869.
This consists in applying and attaching outside each of the usual pieces of elastic or side springs a protective piece of kid leather or other suitable material, according to the nature and strength of the boot or shoe.—Patent abandoned.

1324 O. ROSE, Bolton. *Steam engines.* Dated April 29, 1869.
These improvements consists in using a small steam piston and cylinder which may be combined with what is termed a "dash pot" for suddenly closing each emission valve, or for suddenly opening each emission valve when so arranged that the steam can be admitted and exhausted from the small cylinder through ports in its piston and cylinder at each movement thereof.—Patent completed.

1325 J. G. F. and G. W. BLOW, Commercial-street. *Driving bands.* Dated April 29, 1869.
The inventors employ thin and flexible steel bands on which they thread small pieces of leather of a width equal to the thickness of the band which it is desired to make. The strips of leather run transversely across the driving band, so that the length of the strip corresponds with the width of the band.—Patent abandoned.

1326 E. CROWE, Middlesbrough-on-Tees. *Utilising waste heat.* Dated April 29, 1869.
The inventor employs a boiler of two horizontal tubes arranged one over the other, and connected by a number of upright tubes arranged at short distances apart along the horizontal tubes. The water line of the boiler is at the diameter of the upper tube or thereabouts, and the boiler below this line is enclosed in a chamber of brickwork into which at one end the products from the furnace enter, and which at the other end is connected with the chimney, so that the chamber is in fact the flue of the furnace. The sides of the chamber at the level of the vertical tubes are corrugated so as alternately to approach and recede from the vertical tubes, so that the draught is caused to pass in an undulating direction. This causes it to impinge more effectually on the vertical pipes, and at the same time sufficient space is obtained for a man to pass through the chamber to clean it from time to time.—Patent completed.

1327 R. ELSDON, Brockham, Surrey. *Limekilns.* Dated April 30, 1869.
The furnace is built at one end or foot of kiln for combustion of coal or other fuel, and beyond this is a second furnace, in which coke or other suitable fuel is burnt. The gases from the first pass over, and are brought into immediate contact with the heated fuel in the second furnace, and are there mixed with a larger quantity of atmospheric air than is necessary for perfect combustion of the fuel. The total product of combustion and distillation from the coke furnace passes through a brick chamber, where a still further supply of air is introduced sufficient to reduce the temperature to the degree required. —Patent completed.

1328 W. SPENCE, Chancery-lane. *Making felt.* (A communication.) Dated April 30, 1869.
According to this invention in machines for making felt in sheets, the table which covers the wool to be felted has imparted to it at the same time both a longitudinal and a transverse reciprocating motion. The table is thus caused to work both longitudinally and transversely at the same time, but with the extent of its motion in one direction differing from the extent of its motion in the other direction.—Patent completed.

1329 J. BROADFOOT, Glasgow. *Lavatories.* Dated April 30, 1869.
This consists in forming a hollow support or stand for the lavatory top or basin piece, into which the used water may be allowed to pass through a plug-hole in the bottom of the basin, and which is fitted with a tap at the bottom for withdrawing such used water periodically. The basin piece may be of earthenware or enamelled cast iron, and the support may be of cast iron, zinc, or other metal, or of earthenware. The support is made in the form of an ornamental bracket, and is fixed against the bulk-head, partition, or lining by screws, some of which can be entered from the inside, whilst lugs may be formed on the hollow support for others.—Patent completed.

1330 J. JAMIESON, Oldham, and T. HOLT, Rochdale. *Steam engines.* Dated April 30, 1869.
The inventors employ four valves having a steam valve and an exhaust valve at each end of the cylinder, each working independently on the facing of its respective port, the valves being of a plate form, and the exhaust ports and their valves being of about twice the area of the steam ports and their valves.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated November 9, 1869.

3220 J. V. Michaux, Hampstead. An improved method or means of securing corks in bottles.

3221 S. Heath, Walsall, Staffordshire. An improved machine or apparatus for clipping horses.

3222 R. Aders, Manchester. Improvements in the tinning of metals.

3223 R. Jones, Birmingham. A special and general paper, card, or form holder, such as for address cards, envelopes, bill heads, and general stationery, or like matter, and which said invention is also applicable for holding special patterns or fancy goods not of a bulky character.

3224 A. C. Kirk, Glasgow. Improvements in or connected with retorts.

3225 G. D. Davis, Woodstock-road, East India-road. Improvements in machinery for working rudders.

3226 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machines for heckling hemp.

3227 T. Hattersley, Leeds. Improvements in spindles and flyers used in the spinning and preparing of flax, tow, hemp, jute, worsted, wool, cotton, silk, and other fibrous substances.

3228 C. Mole, Tottenham Court-road. Improvements in the manufacture of boots and shoes.

3229 A. M. Clark, Chancery-lane. Improvements in the transportation of letters, parcels, and other freight by atmospheric pressure, and in apparatus connected therewith.

Dated November 10, 1869.

3230 J. and H. Tracy, Shacklewell-lane, Dalston. An improved stick or stem for umbrellas, parasols, whip and other handles.

3231 A. Bohlken, Varel, Oldenburg. Improvements in terriers.

3232 E. Thomas, Cardiff-street, Aberdare, Glamorganshire. An improvement in the construction of miners' safety lamps.

3233 W. Donbavand, Manchester. Improvements in balances for weighing.

3234 J. Riley, Shoreditch. Improvements in roofs and other parts of buildings.

3235 G. Knighton, Riddings, Alfreton, Derbyshire. Improvements in core barrels for making pipes and hollow castings.

3236 F. Jenkin, Fittis-row, Edinburgh. Improvements in submarine telegraph cables.

3237 J. W. Hackworth, Darlington, Durham. Improvements in slide valves for steam engines.

3238 J. Ingletop, Glasgow. Improvements in water-closets.

3239 H. Lee, Manchester. Improvements in looms for weaving.

3240 F. B. Dœring, Victoria-street, Westminster. An improved construction of stand or carriage for rock boring or excavating machines.

3241 I. and G. Battinson, Halifax, and T. and H. W. Whitehead, Leeds. Improvements in machinery for combing wool, cotton, flax, and other fibrous substances.

Dated November 11, 1869.

3242 J. Logan and W. Gardner, Paisley, Renfrewshire. An improved mode of ornamenting textile fabrics.

3343 A. Mosley, Old Radford, Nottinghamshire. Improvements in lace machinery.

3244 H. Robinson, Skipton, Yorkshire. Improvements in the construction of kilns for burning limestone, chalk, cement, or for calcining ores, part of which being applicable to blast furnaces.

3245 T. Herbert and J. C. Fowler, Leicester. Improvements in means or apparatus for signalling between various parts of a railway train.

3246 M. Tuthill, Mota Borrisokane, Tipperary. Improvements in horse gear.

3247 J. P. Budd, Ystalyfera, near Swansea, Glamorganshire. Improvements in the manufacture of iron.

3248 J. M'Cormick, Boston, Massachusetts, U.S.A. An improvement in the process of brewing malt and other substances.

3249 I. Nasch, Berlin, Prussia. Improvements in button-hole sewing machines.

3250 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in combination locks.

3251 J. Guesne, Charlotte-street, Portland-road. Improvements for an organ and piano combined.

3252 G. Simpson and L. Strauss, Glasgow. Improvements in arrangements or apparatus for withdrawing beverages or other liquids from casks or other vessels, and for elevating the same.

3253 J. M. Rowan and T. R. Horton, Glasgow. Improvements in steam engines and boilers.

3254 J. H. Johnson, Lincoln's Inn-fields. Improvements in the treatment of caoutchouc, gutta-percha, and analogous gums for the production therefrom of articles of utility and ornament.

3255 J. Mason, Birmingham. An improvement or improvements in metallic pens.

3256 W. Harris, Birmingham. Improvements in locks and latches.

3257 P. Wilson, Birmingham. Improvements in locks and latches, and in keys for locks, and in attaching door and other knobs to spindles.

3258 H. Rochatte, Boulevart de Strasbourg, Paris. Improvements in breech-loading firearms with central percussion.

3259 G. A. Buchholz, Regent's Park. Improved machinery for hulling grain.

Dated November 12, 1869.

3260 M. Benson, Southampton-buildings, Chancery-lane. Improvements in a machine for dusting bran, or separating the flour from the bran after it has undergone the usual process of bolting, and also for cleansing cracked wheat and other grain.

3261 B. Shaw, Calder Soap Works, Wakefield, Yorkshire. Improvements in machinery for cutting soap.

3262 S. Martin, Clarence Works, Sheffield. Improvements in the construction of chairs for supporting the rails of rail and tramways.

3263 C. Brakell, North Moor Foundry, Oldham. Improvements in obtaining and applying motive power.

3264 S. Chatwood and R. Kenyon, Bolton-le-Moors, Lancashire. Improvements in furnaces, and in apparatus connected therewith.

3265 O. Rose, Bolton, Lancashire. Improvements in pistons for steam and other motive engines.

3266 G. D. Edmeston, Preston, Lancashire. Improvements in hammers to be worked by steam or other elastic fluid.

3267 W. Gorman, Glasgow. Improvements in the manufacture of iron and steel, and in apparatus therefor, parts of the improvements being also applicable to furnaces of various kinds, and parts to some motive-power purposes.

3268 T. Snow, Inner Temple. An improved column for exhibiting notices at railway stations and other public places.

3269 W. E. and F. Dobson, Meadow Mill, Nottingham. Improvements in the manufacture or production of shawls made on lace machines.

3270 S. W. Shaw, Bower Hill House, Maidstone, Kent. Improvements in burning bricks.

3271 H. R. Minns, Bristol. Improvements in letter pillar posts.

Dated November 13, 1869.

3272 G. H. Hannaford, Finsbury-place South, City. Improvements in apparatus for working, locking, and controlling railway switches, points, and signals.

3273 J. Edwards, Richmond-road, Hackney. Improvements in the permanent way of railways, and for giving signals on the same.

3274 W. E. Gedge, Wellington-street, Strand. A new or improved composition or electro-cathodic insulating mastic to be used as a coating for preserving metal and other surfaces from the effects of humidity, and also as a cement.

3275 W. E. Gedge, Wellington-street, Strand. An improved machine for cutting, drilling, and shaping wood and metals.

3276 C. H. Holt, Byrom-street, St. John's, Manchester. Improvements in apparatus for obtaining blast in smelting and other furnaces, which improvements are also applicable in injecting air for other purposes.

3277 R. Hardman, Ramsbottom, Lancashire, and G. Hardman, Newchurch, Lancashire. Improvements in carding engines.

3278 C. Burgon and J. Ball, Sheffield. Improvements in the manufacture of sheep shears.

3279 R. Smith and J. Higginbottom, Paper Staining Works, Hyde-road, Manchester. Certain improvements in the manufacture of paper-hangings.

3280 C. Sutton, Holloway-road. An improved means of, and apparatus for, ascertaining the presence of certain bodies which are concealed from view, and for discriminating between one body and another.

3281 T. A. Dillon, Dublin. An improved safety lamp.

3282 W. Richardson, Oldham. Improvements applicable to valves of steam engine cylinders.

3283 H. H. Grierson and J. M. Rigby, Manchester. Improvements in machinery for cutting or dressing stone.

3284 J. Henderson, Bishopton, Renfrewshire. Improvements in treating certain ores and in obtaining products therefrom.

3285 C. D. Saintgeot and C. Poucel, Rue Ste. Appoline, Paris. Preventing and removing incrustations in steam boilers.

3286 R. Ganthony, Richmond, Surrey. An improved inking or stamping pad.

Dated November 15, 1869.

3287 P. Koch, Manchester. Improvements connected with the knobs or handles of locks and latches of doors and gates or similar purposes.

3288 W. E. Gedge, Wellington-street, Strand. A novel manufacture of box for matches and other objects.

3289 F. Clarbour and W. E. Teale, Salford, Lancashire. Certain improvements in mining lamps.

3290 F. Brampton, Birmingham. Improvements in locks.

3291 F. Clark, Tamworth, Warwickshire. Improvements in machinery for the manufacture of pipes, bricks, tiles, and other articles from clay and other materials.

3292 C. D. Abel, Southampton-buildings, Chancery-lane. A new or improved process for refining and desilvering lead, and apparatus employed for that purpose.

3293 J. Tribe, St. John-street, Smithfield, and J. Mallet, Charles-street, St. John-street-road. Improvements in despatch boxes and other similar articles.

3294 A. Jugla, Regent-street. An improvement in gloves.

3295 W. Gossage, Widnes, Lancashire. Improvements in obtaining a certain compound of soda by the decomposition of sulphate of soda, and a certain compound of potassa by the decomposition of sulphate of potassa; also in obtaining sulphur, either free or combined, from the gaseous products of such decompositions.

3296 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in means and machinery for clipping horses and other animals.

3297 G. R. Mather, Wellingborough, Northamptonshire. Improvements in means or apparatus for cutting or giving form to wood.

3298 J. G. Jones, Blaina, near Newport, Monmouthshire. Improvements in apparatus for breaking down coal.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," November 16, 1869.

1962	T. Atwater	2063	W. Hutchinson
1984	J. D. Dougall and W. Bartram	2079	T. D. Waller
		2082	S. Read
1993	H. A. Bonneville	2104	C. A. Count de G. de Liancourt
1995	E. Scott		
1996	S. Smithson and G. S. J. Inman	2108	C. P. E. Roche
		2115	J. Barnett
2012	A. H. A. Durant	2121	R. Willcox
2014	I. James	2122	M. Jack
2016	J. Hart	2153	A. Rollason
2017	T. Butler and R. F. Carey	2179	V. E. Mauger
		2297	W. R. Lake
2019	J. Clark and A. Ewing	2327	J. T. Way
		2328	J. T. Way
2029	W. B. Haigh	2330	I. Davies
2030	J. Gedge	2451	R. H. Charsley
2038	W. Q. East	2473	J. Mitchell
2040	J. Shore	2848	R. Crickmer
2041	D. Cope	2907	E. Tyer
2042	H. E. Knight	3006	W. R. Lake
2045	V. A. Deaubeuf	3070	J. Buchanan
2049	J. Robinson	3086	T. Diechmann
2051	W. Arnold and W. Carnelley	3093	W. R. Lake
		3114	J. Wakefield
2059	W. Davis	3120	J. B. Elkington
2060	T. Knowles	3130	N. R. Vail
2061	I. Williams and R. C. H. Wallendahl	3139	J. A. Miller
		3218	N. Shaw

The full titles of the patents in the above list can b ıcertained by referring back to their numbers in the lis f provisional protections previously published.

Opposition can be entered to the granting of a patent to ny of the parties in the above list, who have given notice f their intention to proceed within twenty-one days from he date of the "Gazette" in which the notice appears by ›aving at the Commissioners' office, particulars in writing f the objection to the application

LIST OF SEALED PATENTS.
Sealed November 12, 1869.

1367 J. Bullough
1471 J. Fawcett
1477 L and J. H. Storey, H. Lea, and T. Lane
1480 J. T. Griffin
1482 H. B. Barlow
1485 F. Hedley
1494 F. E. Saxby and I. M'George
1495 W. Wilkinson and M. Boss
1502 H. G. Whitehead
1531 E. Taylor
1549 W. M'Adam
1558 C. C. Parker
1629 J. Snape
1670 J. Hauworth and H. Horsfall
2027 J. Knight
2329 J. Bapty and A. Hall
2712 A. Collingridge

Sealed November 16, 1869.

1505 A. Dunn and A. Liddell
1515 T. and J. Fagg
1519 A. M. Clark
1520 G. Allan
1535 A. B. Winkle
1538 W. Martin
1540 G. Martin
1543 J. E. and A. Dowson
1560 A. A. Rossignol
1569 J. G. Tongue
1573 A. Munro and W. B. Adamson
1571 E. H. Pulbrook
1667 J. Cookshoot and H. Weatherill
1668 P. Kirk
1706 H. Larkin and W. White
1747 H. Kinsey
1862 J. H. Banks
1985 J. H. Johnson
2089 W. R. Lake
2435 E. H. C. Monckton
2551 J. Ritchie
2684 J. J. Bodmer

'ATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2926 H. A. Bonneville
2948 G. Crawshay and J. Thomas
2957 G. Crawshay and J. Thomas
2959 J. R. Cadman
2960 A. Hawkins
2976 J. F. Belleville
2978 J. Whitehead
2986 T. Page
3012 J. M. Dunlop and F. Crossley
3061 P. G. B. Westmacott
3065 G. Haseltine

'ATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3038 W. Palliser
3097 C. W. Harrison
3136 J. Taylor
3111 J. B. Edmondson, J. Carson, and J. Blaylock

LIST OF SPECIFICATIONS PUBLISHED
For the week ending November 13, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
700	0 4	918	0 8	983	0 6	1034	0 4	1058	0 4	1082	0 4
804	1 8	928	0 10	985	1 6	1035	0 4	1059	0 4	1083	0 4
858	1 4	931	0 10	987	0 6	1037	0 4	1060	0 4	1084	0 6
864	0 8	933	1 0	989	0 6	1038	0 4	1062	0 4	1087	0 4
874	1 2	937	0 8	994	0 10	1041	0 4	1063	0 4	1089	0 4
890	0 8	940	0 8	995	0 6	1043	0 4	1064	0 4	1090	0 4
893	3 4	941	0 8	998	0 8	1044	0 4	1065	0 4	1092	0 4
895	0 8	942	0 10	1003	1 10	1047	0 4	1066	0 4	1095	0 4
896	2 0	943	0 8	1006	0 8	1049	0 4	1067	0 4	1103	0 6
900	0 8	957	0 10	1023	0 4	1050	0 4	1069	0 4	1104	0 4
907	1 4	959	0 10	1027	0 4	1052	0 4	1070	0 4	1106	0 4
911	1 0	962	3 0	1028	0 4	1053	0 4	1073	0 4	1109	0 4
913	1 0	963	0 10	1029	0 4	1054	1 6	1074	0 4	1110	0 4
914	1 6	967	0 8	1030	0 4	1056	0 4	1076	0 4	1121	0 4
915	1 0	973	0 8	1033	0 4	1057	0 4	1078	0 4	1231	0 4
916	0 8										

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2618	3073	3109	3130	3144	3158	3172	3185
2627	3075	3111	3131	3145	3159	3173	3186
2814	3079	3113	3132	3146	3160	3174	3187
2848	3083	3115	3134	3148	3161	3175	3190
2919	3087	3120	3135	3149	3162	3176	3191
2942	3090	3122	3136	3150	3164	3177	3192
2968	3093	3123	3138	3152	3165	3178	3193
2985	3095	3124	3139	3153	3166	3179	3194
3000	3097	3126	3140	3154	3168	3180	3196
3019	3099	3127	3141	3155	3169	3181	3198
3065	3101	3128	3142	3156	3170	3182	3200
3067	3103	3129	3143	3157	3171	3184	3202
3071	3105						

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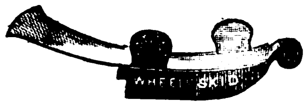
THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 26, 1869.

POUPARD *v.* FARDELL.

A CASE involving points of the greatest importance to patentees and inventors has just been argued in the Court of Chancery before Vice-Chancellor Sir R. Malins, and which occupied the court for six days. This case was briefly reported in our legal intelligence of last week, but, as it illustrates on the one hand the inevitable consequences of wrongful litigation, and on the other the importance of patentees having their inventions precisely and clearly defined, we purpose now to consider the whole case as it is presented to us by the evidence of the witnesses and the decision of the judge. The plaintiff in this case—Poupard *v.* Fardell—is the well-known weighing machine maker, of No. 7, Blackfriars-road, and is also the inventor of the serpentine screen described in these pages about twelve months since. In January, 1859, Mr. Poupard obtained letters patent for some important improvements in the construction of wheel skids, and which are embodied in what is now widely known as his curvilinear wheel skid. In order to render the subject perfectly clear we here reproduce the description of this invention as it stands in the plaintiff's specification:—"My invention consists in constructing a skid or shoe for the skidding of wheels in descending inclines with a tail-piece projecting from the back part and top of the skid chamber. This tail-piece may be carried entirely through the front of the shoe. I prefer to form it of wrought iron or steel, while the body of the shoe may be made of cast or wrought iron. I find the best results to be obtained when the projecting tail-piece is curved upwards, but I do not limit myself to so shaping it." The form of the skid is seen from the annexed cut. The history of the in-



vention is soon told, and the improvement will be easily realised by those who still use the ordinary skid. By chance, one day, the plaintiff noticed the inefficient way in which an ordinary skid acted at Blackfriars Bridge—the carter being obliged to use a whisp of straw, the object of keeping the wheel in the skid even then not being effected. On his return home the idea struck him as to how it might be obviated. The result was that he constructed the skid (for which he afterwards took out the patent), and tried it at night down all the London hills with perfect success. He then took out his patent, and his skid was supplied to between 500 and 600 omnibuses, besides other carriages.

Matters went on smoothly with respect to the skids, the plaintiff continuing their manufacture and sale until 1866, when he discovered that the defendant—Mr. Fardell, a carman in Hermitage-street, Wapping—was using similar skids for his vans. The plaintiff remonstrated with the defendant by letter, to which no answer was vouchsafed, but the result was that the use of the skids was discontinued—at least, their tails were cut off. But the partiality of the defendant for the plaintiff's skid developed itself again in 1868, when the infringement was discovered, and out of which circumstance arose the present suit. Some estimate of the importance of this cause may be formed from the fact that nearly 100 witnesses—about 60 for the plaintiff and 40 for the defendant—were examined by affidavit, and some of them in court. Amongst the plaintiff's witnesses were Colonel Phillpotts, of the Royal Horse Artillery, Quarter-master Serjeant Henderson, Wheeler-Major Green, Quarter-master Sergeant Bennett, Sergeant-Major Fairburn, Farrier-Sergeant Holt, Armourer-Sergeant Duffield, Sergeant Dovey, Sergeant Gadd, Gunner Owens, Gunner Crighton, and several artillerymen. In order to illustrate the case and present it clearly to the mind of the Vice-Chancellor—who had to act in the double capacity of judge and jury—a great number of skids, models, and actual articles used, or capable of being used, were produced in court. These may be divided into three classes—the ordinary skids used before the date of the patent, the plaintiff's patented skids, and the service skid used by the artillery for their guns. The old skids were formed flat with raised sides, a handle with an eye behind, and finishing at the other end somewhat abruptly, so as to form a sort of short trough for the wheel. Upon that there were improvements by bevelling off the corners of the raised sides, or, in their places, substituting two pairs of lugs or ears, and sloping off the substance of the floor of the skid. The service skid was very massive, also with a straight or level bottom and a large subtension of the hinder part, with an eye in it to hook on to the gun, and two pairs of lugs or ears, one pair having eyes in them. The plaintiff's skids were formed of two pieces of iron, or one of iron and one of steel, as described in his specification, with a projecting tail-piece of the upper plate, with two lugs or ears standing alternately or in pairs, and the whole chamber or course of the skid between the lugs formed a segment of a circle.

On the part of the plaintiff the evidence went to show that the invention was a new one, and its action most successful, the idea having occurred to the plaintiff as stated, and he not being able to discover from all the inquiries he had made that such a skid had ever been made or used. One of the plaintiff's witnesses, who was in the defendant's employ at the time the letter of remonstrance already referred to was sent by the plaintiff to the defendant, proved that in 1866, when the defendant was remonstrated with, by his orders the tail-pieces of the skids were cut off. After a lapse of time, however, nothing further being heard of the matter, they were resumed in the lengthened shape, by drawing out the iron if there was substance enough, or, if not, by shutting on another piece. With regard to the service skid used by the Royal Artillery, the defendant wanted to show that the tail-piece was equivalent to the continuation of metal in the plaintiff's skid. But it was clearly shown that the so-called tail-piece in the service skid was simply a massive eye-piece, which, being there only for the purpose of hanging on to the gun, was in the way and acted detrimentally. It was shown to be dangerous when used by a novice, inasmuch as if the skid was not placed before the wheel with great accuracy, the wheel might strike the eye-piece and send the skid flying. On the other hand, Colonel Phillpotts and all the other artillery witnesses stated that they considered the principle of the plaintiff's invention totally different, and highly superior to the service skid. The defendant's evidence was that the plaintiff's invention, so called, was not new, but had been known for some years antecedently to the patent, and the plaintiff's inquiries had been limited to London, it not being pretended that he had inquired either in Liverpool or Edinburgh—had he done so the result would have been probably different; that the principle of the plaintiff's and the service skid was precisely the same; that the incline was also the same when used; and that in 1854-5 the defendant had his skid altered and lengthened by a tail-piece put on the upper plate, with a curve.

The plaintiff's counsel contended that the value and novelty of the invention had been sufficiently made out, and that it had also been distinctly proved that the defendant had used skids made by his order precisely like the patented article, and that therefore the plaintiff was entitled to what he asked. The counsel for the defendant followed, insisting that the question was purely whether the invention was novel, not whether it was successful or valuable, admitting both those qualities; and it was immaterial, if it was not new, whether the plaintiff was ignorant of that fact or not. On his own specification, moreover—it was argued—the principle was the projection of the tail-piece, and the curvature and the other parts were not the principle, but only useful adjuncts; and therefore a straight skid with a straight tail-piece was as much an infringement as a curved one, and the concluding words, "this shape may be varied," threw the whole open. The curvature had been relied on; but here the specification itself denied it, and the tail-piece was the only novelty, which in fact was none. This was shown by the figures, which were merely for reference, and were valueless unless borne out by the specification. There was therefore no novelty, and the patent was bad, irrespective of the question whether the invention was a fit subject for a patent. If, said the defendant's counsel, a patent was defective as to the specification in part, it was bad entirely, and that was the case here. It had been proved that before the date of the patent the defendant had used skids in principle precisely similar to the plaintiff's. Mr. Glasse, Q.C., replied to the effect that the invention was novel and the patent valid, the specification being perfectly expressed and good.

In delivering a lengthy and elaborate judgment, the Vice-Chancellor first observed that it was a most unfortunate litigation, and one deeply to be deplored. The patent had been acquiesced in so long that it must be of great value to the plaintiff, whereas if the defendant succeeded, it would save him some £10 or £12 which the purchase of the plaintiff's skids would cost him. The Vice-Chancellor observed that there were two points raised—novelty and the sufficiency of the specification. It was sworn by one of the defendant's witnesses that thirty years ago, and therefore many years before the plaintiff's patent, he, as foreman of a manufactory, had superintended the making of skids with projecting tails for the top plate. In point of fact, that was identical in principle with the plaintiff's skid, and if that witness was to be believed there was an end of the plaintiff's case. But, from his demeanour and evidence, his Honour distrusted him, and considered that he was not to be relied upon. There was nothing to confirm his evidence, and four witnesses contradicted him. He (the Vice-Chancellor) therefore disbelieved him. Not that, perhaps, he meant to commit perjury, but, from beer or some other cause, he did not remember what happened even last week. Then, as to the field service skid, Colonel Phillpotts, Quarter master Sergeant Henderson, and others, contradicted the supposition that that skid was the same in principle with the plaintiff's. The tail was not to guide the wheel, but merely to hook up to the carriage. It was agreed by all these witnesses that it was a most inefficient one, and that accidents occurred from the tail-piece, which was an impediment instead of an advantage. Colonel Phillpotts deposed that the plaintiff's tail-piece was of great practical utility, and valuable to the public. The defendant's case, therefore, failed as to prior user by the Royal Horse Artillery.

Next, with regard to the use by the defendant himself, his Honour observed that there was a painful conflict of testimony. One set of witnesses had sworn that for years before the patent it was used by the defendant, and the other set that it was not. In this state

of things, sitting as a jury, his Honour must believe one set and disbelieve the other. What were the antecedent probabilities? The defendant was largely engaged in trade, and for many years employed skids, and in 1866 the plaintiff wrote to him on the subject of his using skids similar to the patented one. But he did not reply to that letter, and if he had then stated that since 1854 he had used them, this litigation would never perhaps have arisen. The defendant had not been cross-examined, but a great number of others for him had been, and they all deposed to the same effect—namely, that they used them. There was a body of testimony the other way, that the lower plate was always the longest, and it was impossible to reconcile the two; and on this point the defendant's case entirely failed—there had been no prior user by him. The invention was therefore novel, was admitted to be important, and was properly the subject of a patent. The plaintiff's improvement therefore being novel, important, and properly the subject of a patent, and having been acquiesced in for ten years, the question was whether the specification was sufficient.

Upon this point his Honour observed that Lord Eldon's view that the specification must be so precise as to enable a person to make the article without the drawings was no longer the law, for a specification might now consist of a figure only. Mr. Poupard's specification, with the drawings accompanying it, explained his invention with sufficient clearness to prevent the public from being misled. The words "but I do not limit myself to so shaping it" would have been better omitted, but upon none of the authorities cited, and upon no principle of justice, could he come to the conclusion that the introduction of them vitiated the patent. The plaintiff was entitled to the perpetual injunction for which he asked; to the delivery up by the defendant of all patented skids in his possession; to an account, and to an inquiry as to damages; and the defendant must pay all the costs of the suits.

Such, then, is the judgment in the present cause, and we wonder how anyone could be found so ill-advised as to persistently defend it in the face of easily ascertainable facts. The result teaches two practical lessons. The first is the folly—if nothing worse—of defending in a frivolous and vexatious manner a clear and unquestionable infringement upon the grounds of prior user, so little was really to be gained by it, and so much certainly stood the chance of being lost. Had the defendant won the cause he would only have saved himself some £2 or £3 a year for three years, as the patent expires in January, 1873. On the other hand, he stood to lose time and money to a very considerable extent, besides that loss of moral reputation which invariably follows the endeavour to deprive others of their just rights, and to persistently defend such a course of action. The second lesson inculcated by these proceedings is the necessity of inventors at all times making sure that their specifications are sufficient. This can only be effected by the employment of competent and responsible agents. The specification in the present case was prepared by Messrs. Robertson, Brooman, and Co., patent agents, of 166, Fleet-street, and was found proof against all the specious devices which could be invented to destroy its validity. It was, as the Vice-Chancellor expressed it, "sufficient." And so should all such documents be, neither redundant nor involved, neither vague nor obscure, but stating in plain and precise terms the nature of the invention, and clearly illustrating the same where necessary. "That was certainly the case here," said his Honour. Had it not been so, the defendant would most probably have gained the cause. The results would have been disastrous in the extreme to the plaintiff, besides the injustice that would have been committed in the name of the law in allowing an imitator to benefit by the brains of the legitimate inventor. As the case stands, clear evidence and an unassailable specification have given the victory to talent, industry, and inventive genius.

THE "THISTLE," THE "ROCKET," AND THE "TEAZER."

WERE we not living in the latter half of the nineteenth century, it is very probable that we should now be consulting the stars or some other equally satisfactory oracular source of information, in order to find out what evil genius or fatality was working against British gunboats. We might be inquiring whether Neptune was angry, or whether the mythical inhabitants of the vasty deep were extramischievously disposed at the present season of the year, in order to account for the unwonted series of accidents that have just befallen three of her Majesty's ships of similar build, capacity, and armament—to wit, the "Thistle," the "Rocket," and the "Teazer." The first occurrence was the calamitous boiler explosion on board the "Thistle," which has of late absorbed public attention. Next came the "Rocket," sister ship to the "Thistle." She was being taken out this day fortnight for a run over the measured mile when her boilers primed to an alarming extent. Nearly all the water was blown out of the boilers, and the fires had to be drawn, there being a very narrow escape from an explosion. To complete the series of accidents, we now have the "Teazer," a similar vessel to the other two, getting into trouble. In this case the "Teazer" was being taken from Portsmouth Harbour for the trial of her engines, preparatory to taking the place of the unfortunate "Thistle." She was placed in pilotage charge of a staff commander of the steam reserve, instead of a Queen's pilot, who is properly qualified and appointed for this service. The result was that she ran foul of the "Trafalgar," smashing a new cutter belonging to the "Teazer," and carrying away some of her mizen topmast rigging, besides carrying away the ensign, gaff, and doing other damage to the "Trafalgar," the whole amounting to at the least £50. It appears that if a proper Queen's pilot had been placed in charge the cost to the country would have been something under fifteen shillings, a very different figure of cost from that now presented. Surely discretionary powers should be given to the admiral, superintendent, or master attendant, to place in charge persons who are duly qualified for such a responsible duty, and for the protection of valuable property. Some folks — representatives of the "good old times"—hold that when one accident or fatality occurs, two more must follow, to make up the mystic list of three. We trust, now that we have completed this triangle, we shall have no more catastrophes or casualties in her Majesty's fleet.

Since the foregoing was written, another of her Majesty's ships has had a narrow escape from getting into trouble and thus completely upsetting the triangular theory of accidents above alluded to. The victim of circumstances this time was the "Druid," a wooden corvette of 10 guns, 1,322 tons, and 350-horse power nominal. She was taken on Tuesday last from Sheerness Harbour to the measured mile on the Maplin Sands, to try her engines and speed. The vessel had been tried on the Saturday previous, but was obliged to return to harbour at an early hour, in consequence of its being found impossible to retain the necessary pressure of steam, viz., 30lb. to the square inch, in the boilers, the cause being the leaking of the valves. Time was needed to remedy this defect, and the vessel accordingly remained in port until Tuesday. As far as the trial of speed and handiness of the ship went everything proved very satisfactory, although it was again found almost impossible to retain the necessary supply of steam. During the runs at full boiler power, however, the ship herself vibrated and shook fore and aft in the most unusual manner, her stern jerking with a most unpleasant lateral motion. The fore and mizen masts, from the step to the truck, also oscillated to such a degree that it seemed as though the rigging had never been made taut. After her trials the "Druid" was put under easy steam and headed for port, a fog coming on at the time. She steamed slowly for half an hour, when the leadsman announced shoal water, which was quickening. The engines were at once stopped, and the vessel backed astern, when it was found that the compasses, which were correct when the vessel left the harbour in the morning, had got out of gear, and would not travel at all. This was a decidedly uncomfortable state of things—a thickening fog, the evening closing in, the vessel out of sight of land, and out of her proper course, in shoal water. The "Otter" steam tug, however, hove in sight, and she shaped the true course of the "Druid," which vessel was then found to be about a quarter of a mile below the "Nore Light Ship," and heading seaward instead of homeward. At length the well-known black buoy was found by the "Druid's" look-out men, and, thus relieved of her difficulties, the vessel made the best of her way out of the fog and into the harbour. A court martial will probably sit on the recreant compasses and their maker, and so here endeth for the present this chapter of accidents.

PHOTOGRAPHS OF THE PLANET MARS.

MR. JOHN BROWNING, F.R.A.S., is now publishing some beautiful photographic stereograms of the planet Mars, showing its islands, seas, continents, and snow-clad poles. As the image thrown by Mars upon a photographic plate by the telescope of Mr. Warren De La Rue, F.R.S., is only about as big as a pin's head, without some explanation Mr. Browning's large, well-defined stereograms are a complete mystery, and we must confess to having been perfectly puzzled at the first sight of them. Manifestly he could not have photographed them direct from the planet, as the details were far too perfectly defined for such a mode of operating to have been employed. Obviously also the photograph was not taken from a drawing, because in the stereoscope the planet shows up with solid rotundity. A pamphlet, by Mr. R. A. Proctor, B.A., F.R.A.S., which accompanies the stereograms, solves the question.

A few years ago, Mr. Browning made a globe of Mars, and all the details were given with very great accuracy, for not a single feature was marked which had not been seen more than once, and mapped, by such keen reliable astronomical observers as Dawes, Herschel, Madler, Secchi, and Lockyer. This globe he exhibited at the Royal Astronomical Society in 1868, where it was much admired. The stereograms, therefore, are in reality photographs of Mr. Browning's globe. To get the necessary softening round the edge of the disc, Mr. Browning first tried vignetting, but as the results were unsatisfactory, the negatives were printed without vignetting, and the edges of the planet afterwards softened by hand.

Five stereograms of the planet have been taken, and all of them are good ones. Mr. Proctor's pamphlet is also handsomely printed and very interesting, as the following quotation, with which we close this brief notice, will show:—"Throughout the whole of the solar system there is no object which affords so many points of resemblance to our own earth, or exhibits so clearly the signs of

adaptation to the wants of living creatures, as the small orb which is our nearest neighbour among the exterior planets. With oceans and continents such as we have; with polar snow-caps widening in the Martial winter, and melting again under the returning sun of the Martial summer; with an atmosphere supporting clouds and mists, carrying the vapour from his seas to aggregate in snow and ice around his poles, or wafting refreshing rains over his continents; Mars presents a scene which it requires no very lively exercise of the imagination to dot with villages, towns, and cities peopled with busy workers. Over those seas—we may well believe—ride the navies of unknown nations; across those continents lie the tracks of a busy civilisation; and, over all, a ruling Providence extends which sways the destinies of terrestrial races."

DR. LIVINGSTONE.

INTELLIGENCE of the safety of Dr. Livingstone has just reached us from Bombay, and will be welcomed wherever it is made known, both in England and on the continent, and, in fact, wherever the labours of this great explorer are known and appreciated—and where are they not? This confirmation of the veteran traveller's safety comes in a telegram which was received on Wednesday at the India Office from the Governor of Bombay. It reports that a letter had been received from Dr. Livingstone dated Ujiji, May 13, 1869. This letter is nine months' later intelligence from the Doctor than formerly received. We may now, therefore, reasonably presume that the dauntless explorer has surmounted the worst dangers, and that his researches are progressing without any more than natural impediments. We last heard of him from a latitude far beyond the limit reached by Grant, Speke, or Baker, and this ten months since. In these remote regions, far away from family or friends, and practically cut off from all communication with the outer world, Livingstone keeps on his course, untired and undismayed. He knows that the great end and purpose of all his toilings and wanderings is not the glory which they will shed on his name. He knows, too, that it may be long ere the discoveries he has made, the lakes, watersheds, and lands of promise he has mapped out, shall be of practical value to man. But he also knows and feels, as a Christian and a philanthropist, that he is opening up a wide field for the spread of civilisation, and, as a practical man, he knows that there is an abundance of material wealth in the earth and on its verdant slopes and plains for man to develope and utilise. He is the great pioneer pointing out the path, which, however, may not be trod before he has ceased from his labours. But the whole civilised world appreciates, and stands still to admire, the noble self-sacrificing labours of the man in whose safety we now rejoice, and of whose return we once more have every hope.

CONCRETE.

WERE any proof required of the necessity that exists for practical information respecting the proper manner in which to make concrete, it is to be found in the failures that have attended many of the efforts to build with it in the mass or bulk. These are frequently attributed to an imperfect method of constructing the frames, of adopting a wrong principle of dealing with the material, and of hurrying the work. No doubt all of these causes and many others contribute towards the want of success, but the real source of mischief lies in the fact that the concrete is not properly made. From the slovenly, careless manner in which this conglomerate is often made, and the little care taken to ensure that thorough incorporation and amalgamation of the ingredients which is indispensable to a good concrete, the whole mass is frequently utterly useless and valueless. In this condition it possesses neither powers of setting nor of resistance, and whatever superstructure may be reared upon it would be a great deal more secure without a foundation so treacherous. Mr. Reid, whose volume on the "Manufacture of Portland Cement" is well known to the profession, has been for a long time impressed with these facts, and the object of the present treatise* is to afford sound practical rules, the observance of which will always ensure the preparation of a reliable concrete. There are two principal classes or descriptions of concrete. The one is that in which lime constitutes the chief amalgamating ingredient, the other in which a cement is substituted for the lime. It is needless to remark that the latter is the more expensive article, although not to the extent that might be anticipated, because the cement will stand a larger proportion of what our author calls "aggregates" than even the best lime. If we regard lime or cement as the basis of all concretes, then whatever other ingredients may be used they come under the term of "aggregates."

Mr. Reid devotes the first part of his treatise to the "bases" of concrete, commencing with lime. There is a difference to be noticed here in the nature of a concrete made with lime and one made with cement. The former, if properly manufactured, will possess superior cohesive properties to the pure lime, whereas in the latter case samples of pure Portland cement have been proved to be stronger than those mixed with sand or gravel. The use of puzzolana, which is of volcanic origin, commenced in this country with the erection of the Eddystone Lighthouse, and to the success which attended its mixture with various kinds of limes may be traced the subsequent manufacture and introduction of Portland cement, which now plays so important a part in nearly every engineering and architectural work of magnitude. One advantage of puzzolana is that it can be used in its natural condition. At the same time it is beneficial to slightly burn some of the varieties, as they then amalgamate better with lime. Previous to the employment of Portland, Roman cement was that most in favour, but it has been nearly completely superseded by the former material. Roman cement was never a cheap cement for several reasons. Firstly, the "clay balls" from which it is procured were difficult and expensive to obtain; secondly, the cost of carriage was heavy; thirdly, it could not be profitably manufactured on a small scale; and, fourthly, it is not able to bear much sand. In all important works it was used pure, as, for instance, in the Thames Tunnel. This cement may be easily known from Portland, not only by the great difference in colour, but from its inferior weight, which should not exceed 80lb. per imperial bushel. Portland cement may reach so high as 120lb. and even 130lb. per bushel without being of a spurious character, although our author recommends 110lb. as about the right weight. The peculiar property of Roman cement is that it sets very quickly. It is thus very valuable for pointing the joints of a dock wall, or other building exposed to the action of running water, the stones of which have been laid in the ordinary manner. Medina, which is only a variety of Roman cement, may be also advantageously applied in this manner.

The next chapter is an epitome of the more detailed account of Portland cement given in Mr. Reid's former publication, so that we shall pass on to the other ingredients or aggregates. Clean sharp river gravel, such as Thames ballast, is, on the whole, the best description of aggregate, but broken stones, bricks, slag, ashes, and, in fact, almost any hard material reduced to small dimensions, will answer the same purpose. The sharper and more angular the aggregate the better, as it possesses greater binding properties than smooth rounded particles. We have frequently witnessed stones, such as shingle, being used without any preparatory breaking up, or any attempt being made to bestow sharp edges upon them. It is also necessary that an aggregate should not be of a porous, absorbent nature, or it might otherwise abstract from the base, whether lime or cement, with which it is mixed, the water it contains, and so prevent the subsequent induration of the mass. The cause of the setting of limes, cements, and concretes has never been clearly or satisfactorily accounted for, although the supposition is that the lime which in one shape or another exists in them all has a tendency to return to its former condition of a carbonate. Our knowledge on this point is very imperfect, and it is questionable whether it will ever be anything else. It constitutes one of those operations of nature which we can only judge of by their effects. So long as concrete was employed only in the foundations of buildings, there did not exist so great a necessity as there is now for its careful preparation. It ought at all times, and for whatever purpose it is required, to be properly prepared, but since its application to the building of walls, houses, and superstructures generally, a greater degree of skill, intelligence, and care must be employed. The old method of mixing the ingredients by manual labour is now superseded by the more modern appliance of machinery, so that, provided the ingredients, bases, and aggregates be of good quality, the concrete will necessarily be equally good. We fully endorse the advice of the author, which prohibits any but ground lime being used for making lime concrete, employing the latter term in contradistinction to cement concrete. A great error in the preparation of concrete is the superfluous quantity of water used in the mixing. It is not an uncommon circumstance to witness a mass of concrete quite drowned in water, and this, too, when it is intended to be deposited in a wet situation. We remember once having to lay concrete in a very wet foundation, and we simply mixed it *in situ*, which answered remarkably well. Both the Roman and Portland cement may form the base of a cement concrete, but the former is now but seldom employed. It nevertheless is valuable in situations where there is running water to contend against, from the greater rapidity with which it sets, but in general utility and application it bears no comparison with the more recently manufactured article. After describing the various machines by the aid of which the labour formerly requisite to make concrete is now obviated, Mr. Reid concludes his volume with some general observations of a practical character. In a sanitary point of view, the application of Portland cement concrete to the erection of houses would be attended with considerable domestic advantages. Damp walls are the cause of more sickness in young and old than people are probably aware of. What is required in all the houses of the poorer class are walls that will wash and yet not retain damp, and this could be obtained by the employment of Portland cement concrete. Plates are attached to Mr. Reid's volume, containing illustrations of moulding, testing, grinding, and concrete-mixing machines, and the treatise is calculated to be of the greatest service to the practical man. All builders should have it in their possession, and those who have anything to do with the purchase, sale, or application of limes and cements

* "A Practical Treatise on Concrete, and how to make it, with observations on the uses of cements, limes, and mortars." By HENRY REID, C.E., author of a "Practical Treatise on the Manufacture of Portland Cement." London: E. and F. N. SPON, 48, Charing Cross. 1869.

will find in it rules for their guidance which will be of pecuniary importance to them. The publishers have brought out the book in their usual excellent manner, and our readers who are interested in its contents have only to purchase it to be satisfied of its merits.

TELEGRAPHIC NOTES.

THE Postmaster-General has recently given his sanction to the adoption of the Army and Navy telegraph code, by means of which telegraphic correspondence is carried on in cypher. The code system is the invention of Major Bolton, and its simplicity and ingenuity are seen from the example given below. The principle upon which the system is based consists in giving an individual number to the most frequently recurring sentences and phrases in a language. The code embraces every conceivable sentence and phrase the English language contains. These stand in alphabetical order, numerically arranged under the head of a certain page. As an example of its working we will assume that the following message is to be transmitted:—"Cotton is falling and I should not advise you to buy." On turning to the letter C of the code, we find the word Cotton at page 094, and the exact sentence we require numbered 07, so we write 09407. In this way the message is forwarded in code, beyond the least chance of being tampered with or mutilated. The advantage in favour of the code is that those using it can ensure perfect secrecy for their despatches, and it is applicable to every written language. A comparison of the Bolton or Army code system with the Morse system is afforded by a series of experiments which were conducted on board the "Great Eastern" in 1865 in the presence of the most eminent English and American electricians of the day. As a specimen of the results we may take the following:—Three identical messages were transmitted through the whole length of the Atlantic cable by means of the Bolton code, and also by the Morse system; the time required for their transmission and the number of symbols used was as follows:—Number of groups of figures by the Bolton code, 56; number of letters by the Morse system, 611; time by the code, 27min. 45sec.; time by the Morse system, 74min. 30sec. It will thus be seen that the Morse system required about three times the number of symbols and nearly thrice the time requisite for the transmission of the same messages by the Bolton code.

The directors of the Telegraph Construction and Maintenance Company have called a meeting of the shareholders for the 30th inst., for the purpose of considering the propriety of reducing the capital of the company—which now consists of 37,350 shares of £20 each fully paid up, being equal to £747,000. It will be remembered that at past general meetings of the shareholders the chairman, in referring to the accounts, pointed out that a considerable portion of the capital was represented only by the goodwill of the businesses purchased from the Gutta Percha Company, and Messrs. Glass, Elliot, and Co., and that the board desired to reduce this item as early as possible, and to leave the capital at the amount which would be represented by actual and available property and securities of the company, and the shareholders expressed their approval of this course. The satisfactory operations of the company during the last eighteen months enable the directors in their report to recommend the shareholders to begin to carry out this policy at the present time. It will therefore be proposed to the meeting that £4 per share of capital should be returned to the shareholders at the end of the present year, and that as soon as practicable a further return of capital of £4 per share should be made, leaving £12 per share paid up, or a total of £448,200, which will be fully covered by buildings, plant, stock, and stores of the company. If the shareholders sanction this arrangement, the necessary legal steps will be taken under the "Companies' Act, 1867," to reduce the nominal amount of the capital of the company, so as to leave the shareholders free from liability for future calls.

The report of the West India and Panama Telegraph Company, to be presented to the shareholders at their first meeting to be held to-day, states that the number of shares allotted is 43,710, which, with the 5,000 fully paid up shares to be handed to the contractors in part payment for the cable, represents an available capital of £487,100. The manufacture of the cable has been commenced, and 498 miles have been already completed to the entire satisfaction of the company's engineer. The directors anticipate that the greater part of the cable may be sent out by March next. A communication has been received from the Governor-General of the Leeward Islands, expressing a desire that those islands should be included in the company's scheme, and negociations are in progress for settling the terms.

The Council of the Society of Arts, looking at the fact that the Government have now taken under their control the whole of the telegraphs of the United Kingdom, have appointed a standing committee of the Society to watch the interests of telegraphy generally, as well as to promote the progress of the science and the efficiency of the system. The following gentlemen have been invited to serve on this committee:—Lord Sackville Cecil, the Earl of Caithness, F.R.S., Sir W. Fothergill Cooke, Mr. Latimer Clark, Mr. Hyde Clarke, D.C.L., Colonel Glover, Professor Guthrie, Sir J. F. W. Herschel, Bart., F.R.S., Professor W. A. Miller, F.R.S., Mr. C. W. Siemens, F.R.S., Professor Tyndall, F.R.S., Sir William Thomson, F.R.S., Mr. Cromwell F. Varley, and Sir Charles Wheatstone, F.R.S. Telegraph wires are to be carried from the Great Eastern Railway goods station at Wisbeach to a house in Bridge-street, where the telegraph business of the town will be conducted on and after January 1. The wires in connection with the Oundle Post-office will form a junction with the London and North-Western Railway at the Ashton crossing. The distance from the point of junction to the post-office is about a quarter of a mile. An additional room is being fitted up at the Boston Post-office, which will be entirely devoted to telegraphic business. Posts and wires are being erected between the railway stations and the post-offices of Louth, Gainsborough, and other Lincolnshire towns.

We read in the "North German Correspondent" that the project of leasing a wire of the submarine telegraph between England and America for the exclusive use of Germany has been brought to a successful issue. The old cable will now pass entirely into the hands of the German company, its owners only reserving the right of using it when their own is injured. The communication between Valencia and Berlin via London will be also carried on by a line exclusively under the management of the German company.

The following telegram having reference to the Suez Canal and the telegraph has been received by the Telegraph Construction and Maintenance Company:—"Nov. 20, 11 a.m. "Hawk" at Suez, after most successful passage throughout. Make your arrangements for passing Suez section (of cable) through canal. Briscoe will send you soundings, which have been most carefully taken. Seventeen feet will easily pass."

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

UTILISATION OF THE RETURN CURRENT IN SUBMARINE CABLES—ARTIFICIAL IVORY—PRESERVATION OF TELEGRAPHIC POSTS—METEORS.

A COMMUNICATION to the Royal Academy of Sciences of Brussels, by M. Zantedeschi, offers an idea which we present to practical telegraphists for what it is worth. Regarding, as has been often said before, a submarine cable as a Leyden jar, the author points out that when the inner insulated wires convey a message from Europe to America, the message is re-conveyed from America to Europe by the wires forming the outer portion of the cable, and he proposes to establish instruments at each end to receive this return message, so that the operator may see that the telegram has been correctly transmitted. The details of the author's plan are not before us; but electricians will be able to judge whether or not his idea is worthy of consideration.

A process for producing artificial ivory has been published in a German journal. The inventor, whose name for the moment escapes us, makes a solution of indiarubber in chloroform and passes chlorine gas through it. After this, he heats the solution to drive off any excess of chlorine, and also the solvent, whereupon he has left behind a pasty mass with which it is only necessary to incorporate sufficient precipitated carbonate of lime or sulphate of lead, or, indeed, any other dense white powder, to obtain a material which may be pressed into moulds to form whatever articles may be desired. The details of this process are obviously incomplete, and the success of it may be doubted. Only good and well masticated rubber could be employed, and even then a dilute solution must be made, and any earthy impurities allowed to deposit. In the next place, we are doubtful of the bleaching action of chlorine on rubber, and, moreover, chloroform is, under some circumstances, decomposed by chlorine. Lastly, it is clear that, to obtain a hard material at all resembling ivory, it would be necessary to make a "hard cure," for which a considerable proportion of sulphur would be required. The simple purification of indiarubber by means of chloroform would, however, furnish a mass of a very fair colour.

A Belgian report on the preservation of telegraphic posts decides that chloride of zinc is the best and cheapest agent to employ. It is admitted that differences in the soil in which the posts are set make considerable differences in the preservative action of the matters employed. Thus, while sulphate of copper succeeds admirably well in some situations, it is shown that calcareous soil tends to produce a decomposition of the sulphate, and a very sandy soil draws out the salt from the wood. Creosote, the report says, possesses many advantages, and in particular is very cheap, but the Belgian administration consider that these advantages are more than balanced by difficulties in manipulation, and they have given up the use of creosoted posts.

The meteoric showers of the 13th and 14th were concealed from view in this country by a thick canopy of cloud. Some glimpses of them were caught at Luxemburg by an eminent observer, M. C. C. Gravier. We shall no doubt have further accounts from the French astronomers who went to the south of France to observe, where, however, it is likely that although no clouds intervened the brightness of the moon may have rendered all but the nearest to the earth invisible. Awaiting those observations, we turn for a moment to some recent speculations on the phenomena presented by these remarkable bodies. The incandescence of meteors which alone renders them visible has in general been attributed to the heat developed by friction against our atmosphere, but it is now suggested by M. Govi, who is supported in his opinion by Regnault, that the heat is really developed by the compression exerted on the air by the weight and velocity of the stone. This idea is also adopted by M. Delauny, who starting with it explains all the phenomena attending the fall of a meteoric stone, the explosion more or less violent which is generally heard, the fact that the stone falls to the earth with a velocity relatively slight when compared with the rate at which it traverses the sky, and, lastly, the circumstance that the fragment is entirely covered with a vitrified crust. The compression of the air exerted by the meteor must produce a resisting pressure on its anterior part, which M. Delauny estimates as at least equal to a pressure of twenty-two atmospheres, and this he considers sufficient to produce the rupture of the stone. When the rupture takes place the small fragments are driven back behind the principal mass, and thus a vacuum is produced and air rushing in produces a noise just as when a cannon is fired. At the same time the initial velocity of the fragment is destroyed, consequently it falls to the earth with only the force determined by its own weight. Lastly, the extreme compression of the air raises the temperature sufficiently high to produce a superficial fusion of each fragment, and hence the enamelled surface observed.

We may add to this some highly interesting remarks by M. Stanislaus Meunier, on the Deesa meteoric stone, in which he finds evidence of eruptive rocks, such as we know on our globe, and from which he draws most important consequences. To M. Meunier meteoric stones are fragments of a star or world in ruins. The sun, he conjectures, is an example of a star in its first stage of evolution, our earth is an illustration of the second stage, that of life properly so called, while the moon is to be considered a dead world, and meteors the result of the decomposition of some other body. It is unpleasant to read that the moon shows signs of dropping to pieces, but possibly it may last our time.

THE LOW WATER BASIN AT BIRKENHEAD.

AT a meeting of the Institution of Civil Engineers held November 9, 1869, Mr. C. H. Gregory, president, in the chair, the discussion upon Mr. Ellacott's description of the low water basin at Birkenhead, which had been adjourned from the last session, was resumed and concluded.

In the course of the discussion it was remarked that the Low Water Basin should be of the utmost value to the commerce of the Mersey, inasmuch as the bottom of the basin was 12ft. under low water of spring tides, while the sill of the Princes Dock, at Liverpool, was 2ft. 10in. above such low water. The works, however, as actually carried out, differed materially from the plans proposed by Mr. Rendel, as would be seen from the following figures:—

	Mr. Rendel.	Actual.
Area of basin	37 acres ...	14 acres.
Sectional area at entrance to river, at low water	4,200 sq. ft. ...	3,600 sq. ft.
Aperture of sluices ...	1,820 ,, ...	826 ,,
Ratios of areas of sluices to area of basin at entrance, at low water	1 to 2·3 ...	1 to 4·33

From this it would appear that, in order to produce a given flow from the basin into the Mersey at low water, the velocities through the sluices must, by the actual plan, be 1·85 time as great as those intended by Mr. Rendel; and, if the action of a stream of water were as the square of the velocity, the destructive effect would be about 3½ times greater. It was further observed that the discharge from two sets of sluices, separated by an interval of 120ft., differed essentially from the continuous sheet advocated by Mr. Rendel; and that the result of such differences would lead to eddies and foul currents. Again, although the levels of the sills of the sluices were about the same as in the original designs, yet, in place of the water having a short run through the sluicing chambers, the inner ends of the bottoms of these passages were at a level of 8ft. below the Old Dock sill, and distant, on an average, 265ft. from the paddles, the sills of which had been placed at a level of 18ft. below the Old Dock sill, thus creating a fall outwardly of 10ft., and from the sills of the paddles to the extremity of the apron another fall of 3ft., making together 13ft. from the inlet side of the sluicing passages to the bottom of the low water basin. It was argued that such a fall must have a tendency to tear up the bottom at the extremity of the apron. It was also pointed out that the use made of the sluices, as recorded in the paper, was entirely at variance with the use proposed by Mr. Rendel, who had repeatedly and distinctly stated that the sluicing was only to remove the material brought in by the tides, say about 1-10in. of newly-deposited silt every twenty-four hours. Now, it was stated in the paper that the actual sluicing operations had been directed to the removal of a depth of 32in. of clay, and the quantity displaced on fifty-six occasions was estimated at 106,100 cubic yards, which was about equal to 1in. over the whole surface of the basin, or ten times the amount originally contemplated. Further, the velocity of efflux was never intended to exceed 5·08ft. per second, whereas, on the 18th, 19th and 20th of August, 1864, it was calculated that the velocity of discharge had been 30·87ft. per second, while if the whole of the fifty-six days were taken, it would be found that the average velocity of discharge was 26·54ft. per second. It was not stated to what height the sluices were drawn, but it was presumed that they must have been opened to their full extent. In making trial of such an important work, it would have been judicious to draw the sluices about 18in., or a little more, at one time, opening some of them, keeping others closed, and interspersing the apertures in such a way as to cause the current to act in the most efficient manner throughout the low water basin. If this had been done it was believed that a current of 2 miles per hour would have sufficed to clear the basin of all ordinary deposits.

On the other hand, it was contended that in 1856 the Parliamentary plan of Mr. Hartley abolished the low water basin, and substituted in its place an outer dock, with locks, and a small entrance basin recessed back only 400ft. from the Mersey; but the low water basin was subsequently forced upon the Liverpool Corporation by the railway interests. The original idea in treating Wallasey Pool was that it should form a great highway leading to docks to be ultimately found on its margin. In 1858, however, an alteration was made, and Wallasey Pool was no longer regarded as a highway, but as a great dock. Obviously, then, what would apply in the one case would not apply in the other. It was asserted that the mode of sluicing suggested was inapplicable, as far as the working of the dock was concerned, and that it would have failed to keep the low water basin open. It was maintained that there was no volume of water available to produce the requisite current, and therefore that the Liverpool authorities had acted wisely in determining to abandon the project, and at once to make a dock, with a small tidal basin, so far recessed from the Mersey that it could be kept open by sluicing from the gates above.

It was stated that throughout the controversy in 1844, it was distinctly urged that it was not intended that the water should have an inclined downward action, but that it should issue from the sluices horizontally. It was alleged that the sluicing had failed, from the water having been projected downwards, which, so projected, followed the same law as a solid mass; it was reflected upwards, and produced an upper current. It might be quite true that in 1853 it was difficult to get water to maintain the low water basin; but the conditions were very different in 1844 and in 1853. It was proposed, in 1844, that the float should be filled at every tide to the level of the tide of the day; and inasmuch as the indraft from the Mersey would have been at the rate of ½ a mile per hour during the six hours of flood tide, the water would only carry material due to that velocity. But the rate of discharge was to have been 2¼ miles per hour—a velocity amply sufficient to remove particles brought in by the flood.

In seeking for the cause of the failure of the sluicing operations, it was contended that the first thing to be regarded was the work to be done, and then the means provided for doing it. The primary object was to set in motion the body of water contained in the low water basin. This was 1,750ft. in length, and varied from 300ft. to 400ft. in width; and the depth when the sluicing was commenced was 19ft. 4in. The weight of the water to be set in motion, or simply to be started, was 338,275 tons; and for this purpose twenty sluices were provided, having a combined area of 826 square feet, with a head of water against them at the first sluicing trial of 14ft. 3in., producing a total pressure of 336 tons, or less than the one-thousandth part of the load. This was a greater disproportion than was found to exist in other instances where a load had to be moved with a comparatively small power. Some intermediate gearing was wanted between the power and the weight; but in the work as carried out this had not been supplied. The 336 tons of power seemed to have been employed against the 338,275 tons of load at a velocity of about 17 knots per hour; that had simply had the effect of disturbing portions of the water, and throwing the water into a state of great confusion. Gradually the water appeared to have attained a more uniform motion, but at the end it resembled a series of eddies and strong currents rather than a stream.

With regard to the question of sluicing in water of considerable depth, it was observed that Mr. Rendel had evidently contemplated the removal of the deposit, not by the direct sluicing and violent action of the water rushing out of the Great Float, but by setting in motion, gradually and at a much lower velocity, the large body of water which had been previously collected, or which remained in the low water basin. The silt in the Mersey was of a very binding quality, and when it had once aggregated it was difficult to move it except by great violence. There were sandbanks in the Mersey which resisted a velocity of from 8ft. to 12ft. per second; and therefore it was that Mr. Rendel had proposed very frequent sluicing, so as to prevent any serious amount of deposit and of aggregation taking place. Upon the general question of sluicing it was remarked that if it were intended to effect scour by setting a large quantity of deep water, or at least a substratum of water, in rapid motion, it would be utterly impossible. No doubt, in the immediate proximity of the aperture of emission, the water would issue and would flow for some distance with a velocity due to the head of water with which it was propelled—in the case under consideration from the interior of the Great Float. But there were causes which prevented that action continuing to any considerable distance. In the first place there was the enormous friction between the moving water and the immovable bottom over which it flowed. Besides that, a volume of water moving with a high velocity through a body of water in a nearly qui escent state encountered a large resistance. When the endeavour was made to sluice the bottom of the Great Float at the Birkenhead Docks, the water rose up, spread out until it assumed almost an umbrella shape, and moved the deposit away for a short distance; then, as the water lost its velocity, the deposit again collected in banks, and the sand accumulated and aggregated, while a succession of waves was produced in the basin. It was admitted that, under ordinary circumstances, it was possible to effect sluicing provided a sufficient quantity of water was obtained to give that general velocity, not bottom velocity merely, necessary to move the particular material to be dealt with; but it was impossible to establish a bottom velocity of great amount for any considerable distance. The opposite was indeed the case,—that the velocity of the water at the bottom was always less than the velocity at the top, except in the immediate neighbourhood of the sluicing operations.

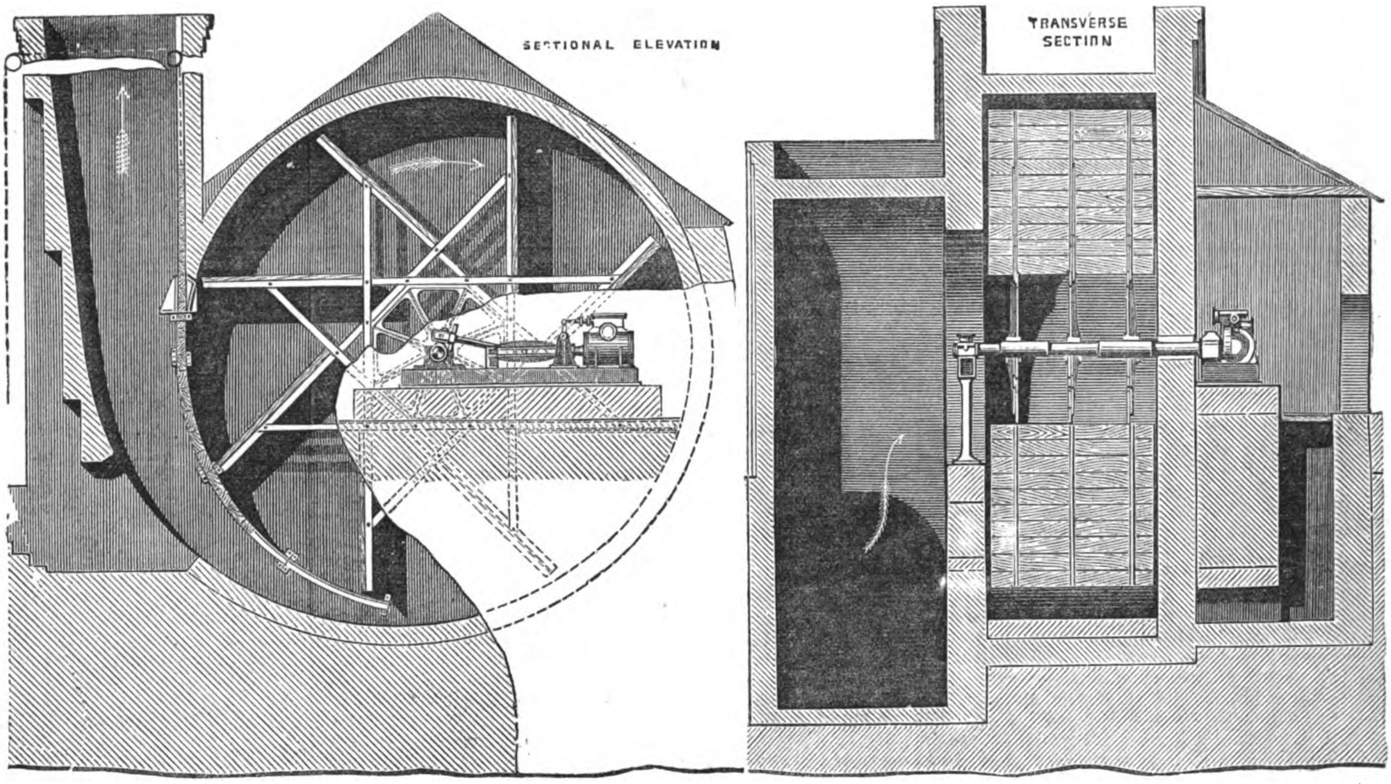
THE METEOROLOGICAL SOCIETY.

THIS society commenced its session of 1869-70 on the 17th inst., by holding the first ordinary meeting at the Institute of Civil Engineers. C. V. Walker, F.R.S., President, occupied the chair, and among the fellows present were J. Glaisher, F.R.S., secretary, Drs. Brooke, Mann, Tripe, and Trentler, Messrs. Symons, Eaton, Doggett, Cyrus Field, Perigal, Brewin, Dines, Gaster, and Mackenzie. Six gentlemen were balloted for, and duly elected fellows. The first paper read was from the pen of Dr. Fielding, of Tunbridge, on the "Weather of the Year 1868." After describing the position of his instruments and the shading of the thermometers, the author proceeded to remark on the weather of each month. Attention was specially directed to the excessive and protracted heat of the remarkable summer, but many of the temperatures recorded were so extremely high, and so much in excess of those recorded at neighbouring stations, that the meeting, after some discussion, requested the secretary to communicate with the author in order to ascertain what were the errors of his instruments, and whether they had been compared with standards. Mr. Symons remarked that, with regard to the accuracy of Dr. Fielding as an observer, no doubt whatever could exist, and that to all appearance the instruments were well placed, though perhaps scarcely sufficiently shaded from the sun's rays in summer. Mr. Glaisher also said there could be no question so far as observing went, but he much desired to examine the instruments, since a maximum temperature in the shade exceeding 101deg., and several readings exceeding 95deg., in one summer, were not only unprecedented in this country but unsupported by observations made in all parts of the kingdom. After some further remarks by various gentlemen, Mr. Glaisher made a brief verbal statement as to his having, during his late balloon ascents, experienced temperatures at very considerable elevations above the earth's surface higher than those just above ground, the law appearing to be that in calm weather the stratum of air nearest the earth is warmer in the daytime but colder at night than that at (say) half a mile high. This, he contended, was entirely contradictory to the old theory of a regular decrease of 1deg. for each 300ft. of altitude, which theory appears to have no support from facts under any circumstances. Those who took part in the discussion all appeared desirous of having a larger basis of observations for forming an opinion on the subject. It is to be hoped that Mr. Glaisher will submit his entire series of balloon observations to the society, and so give others an opportunity of discussing them. It is well known that Mr. Glaisher's balloon series of observations are almost the only reliable data obtained for the higher regions of the atmosphere in this country. Aëronauts generally sadly misuse the opportunities they have for enriching meteorology. The only other paper which attracted any notice was one by the Rev. Mr. Previté, on the "Readings of Barometers not Suspended Perpendicularly." The author had calculated the errors which would be produced by different degrees of divergence from the vertical. The paper was very properly objected to by some of the fellows on the ground that it gave countenance to placing instruments badly, and that meteorology is always burdened with difficulties enough to overcome without imposing on itself erroneous barometrical readings to correct. The paper which had been announced from Mr. Bloxam, of Newport, on "Lunar Influence upon Rainfall," was not read.

On the whole, we congratulate the fellows upon their determination to exclude worthless papers from their proceedings, but as an inauguration of the session, the meeting was not at all promising of any revival of this rather lethargic society.

THIRTY-FEET GUIBAL FAN.

BY MESSRS. BLACK, HAWTHORN, AND CO.



THE MECHANICAL VENTILATION OF MINES.*

By Mr. William Cochrane.

It must be admitted that in the great advance which has been made in the development of mining enterprise, and looking to the future requirements of our local coal-fields, adequate ventilation is not inferior in importance to any of the problems which the mining engineer has to solve. The earliest records of mining make us acquainted with the readiest mode of ventilation, no provision beyond the natural conditions being adopted; and so long as mines were only worked to a very limited extent by levels or "adits," or if by shafts, of very small depth, the natural system was found to answer all requirements; only there was this disadvantage—that, with thermometrical variations, the determination of the current of air was dependent on the average temperature of the mine, being above or below that of the external atmosphere, a condition constantly varying and interchanging throughout the year, and, therefore, not permitting any certainty of action in the direction or quantity of air which could be used for ventilating the mines. This system is still used in mines of limited extent, and where, from the nature of the mine, very small resistances are offered to the current of air circulating. In some cases, under these conditions, as in the Staffordshire "thick coal" mines, the determination of the air into a particular course is often ensured by placing a fire lamp in the upcast shaft. Such a contrivance, however, can only produce a very small effect, and is, therefore, of limited application. On a larger scale, however, this principle has formed the most generally adopted system of mine ventilation in this country, namely, that of the furnace.

Much discussion had arisen as to the best system of furnaces and the most economical mode of feeding them with air. The following are the results of some recent experiments that have been made at different collieries in the northern coal-fields under various conditions and depths of shafts, extent of workings, and thickness of the seams of coal, and are reduced for the purpose of comparison to the duty that 1lb. of coal consumed effected per horse-power on the air circulated in the mine; the pressure was indicated by a water gauge placed in the mine, and therefore represented only the work done in overcoming the friction down to the mine, and exclusive of the work required to overcome the friction resistance of the two shafts. The general result of the experiments was that that duty varied from 37lb. to 101lb. of coal per horse-power on the air, taken upon currents of air ranging from 40,000 to 120,000 cubic feet per minute. Depth of shaft is the most important consideration for the efficient application of a furnace. There are other conditions, however, which it is necessary to secure, namely, that the shaft be dry, and that it be lined with a good heat-retaining material. It is considered a fair estimate of the economic value of the average conditions in which furnaces are worked that only one-fifth of the heat due to the combustion of the coal is utilised. There are many objections besides the small useful effect to the use of a furnace which cannot be overcome, and which form a constant source of cost attendant upon it, namely, the necessity of cleaning the flues and the consequent suspension of the active ventilation of the mine; the inconvenience, and in some cases the impossibility, of using a shaft highly heated, and often full of smoke, for any other purpose than as a ventilating shaft; and the serious damage done by the products of combustion to cast-iron tubing, timber, pumps, or wire ropes, where winding is carried on in the upcast shaft, especially where the shaft is damp. If the conditions are unfavourable for the use of a furnace, such as shallow shafts and heavy resistances to be overcome, the furnace is then quite unable to compete with a good mechanical ventilator in economical effect. The limit of the furnace as a ventilating power is soon reached where the resistances offered by a mine are heavy, and this objection naturally led to the adoption of other means to meet the conditions under which the furnace would fail to afford a sufficient ventilation.

Machines for blowing fresh air into or exhausting the foul air from mines were adopted in the very earliest times, especially abroad, where the conditions of the seams are such as required more efficient ventilation than the furnaces supplied. Hence it is that mechanical ventilators are very numerous abroad, while in this country, until very recently, they were quite exceptional. In a table compiled by Mr. J. J. Atkinson, Government Inspector for the Durham coal-field, has been shown the depth at which furnaces are estimated to be equal to ventilating machines in point of economy of fuel, assuming that the sources of loss are of the same extent in each case, that is, the loss of fuel in furnaces by cooling in the upcast, and in ventilating machines the power expended in overcoming the useless resistances, and that the ventilating machines utilised 60 per cent. of the engine power. The general result is that the minimum depth at which the economy by the two plans is equal is 960yds., with an average upcast temperature of 100deg. Fah., and a depth of 1,130 yards, with 200deg. Fah. temperature, estimating a consumption of 8lb. of coal per hour per indicated horse-power of the engine. A recent calculation by M. Guibal, of Mons, deduces the following comparisons—that if a furnace in a 12ft. shaft, 400 yards deep, circulate 53,000 cubic feet of air per minute under the total resistances represented by 3¾in. water gauge, and an average excess of upcast temperature of 108deg. above the downcast, with a duty of 31lb. of coal per horse-power in the air estimated upon the total resistances, then a mechanical ventilator utilising 60 per cent. of the power enployed would, under the same conditions, have a duty of 11lb. of coal per horse-power on the air, being a saving of 64 per cent. At a depth of 550yds. to circulate the same volume, the duty of the furnace being 22lb. of coal, that of the mechanical ventilator would be 11lb., being a saving of 50 per cent.

The author then classified the mechanical ventilators which had been used under two heads—first, those working by centrifugal action; and second, those working as pumps. Of those of the first class, one had been described at the last meeting—the Guibal ventilator at Crudley Colliery, Staffordshire. The largest example of that class erected in this country will be seen at the Thrislington Colliery. It is 36ft. diameter, and 12ft. in breadth, driven by a horizontal cylinder 30in. diameter and 30in. stroke. The ventilator has only been recently erected, and is not yet ventilating any large extent of working, but some experiments have been made with it, from which the following results have been obtained. The regulating shutter was not properly adjusted so as to give the best results of working, and the drift to the upcast shaft was too small for accurately increasing the current of air, amounting to 80,000 cubic feet per minute. With 54 revolutions per minute a water gauge of 2½in. was maintained at the inlet; with 70 revolutions a water gauge of 4½in.; and with 80 revolution as water gauge of 6¼in.*

After giving the results of other Guibal ventilators in operation, the paper continued.—In order to make a fair comparison of the Guibal ventilator with the furnace, the following case of the Pelton Colliery, Durham, is given, as it is the only one where the data have been accurately ascertainable respecting the replacing of the furnace by this mechanical invention. In this case the duty obtained by the furnace was 102lb.

* Institution of Mechanical Engineers.

* Our engraving illustrates a 30ft. Guibal fan, constructed by Messrs. Black, Hawthorn & Co., of Gateshead-on-Tyne.

of coal per hour per horse-power in the air estimated, on the water gauge of 1 1-10in. indicated in the mine, and a current of air of 35,000 cubic feet per minute; and the duty was reduced by the ventilator to 20lb. per hour per horse-power with a current of 54,000 cubic feet, and a water gauge of 2in. indicated in the same position. This shows a saving of fuel by the adoption of the Guibal ventilator in place of the furnace, amounting to 80 per cent. The class of ventilators to which the Guibal belongs is that of centrifugal action, and in the same class may be mentioned the Biram, Nasmyth, Brunton, Rammell, and Waddell ventilators. A Biram ventilator (similar in principle to the Nasmyth, with the exception of the vanes being inclined to the radius) the writer has experimented upon at Tursdale Colliery, Durham, and found that only 12½ per cent. was utilised of the gross power supplied from the steam boilers; and from experience with other open running fans he considers that percentage cannot be materially exceeded with any form of open fan without a casing. A Waddell ventilator, recently erected at Pelton Colliery, utilises only 39 per cent. of the power applied; and a Rammell, at Framwellgate Moor Colliery, does not exceed 40 per cent. of utilised power. The Guibal utilises 60 per cent. of the power applied.

Except the Guibal, all the other ventilators of this type discharge throughout the entire circumference; but that this is a defect can be inferred from the fact that if such a fan running open have the access of air into its centre stopped, great power will still be required to make it revolve, though no useful work is done. The useless work done upon the external air in this case is done to a diminution of useful effect, when the fan is exhausting air supplied at its centre from any mine drift or passage. It was anticicipated that the Waddell ventilator would obviate this defect by arranging the air passages through fans of a gradually decreasing section from the centre to the circumference, so that the velocity of rotation at any point multiplied by the sectional area of passage at that point should be constant, thus filling up the fan with issuing air, and preventing the possibility of re-entries. In this case the re-entries cannot be seen as in the Biram, where the eddies of air all round the circumference are easily distinguished, but that they do evidently arise is proved by the low power utilised. The Brunton, which closely resembles the Waddell and the Rammell, cannot be expected to yield any better results. By the kind permission of Mr. Daglish, the results of a Rammell ventilator, recently erected at the Framwellgate Colliery, are here given:—Diameter of ventilator, 22ft., with 20in. steam cylinder, and 102 revolutions per minute; volume of air, 53,600 cubic feet per minute, with a water gauge of 2¼in.; result, 40 per cent. utilised. One of the chief reasons of the low useful effect of these exhausting fans is that they are exposed throughout the entire circumference to the external air, which rushes in behind the vanes to supply the vacuum formed by their revolutions; but this vacuum ought to be supplied only from the mine to be ventilated, and it was this consideration, and the practical proof that this injurious effect was inherent in open running fans, that led to the casing of the Guibal ventilators and discharging the air at only one part of the circumference. This step, however, was attended with the objection that the air was discharged with a high velocity, viz., the velocity of the periphery of the fan, and carried away with it a most important store of force, the partial utilisation of which has been effected by adapting the principle of erased tubes to the expanding chimney, in which the casing of this ventilator terminates. The air entering its base at a high velocity leaves the chimney at a reduced velocity proportionate to the increased area of the outlet, and in this action restores a considerable amount of power it would otherwise carry off. An adjustable shutter was next found necessary, in order to regulate the size of the outlet and the various conditions of the volume of air required, and resistances. A series of very interesting experiments had been made, showing the steadily-improved results obtained from the ventilator, as the casing chimney and shutter, in its accurate adjustment, were consecutively added.

Generally, as to the powers supplied from the steam boilers for working these ventilators, 60 per cent. was found to be utilised; but it must be noted that this amounted to at least 80 per cent. of the power actually transmitted to the ventilator, as one-fourth of the boiler power must be allowed for the loss due to the friction and imperfection of the steam engine. One of the ventilators (of which several examples were now in use in this country of 36ft. diameter) had been recently started in Belgium of 40ft. diameter, but detailed experiments had not yet been made upon it. It was arranged to work at the speed of 80 revolutions per minute, producing a ventilation of 150,000 to 200,000 cubic feet of air per minute, under a depression of water gauge of about 7in., which was certainly the maximum requirement of any known condition of mines. Indeed, there could be no question that any practical requirement in the ventilation of mines could be satisfied by this system, and it could not be surpassed in simplicity of construction, small liability to accident, and the little wear and tear to which its working parts were subject.

The paper next pointed out peculiarities in the Guibal ventilator—as to the concentric form of the casing, and as to the curving of the vanes—and it then dealt with the second class of mechanical ventilators—that in which the principle of variable capacities, as in the pump, was involved. Struve's air-pump ventilator was the best known of the class, and consisted of two gasometer-formed pistons working in rings of water, alternate upward and downward strokes drawing air from the mine and forcing it into the atmosphere by means of suitably arranged valves. The Struve was, when well constructed and in good order, capable of producing a very satisfactory exhaustion, but for certain reasons it did not offer the advantages for mine ventilation which the centrifugal action fan did. The usual effect was from 40 per cent. to 45 per cent. of the boiler power, when all the working parts, and especially the air valves, were in good condition. In conclusion (to quote the words of the paper), the economy of fuel, if neglected hitherto, has now become of paramount importance. To increase the amount of air in any given time the mine requires the consumption of an increased quantity of fuel, proportionate to the cubes of the volumes; thus, for twice the volume eight times the fuel. Hence the best system of ventilation is that which, under the same conditions of mine and the same amount of first outlay, produces the maximum work for 1lb. of coal consumed, so long as such ventilation compares satisfactorily with any other in the points of durability and cost of working, and possesses the quality of adaptability to all the varying conditions which are met with in mining operations.

THE PATENT LAWS.

On Tuesday evening, a crowded meeting of members of the Waverley Club and others was held at the Arundel Hotel, under the presidency of Mr. Samuel Dickins, M. Arch. Assoc., to consider the working of the patent laws. Among the gentlemen present were Mr. Edward Field, C.E., M. Inst. M.E., Mr. Burton, Mr. Jones, Mr. Humphreys, Mr. Hamer, and others. The opening speech was delivered by Mr. W. Lloyd Wise, who pointed out the important and beneficial effects to the public of patent privileges in promoting the progress of the arts and manufactures of this country, and proposed the following resolution:—"That the granting of exclusive privileges to inventors as rewards for their inventions tends to promote the commercial prosperity of the kingdom." An amendment was moved by Mr. W. G. Dickins, but, after considerable discussion, the resolution was carried with acclamation, and the proceedings terminated with a vote of thanks to the Chairman.

The value of the gold imported into the United Kingdom from Australia and New Zealand amounted in September to £791,400 as compared with £875,486 in September, 1868, and £586,357 in September, 1867. For the nine months ending September 30 the receipts were valued at £5,942,949, as compared with £5,236,729 in the corresponding period of 1868, and £3,863,970 in the corresponding period of 1867. Favourable accounts have been received of late from the diggings and quartz reefs of New South Wales. The Trunkey Creek Quartz Crushing Company has so far progressed that part of its machinery was on the ground at the last dates; it was expected that the machinery from the vicinity of Carcoar would also be shifted to Trunkey. The average yield from the Emew Creek reefs keeps up well, while the prosperity of the district has been maintained by the opening up of several alluvial areas, which have all given payable returns.

FREEZING AND ICE-MAKING MACHINE.

Attention has lately been given in several quarters to the artificial production of ice and cold. The latest example before us is that illustrated in the accompanying engraving, and which is the patented invention of Mr. Franz Windhausen, C.E., of Brunswick. It will be perceived that the invention relates to that class of freezing and ice-making machines in which atmospheric air is compressed, then passed through a condenser, and afterwards expanded again to remove the heat, or, in other words, to produce cold, but which machines have hitherto been limited in their cold-producing properties by the degree of expansion to which the air is subjected, and by the temperature of the cooling water employed. In the present case, Mr. Windhausen constructs a machine of small compass which with one constant degree of expansion of the air employed produces any requisite degree of cold, which can be regulated to the greatest nicety by the hand of the attendant by means of graduated adjusting valve mechanism.

Mr. Windhausen employs a single double-acting cylinder, which is capable of compressing the air on one side of the piston and of expanding it on the other. The air is first admitted into the compressing chamber and thence passes into a condenser, which consists of a rectangular chamber divided into two portions having a parallel series of pipes in each part. The nearest series of pipes to the compressing chamber through which the air first passes is surrounded by cold water, which is constantly running through it in an opposite direction to the current of air so as to cool the air passing through the pipes. The second series of pipes through which the air next passes is also surrounded by cold water supplied as we shall presently describe. The air having thus passed through these two series of pipes then enters the expansion chamber, where it is expanded and cooled, and then escapes through a temperature regulator of peculiar construction (acting in the same manner as a three-way cock or valve) into the refrigerator. In this refrigerator the vessels are situated which contain the liquid to be frozen, which may be in the form of pipes, through which the air, gas, or vapour to be cooled may be passed.

By means of the temperature regulator, a portion of the air proceeding from the expansion chamber may be admitted into the space surrounding the second series of pipes, so as to impart coldness to them. In fact, when the cold air admitted into the refrigerator has become heated, it passes through the same space but enters from another point on its way to the compressing chamber, and may previously to reaching the compressing chamber be made to pass through pipes surrounded by the running stream of water, which afterwards passes through the casing containing the first-mentioned series of pipes, and thus may have a cooling effect upon the water. Having thus circulated through the machine the same air is again admitted into the compressing chamber, and the whole operation is repeated, thus keeping up a complete circulation through the machine.

In order to maintain an equal pressure of air in the refrigerator and condenser a pressure regulator in the form of a balloon, made of elastic material, is in communication with the interior of the refrigerator. The regulator stretches out when the pressure in the refrigerator is greater than that of the atmosphere, and is contracted as soon as the pressure in the refrigerator is less than that of the atmosphere. The refrigerator is further provided with a valve opening inwards, which is acted upon by the atmosphere and supplies any loss of air in the machine, the fresh supply entering by the valve being dried by passing through chloride of lime previous to entering the machine.

Fig. 1 in our engraving is a side sectional view of the machine through the line from *a* to *b*. On fig. 2 is a plan with the refrigerator removed in order to show the cylinder and arrangement of pipes more clearly. A is the double acting cylinder, and B the piston of the same, which by means of the forked connecting rod C is connected to the crank D of the driving shaft which carries the fly wheel and revolves in one of its bearings on the pedestal E, which pedestal and the cylinder are fixed upon the cooler F. The cooler F consists of a rectangular enclosed chamber containing a series of parallel pipes. Situated on the top of the cylinder A, and partly supported by a pillar G, is fixed the refrigerator H. This is a

FREEZING AND ICE-MAKING MACHINE.

BY MR. FRANZ WINDHAUSEN.

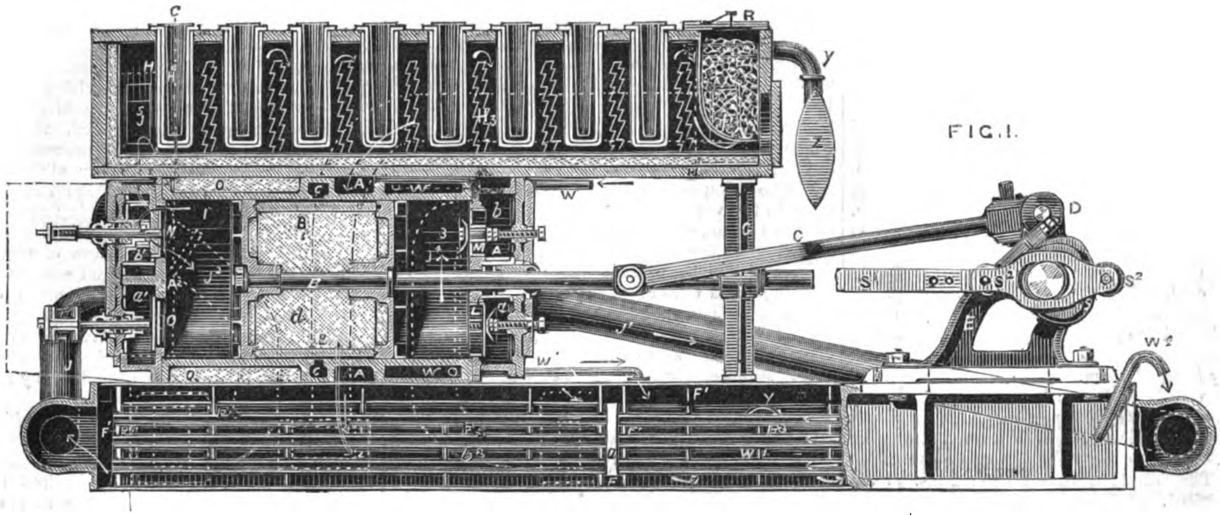


FIG. 1.

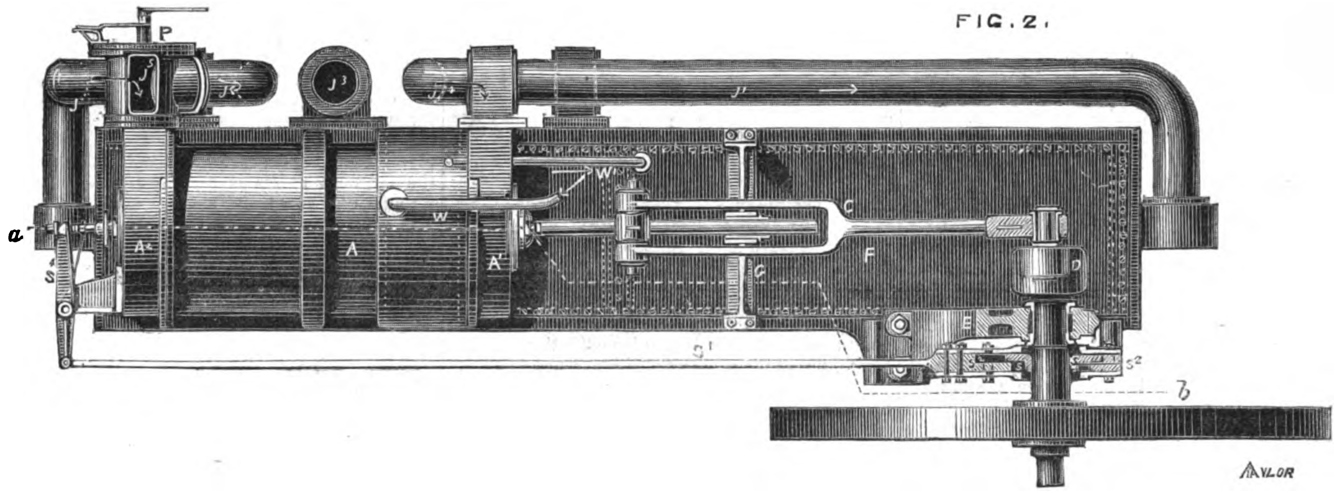


FIG. 2.

rectangular double-cased chamber, in which are suspended the cases H^1 and H^2 which contain the liquid or other medium to be cooled. All the internal parts of the machine communicate with each other by the pipes J^1 and J^2, and valves L, M, N, and O.

The cylinder A is fitted with covers A^1 and A^2, each of which covers is formed hollow and divided by a partition into two compartments a and b, and a^1 and b^1. These compartments communicate with the interior of the cylinder at their respective ends by passages fitted with valves; L being the outlet valve and M the inlet valve appertaining to the compartments a and b, and O being the outlet valve and N the inlet valve appertaining to the compartments a^1 and b^1. The front part of the cylinder in which the compression takes place is surrounded by a jacket W containing water to cool it, and the back part or other end of the cylinder in which the expansion takes place is enveloped in a bad conductor of heat Q^1 composed of sawdust or loose cotton, in order to prevent its being heated from the outside. e is an annular passage or space surrounding the cylinder and separating the front from the back part of the cylinder, in order to prevent the heat being carried from the front to the back. This space serves also as a receptacle for the grease to lubricate the piston. The piston B is nearly as thick as the whole length of the stroke of the crank D, and is constructed of two disc plates B^1 and B^2 fixed to the piston rod, and each of which plates is fitted with the ordinary cupped leathers. The intermediate space between the plates is filled with loose cotton and surrounded on the outside with a wooden casing B^3. This construction is designed to prevent the heat travelling from the front to the back part of the cylinder. The piston rod passes through a stuffing box and is guided at the same time through a bush fitted in the pillar G.

The actuating mechanism of the inlet and outlet valves N and O consists of two cams or tappet wheels S keyed upon the driving shaft, which alternately strike the friction or tappet rollers S_2 mounted upon the rod S^1 according to the expansion in the back part of the cylinder. The rod S^1 is connected to the forked lever S^4, the ends of which actuate the spindles of the valves O and N as illustrated in such a manner that the valve O allows the compressed air to enter the back part of the cylinder for a portion of the forward stroke of the piston, until the valve O closes, when the expansion takes place for the remaining portion of the stroke. During the back stroke of the piston the valve N is arranged to remain open by the disposition of the cams or tappet wheels S upon the driving shaft.

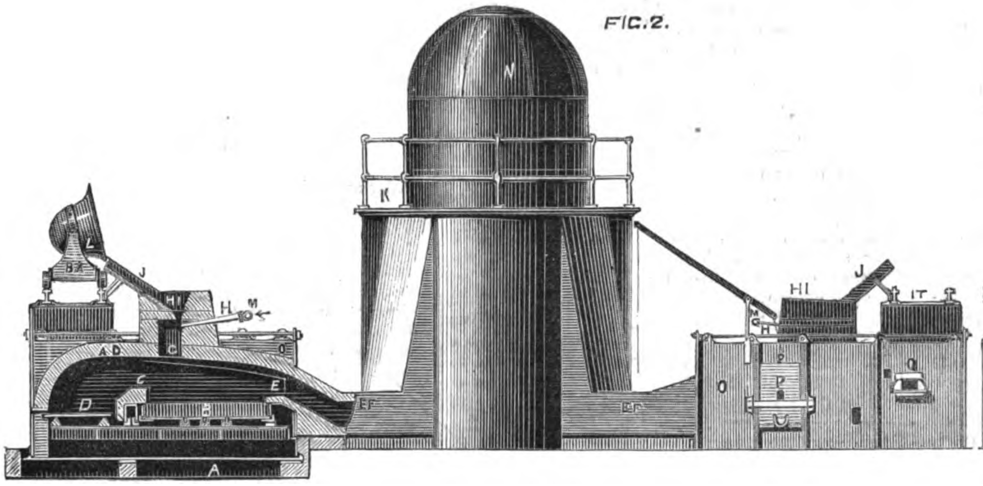
The cooler consists of a hollow enclosed chamber which at the same time constitutes the bed plate, upon which the cylinder A, pedestal E, and refrigerator F are fixed. Its interior is divided by the space E into two compartments w^1 and b^2 hermetically closed; in each of these compartments a series of parallel pipes F^2 and F^3 are fixed, being secured in the ends F^1. The interiors of these pipes are in communication with each other through the space a, and with the space a of the front cylinder cover through the pipe J^1, and with the space a^1 of the back cylinder cover through the pipe J. The space w^1 surrounding the outside of the first series of parallel pipes is entirely filled with a running stream of water, which flows away through the pipe W^2. The fresh supply, which is kept up by means of any ordinary pump, enters by the pipe W and passes through the jacket w surrounding the front part of the cylinder before it enters the space w^1 through the pipe W^1. In order to keep this water in direct contact with the outside of all the cooling pipes the metal plates F^4 are fixed in the compartment w^1 so as to compel the water to pass by or in contact with the outside of every pipe. By this means the water passes through in an opposite direction to the current of air which passes through the interior of the pipes and thus cools the air passing them to the lowest degree, with the smallest quantity of cooling water.

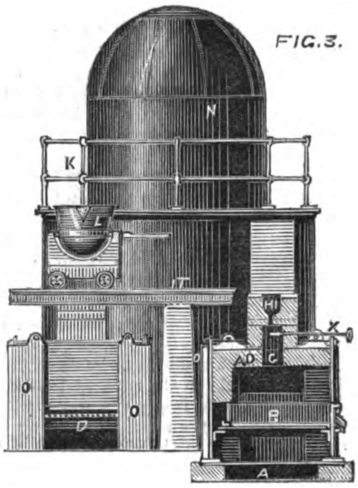
The other division of the cooler b^2 is similar to that just described, with this difference, that the pipes in this compartment are surrounded by a current of cold air instead of water. This air enters through the pipes J^2 direct from the compartment b^1 of the back cylinder cover, and also from the refrigerator F through the pipe J^3, and proceeds in the direction of the arrows 1 2 3 through the pipe J^4 to the compartment b by the front cylinder cover, where it is drawn through the inlet valve M by means of the piston into the front part of the cylinder, to be again compressed at the return stroke of the piston and afterwards driven into the cooling pipes through the outlet valve L and pipe J^1.

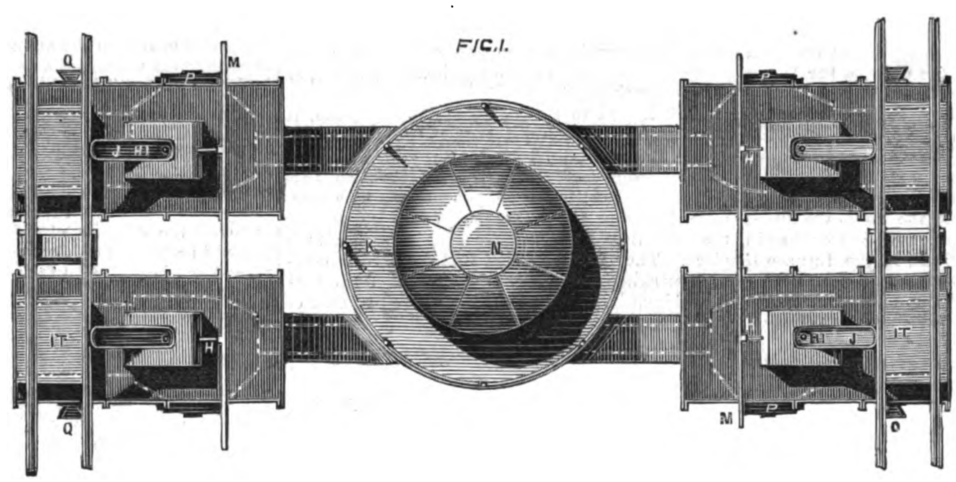
The refrigerator has already been described as being fixed upon the cylinder and pillar G, and consisting of a double-cased rectangular chamber H constructed of wood, the space between the casings being filled with a non-conductor of heat. The cover of this refrigerator has rectangular openings formed in it for the insertion of the corresponding rectangular metal cases H^1, which are open at the top and are suspended in the refrigerator in the same symmetrical order as illustrated. Inside these cases the ice-boxes H^2 (filled with water or other fluid to be frozen) are placed, and in order to effect an immediate contact between the two, the former H^1 are previously partly filled with a fluid which does not readily freeze (for instance spirits of wine), or at a higher temperature a solution of chloride of lime might be used. The cases H^1 may be employed themselves for freezing purposes by filling them direct with the fluid to be frozen, as they are loosely inserted in the openings formed in the cover to receive them and are packed under their top flanges with indiarubber or felt. To ensure a complete spreading of the current of air over the whole outer surface of the cases H_1 the zig-zag partitions H^3 are fixed inside the refrigerator between each of the metal cases, by which means a zig-zag course is given to the current. In the refrigerator the cold air expanded to atmospheric pressure enters through the pipe J^5, and in passing through imparts its cold to the chests H^1, and in a corresponding degree becomes

APPARATUS FOR THE MANUFACTURE OF IRON AND STEEL.

BY MESSRS. THOMAS, BACON, AND GROVES.







heated itself and finally escaping through the pipe J^3 into the cooler F.

In order to maintain one constant pressure inside the refrigerator its interior communicates through the pipe Y with an elastic ball Z formed of vulcanised indiarubber, which immediately becomes distended when the pressure is greater in the refrigerator than that of the atmosphere, and *vice versa.* Any loss of air inside the refrigerator caused by leakage of any of the parts is provided for by means of the valve R, which opens inwards by atmospheric pressure whenever the pressure inside the refrigerator is less than that of the atmosphere, thus allowing the deficiency to be made up, but before arriving inside the refrigerator such supply of air on its way passes through chloride of lime supported in a perforated tin box situated immediately below the valve R.

The refrigerator we have described is designed specially for freezing liquids; but for cooling air or gases, or condensing vapours, pipes are fixed in the refrigerator in the same manner as the pipes described in the cooler F, and which are surrounded with the current of cold air coming from the machine through the pipe J^3. Through these pipes the vapours to be cooled are conveyed in an opposite direction to the current of air passing outside them. In case the machine is required to cool and ventilate apartments, such as cellars, ship holds, hospitals, theatres, and other places, the cold air is conveyed from the tube J^5 directly into the places to be cooled, whilst fresh air is constantly supplied to the machine through a pipe in connection with the pipe J^4 to be thereby cooled and then forced into the apartment.

We have already described the particular manner in which the expanded air passes out of the back part of the cylinder from the compartment b^1 through the pipe J^3 into the condenser, and through the pipe J^5 into the refrigerator. It now, therefore, only remains to show more particularly how the cold air is divided so as to pass in the proper quantities through each of the pipes J^3 and J^5. For this purpose these pipes each open into a cylindrical compartment J^6, which is fitted with a segmental valve P, which turns with a hand lever, so that either of the mouths of the pipes J^2 and J^5 may be partially or entirely closed at pleasure by the hand of the attendant, and the exact relative sizes of such openings is indicated by a finger (forming part of the hand lever) upon a dial plate. Suppose the segmental valve P to be in such a position as that the mouths of the pipes J^3 and J^5 shall be to each other as 1 is to n, then, says Mr. Windhausen, a proportionate part of the expanded air is used for cooling the contents of the refrigerator and n parts are used for the first cooling of the compressed air. A simple calculation then shows that the compressed air is constantly being cooled to a lower temperature, and becoming in a corresponding manner colder by the process of expansion until it reaches the theoretical limit of n times as many degrees colder every time as the expanded air becomes according to the mechanical theory of heat. This maximum degree of cold, however, can only be effected under the supposition that the heat of the compressed air produced by the compression is entirely absorbed by the cooling water in the cooler, and that the heating of the air in the machine through the friction in the piston, the friction of the air in passing through the pipes, and the heat derived from without is not taken into consideration.

We may add that the agents in England for this invention are Messrs. Forbes, Born, and Co., of 2, South-place, Finsbury, and from whom we learn that one of these machines is now in course of erection at the Crystal Palace, where we hope soon to inspect it and to report upon its practical working.

It is stated that the growth and manufacture of sugar in the north of the colony of Queensland are proceeding with extraordinary rapidity and success, and there is every reasonable prospect that, in a very short time, Australian consumers will be entirely independent of foreign producers.

MANUFACTURE OF IRON AND STEEL.

An invention has been patented by Mr. J. Thomas, of Middlesborough-on-Tees, in conjunction with Mr. W. Bacon and Mr. H. Groves, which primarily consists of a new method of making refined iron, wrought iron, and also steel from melted metal run direct from the furnace. They refine the molten metal as it comes from the blast furnace; or the metal, if in pigs or cast scrap, may be melted in a cupola, air furnace, or any other furnace used for melting iron, and if the ground is practicable, they build the furnace at such a level that the metal may run direct from the blast or melting furnace into the air or refining furnace by gravitation, the refining furnace being near to the blast or melting furnace. The refining furnace has a high crown, and on the top of the crown is a well with one or more holes leading through the crown into the furnace. The furnace is heated up to the necessary heat for melting iron and fluxes, and the ores are first melted with the materials used for cleansing or improving iron. When the fluxes are properly melted the molten metal is poured into the well on the top of the crown and let run into the furnace through the holes.

About half way down the furnace are apertures opposite to the streams of falling metal, and into these apertures immediately under the falling metal are inserted paddles or flattened bars of iron, which are protected with a coating of fire-resisting material. The metal falling on the paddles is scattered into a very divided state, or the molten metal is scattered with a jet of air, steam, or gas, so arranged as to strike against the stream of falling metal as it enters the furnace. Previous to letting the metal into the furnace care is taken to have a good fire in the grate, the damper being opened at full so as to draw the gases through with rapidity, and, if the metal requires an excess of oxygen, holes are either opened near the bridge of the furnace to let in air, or superheated steam is introduced. The heated gases will have a powerful effect on the divided metal by attacking and burning out the impurities, while the liquid oxide or other fluxes in

the bottom will hold the dross given off from the metal. When the metal is all in the furnace under the slag, the paddles are drawn out, all holes stopped, and if necessary to make the metal more pure it is left to stand awhile, but with most metals it may be tapped out without loss of time if the operation has been properly performed, and refined iron will be the result.

In making wrought or malleable iron, the inventors tap and run the metal from the refinery furnace into a large ladle on a carriage, and if the puddling furnaces are higher than the ladle the metal carriage and ladle are raised up to a railway constructed on a level with the crown of the puddling furnace, on which is a well with a hole through the crown. The puddling furnace is fettled in the usual way and got up to a high heat, and the oxides or fluxes melted previous to charging the furnace with metal. Into the well on the top of the crown a sufficient quantity of metal for a puddling charge is then poured and let run down into the furnace. Through the side of the furnace is inserted a paddle similar to that used in refining, and the liquid metal is let fall on it so as to divide the metal; or the metal may be scattered with a blast of steam. As in the refinery process care is taken to have a good fire in the grate with a full open damper while the metal is running into the furnace, so that by the aid of the hot gases the iron may be further cleansed of its impurities. When the metal is all in the furnace the holes are closed and it is puddled in the usual way. When the iron in the puddling furnace is balled the balls are taken out, shingled, and rolled off into puddled bars. If bolts or bars are wanted, the puddled bar is run while hot on to a mandrel, and the doubled up iron hammered flat. These are inserted while hot into a re-heating furnace and when welding hot are drawn and rolled into the required size.

In making steel the melted metal is poured into a well on the crown of an air furnace as in refining; previously to pouring in the metal the fluxes are melted and the melted metal scattered as in refining. When the metal is all in the furnace if it is not properly refined it is run out into a ladle and poured into the well again on the top of the furnace, being run through and scattered as before. This scattering process is repeated as often as may be deemed necessary to burn out the impurities in the metal, and the gases are changed from carbonizing to oxidizing as may be required by regulating the fuel, the damper, and the gases to support combustion. The charge is then worked, wrought iron dissolved in the same, or more fluxes added as becomes necessary, and when the charge is ready it is tapped out and cast into the forms required.

It will be seen that in this process for making iron or steel the inventors begin with the molten metal and pass the product of each operation forward up to the finished bar of iron or of cast steel before letting it cool.

The accompanying engraving represents an arrangement of four puddling furnaces constructed according to this invention. Fig. 1 is a plan; fig. 2 a front elevation partly in section; and fig. 3 an end elevation also partly in section. A is the foundation and B the iron bottom of the same; C is the bridge; D the fire-place; A D the furnace crown; E neck leading to the flue E F; G the scattering chamber; H blast pipe for scattering, or, instead of a blast pipe, a paddle or flat bar as seen at X, fig. 3, may be employed for scattering. H I is the well or basin in the crown of the furnace, and having one or more holes leading down into the scattering chamber. This well receives the molten metal from a runner J leading from a ladle L; the ladle is mounted on a carriage B A, which travels on a railway I T. M M are air or steam pipes for supplying the blast pipe H; N is a boiler in the middle of the four furnaces, and K is a staging round the boiler. O O are binding plates for the furnaces; P P are the charging doors, and Q Q the fire holes.

THE Argentine Republic has issued a circular calling attention to a Grand Exhibition to be held at the city of Cordova on April 17, 1870. On the same day will be celebrated the completion of the Central Argentine Railway between Rosario and Cordova, whereby the two cities, heretofore separated by five days of fatiguing stage riding, will be placed at a distance of a few hours' travel, and, by means of the telegraph, in instantaneous communication. The managers invite the exhibition of machines for the manufacture of woven stuffs, paper, sugar, and alcohol, agricultural implements, particularly those of a labour-saving character, steam engines, models and plans of bridges, and whatever may help to improve agriculture, mining, and modes of communication.

THE DANGER OF PLAIN CYLINDRICAL, EXTERNALLY-FIRED BOILERS.

THE Manchester Steam Users' Association has for years laboured to call steam users' attention to the danger of external firing and to the treachery of the plain cylindrical colliery boiler, and the following explosion is an illustration of the correctness of this view. The explosion occurred at a colliery on the afternoon of Thursday, October 14, and resulted in the death of two men as well as in injury to one other. The boiler was of the plain cylindrical, egg-ended, externally-fired class, with the plates laid longitudinally, so that the seams of rivets ran in line from one end of the boiler to the other. It was about 30ft. in length by 6ft. in diameter, while the thickness of the plates was ⅜in. and the pressure to which the safety-valves were loaded about 35lb. per square inch. The boiler gave way at the bottom over the fire, rending in a somewhat zig-zag course throughout its entire length from the front to the back, when the cylindrical portion of the shell opened out and tore away from the two hemispherical ends, the parts being thrown to considerable distances, and the pipes and ruins of the seating scattered right and left. Added to this, a stonemason lighting his pipe at the fire door was killed on the spot, and two other workmen struck by the falling debris and seriously injured, one of them dying shortly after, while, in illustration of the force with which some of the fragments were thrown, it may be stated that a horse standing in a butcher's cart some thirty yards off was struck down and instantly killed, as if by a cannon ball.

With regard to the cause of the explosion, it was stated at the inquest that the boiler, though only a little more than three years old, had been under repair several times, and that two new plates had but just been put in over the fire, while it was as the steam was being got up for the first time after this that the explosion took place. The engineer stated that though the ordinary working pressure was about 35lb., yet that it could not have exceeded 24lb. at the moment of explosion, while he was confident that the plates put into the boiler were of first-rate quality, so that "it was a mystery to him why the boiler burst, as he considered it ought to have stood a pressure of 300lb. on the square inch." The foreman smith said he was "beat entirely in endeavouring to account for the explosion." To this the coroner added that "the Government Inspector of Mines had made an investigation, but admitted that he had no light to throw on the subject, and therefore it was apparent that the occurrence was shrouded in the greatest mystery." The jury, without requiring further evidence, found that "the deceased was killed by a boiler explosion, but how the catastrophe originated there were no means of ascertaining."

In this case the inquest was conducted with considerable despatch, being held the day but one after the catastrophe, so that it was concluded on the same day that the report of the occurrence reached Manchester. On the Association's Inspector reaching the scene of the disaster, he found that the boiler had been cut up and thrown on the scrap heap the day after the inquest was held, so that those who had charge of the boiler seemed resolved that if they could not arrive at the cause of the explosion themselves, nobody else should do so. The colliery engineer, who could have given the Inspector some information as to the direction of the rents and flight of the parts, was most uncommunicative, and referred him to the scrap heap for information, and to the record of the inquest in the local newspaper, so that but few particulars could be obtained. After the Association had gone to the expense of sending an officer between 100 and 200 miles, in order to throw light on the cause of a fatal steam boiler explosion, and thus to save human life, this reception was rather discouraging, though by no means singular. The facts of the case, however, speak for themselves. Here was a boiler but three years old, which had just been repaired and turned out as sound, yet, on the first time of getting up steam, and before the pressure had exceeded 24lb., it exploded, while all connected with it considered the occurrence as an impenetrable mystery. Such boilers certainly deserve the character the Association has given them, viz., that of being untrustworthy and treacherous. This explosion, in common with many others, resulted from the simplest causes, and might have been prevented by the exercise of common knowledge and common care.

UTILISING AMMONIACAL SKIMMINGS.

AMMONIACAL skimmings is a bye-product of the manufacture of galvanised iron, consisting principally of a mixture of chloride of zinc, oxychloride of zinc, oxide of zinc, metallic zinc, and chloride of ammonium. Hitherto it has been customary to convert this material into zinc oxide by calcination, which mode of treatment occasions the loss of the zinc existing as chloride, and part of the zinc existing as oxychloride, and also of the chloride of ammonium. In order to avoid this loss and to recover the ammonia from the chloride of ammonium, Mr. John Pattinson, of Newcastle-on-Tyne, has patented an improved method of treating the skimmings. He reduces them to powder and mixes with it sufficient powdered lime or other suitable alkaline earth to decompose the chloride of zinc, oxychloride of zinc, and chloride of ammonium. As the skimmings are of variable composition it is necessary first to ascertain the amount of chlorine contained in that to be brought under treatment in order to determine what proportion of lime is required for the decomposition of the chlorides and oxychloride. For every thirty-five parts of chlorine contained therein about twenty-eight parts of unslaked lime, or about thirty-seven parts of slaked lime, should be provided and mixed with the skimming. A suitable charge of this mixture is put into a retort, and heat applied thereto so as to decompose the chloride of zinc, oxychloride of zinc, and chloride of ammonium.

By this operation the ammonia contained in the skimmings is volatilised as ammoniacal gas. If it be intended to utilise this gas the aperture of the retort must communicate by pipes with vessels for condensing the ammonia in water so as to form liquid ammonia. Or the ammonia may be made to combine with acid so as to form sulphate of ammonia or other ammoniacal salt. When treating the skimmings with the view to collecting the ammonia the mixture of skimmings and lime is placed in a retort (which may be similar to a gas retort) and heated until the evolution of ammonia has ceased. A temperature somewhat below a dull red heat is generally sufficient to effect the necessary decomposition. After this treatment the charge is withdrawn from the retort and is lixiviated with water, so as to dissolve out the chloride of calcium or other alkaline earth chloride formed during the subjection of the mixture to heat. The washed residue, which contains all the zinc of the sal ammoniac skimmings under treatment in the state of oxide, may then be dried and zinc extracted from it by smelting in the usual manner.

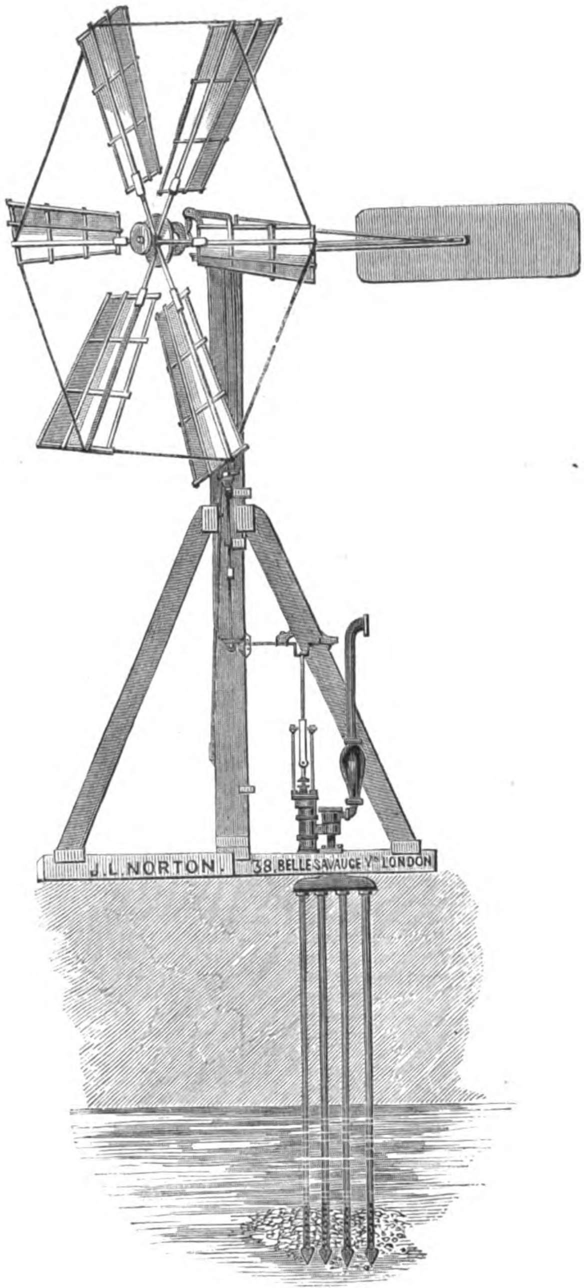
VEGETABLE MANURE.

LET Liebig be comforted. We may yet restore to our soil, and from an unexpected quarter, the annual waste of certain elements of their fertility. In the Atlantic Ocean, west of the Azores, there exists an area seven times larger than all Germany, according to Humboldt, completely covered with a dense mass of vegetation. This vast floating jungle is called the Saragossa sea, and a M. J. Laviniere has calculated that it yearly produces enough vegetable matter to manure no less than 1,800,000,000 acres! The "Journal" of the Chamber of Agriculture asks, can these prodigious marine prairies and savannahs be utilised for the replenishment of our impoverishing husbandry? This French gentleman, with an original idea, has proposed to his agricultural society that the ships which are now occupied during the summer in cod-fishing shall, in other seasons, be employed in ploughing into the thick mass of seaweeds, and loading with cargoes for the Azores, where the vegetable matter can be dried and pressed, and, after having valuable salts extracted from it, can be conveyed as a condensed manure to Europe or anywhere else. Such is the scheme, but many considerations have to be satisfied before that wet salt weed is profitably brought into competition with our highly-concentrated bird-dung, blood, and mineral manures, and Mr. Lawes, Mr. Odams, and their brother manufacturers will prosper some time before they are driven out of the market by M. Laviniere.

A LETTER from Oran states that the sea-wall of that port, for a length of 800 metres, was completely destroyed the week before last by an immense tidal wave. The Mediterranean had been raging with great violence during the preceding night, and at about eleven in the morning a first breach, 40ft. wide, was made, and from that moment the wall rapidly broke up, the immense blocks of stone being swept away like cardboard boxes. The spray from some of the waves reached a height of more than 100 yards. Many vessels were for a time in great danger, but were at length moored to a place of safety.

SELF-REGULATING WIND ENGINE.

BY MR. J. L. NORTON.



SELF-REGULATING WIND ENGINE.

UPON a recent visit to the wharf of Messrs. Owens and Co., of Whitefriars, to inspect some hydraulic machinery—of which we shall have something to say in a future number—we found the self-regulating wind engine illustrated in the annexed engraving. It has been made for Mr. J. L. Norton, who is now largely using them for working his tube wells, for which purpose they answer admirably. The wind engine under notice was one of several which were about to be sent to Austria. It is illustrated as fitted to Norton's pump, which is drawing supplies from a set of tube wells. Its construction is very simple, and its action continuous so long as there is wind enough to fill the sails, and it does not require much. One advantage is that it will work night and day without any watching. The sails regulate themselves according to the wind. It can be managed by a labourer, is stopped instantly, and the power can be varied as required. The first cost is the only one; it costs nothing to keep it in repair, where other motive power requires constant attention.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending November 20, was 1,776. Total number since the opening of the Museum, free daily (May 12, 1858), 1,682,068.

RAILWAY CARRIAGE DOOR.

THE frequent cases of injury to the fingers of railway passengers by the hasty closing or rather banging to of the doors of carriages in these days of rapid transit, is an evil which has been dealt with by Mr. R. Wright, of Richmond, Yorkshire, in a recently patented invention. To prevent injuries to fingers by the closing of the doors, in place of supporting the doors on hinges, as hitherto, Mr. Wright supports it on two pins, one at the top and the other at the bottom, and the side edge of the door near to which the pins are placed is made hemispherical, so that when a door is opened this edge is always close up to the door post, so leaving no opening for the people's clothes or fingers to get between them. The opposite edge of the door is provided with a yielding edge to prevent any injuries to fingers if this edge of the door is closed upon them.

In the annexed cut we have shown a railway door constructed according to this invention. Fig. 1 is a side view of the door, and fig. 2 a horizontal section on the line 1 1, fig. 1. *a a* are the pins at the top and bottom of the door, and upon which the door swings. These pins, as shown at fig. 2, are connected with the hemispherical edge of the door, which fits in a corresponding recess in the door post, so that when the door is open this eged is always close up to the door post. The opposite edge of the door is, in the door shown in the engraving, made capable of yielding by turning on pivots or hinges should it as the door is closed come into contact with anything between it and the door post. The horizontal rails *b b* at the top and bottom of the door are of

FIG.1.

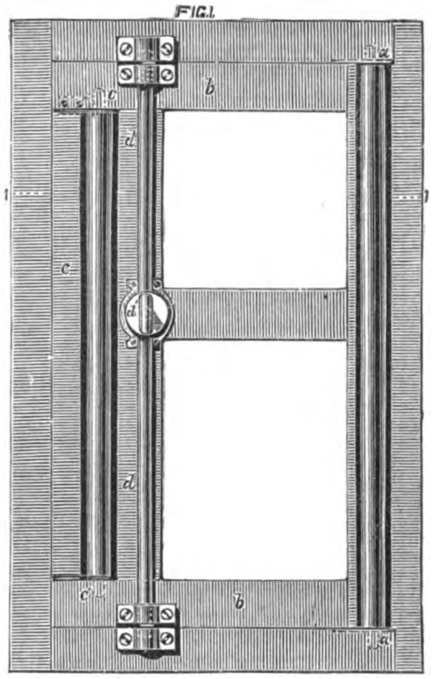
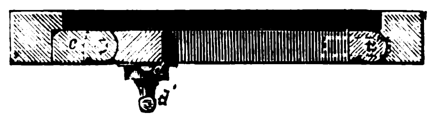


FIG.2.



the usual length, so that they shall catch against the door frame and prevent the train turning inwards. *c* is the yielding edge, capable of turning on pins or pivots c^1 in a similar manner to the door. To fasten the door bolts such as shown at *d d* are used, and which can be simultaneously withdrawn by turning the handle d^1.

CIVIL AND MECHANICAL ENGINEERS SOCIETY.

THE opening meeting of the eleventh session of the above society was held at the Whittington Club on Wednesday evening, October 27. After some observations on the progress of this society, which has been in existence for ten years, the President proceeded to make the following remarks:—Referring to topics of general interest, I purpose, in the first place, to notice briefly the City improvements. Two great works which have been in progress for years past are now virtually complete. In a few days Blackfriars Bridge and the Holborn Viaduct—the latter already accessible to foot passengers—will be formally opened. These, and other works now in course of construction, vast in themselves, are but an instalment of what is required. New and appropriate thoroughfares are urgently demanded for our gigantic traffic, and must sooner or later be made. An able report on this subject has been drawn up by Mr. Haywood, engineer to the Commissioners of Sewers, who has attentively considered not only the wants of to-day but the prospective requirements for the next forty years. The following are his chief recommendations as to the most effective means of relieving the principal traffic arteries of our great city:—

The great streams of traffic which are from north to south pass over London, Southwark, and Blackfriars Bridges, and as these are insufficient a new bridge, with suitable approaches, in the vicinity of the Tower is absolutely necessary. A good approach on the north side could be made without much difficulty by improving thoroughfares already existing. On the south side, however, new approaches would be necessary, and these should extend to Bermondsey-street, and be carried on to Great Dover-street by the Old Kent-road, and, perhaps, on to Camberwell Green. I may notice that the position of London Bridge, in relation to the immense districts lying far to the eastward on both sides of the river, between which it forms the means of communication, is a strong argument in favour of this bold scheme. While admitting that a considerable increase of facility for the passage of its great traffic would result from the widening of the present bridge, Mr. Haywood is of opinion that the construction of the new bridge he advocates is the only true solution of the problem. He takes this opportunity of protesting energetically against the very barbaric proposition that an increase of car-

riage way could be obtained on London Bridge by appropriating for that purpose the present footpaths, which are to be replaced by attaching iron cantilevers for the support of new ones. But it is incredible that anyone could seriously advance such an outrageous plan for the gross disfigurement of one of the most beautiful bridges in the world. By the formation of the thoroughfares in the district of Bermondsey, as recommended by Mr. Haywood, and the construction of the bridge at the Tower, a line of direct communication would be afforded between this part of London and Shoreditch, and much traffic would cross the bridge. In the course of these improvements it is suggested that Billingsgate Market be removed from the present very inadequate building to a site lower down the river or to Farringdon-street. To accommodate shipping a central span of the bridge could be made to open to admit of vessels passing up and down the river. As an alternative, a tunnel is suggested, although not so convenient, and in addition steam ferries might be established at various points. In respect to the east and west traffic, coming to the City by the lines of Oxford-street and Holborn, Piccadilly and the Strand, the whole line from Temple Bar to Cheapside is quite insufficient, notwithstanding the relief afforded by way of Cannon-street, while the junction in the heart of the City of both lines of road causes a jamb which can only be relieved by two new broad thoroughfares between the districts lying east and west of the City. While the noble lines of the Thames Embankment fitly stand for one of these, a new east and west street will be requisite for a breadth of 70ft. or 80ft. It is proposed that this broad line of road shall commence at the east end of Holborn Viaduct and extend to Whitechapel, High-street, close to Commercial-street. From Newgate-street it would pass eastwards across King Edward-street and St. Martin's-le-Grand to the north of the Post Office, thence across Noble-street, Wood-street, Aldermanbury, Basinghall-street, to the north of the Guildhall and Coleman-street, to a point about 250yds. north of the Bank. Thence it would cross Little Bell-alley and be carried on to the end of Bloomsfield-street, and by way of London-wall and Wormwood-street to Bishopsgate-street, and finally across Houndsditch and Petticoat-lane to its junction with High-street, Whitechapel. Opposite this point will commence the new street, projected by the Board of Works, from Whitechapel to the Commercial-road. This new road would take the largest portion of the north-west and north-east traffic, which now passes right through the centre of the City, and would furnish additional outlets to Aldersgate-street, Noble-street, Wood-street, Aldermanbury, Basinghall-street, and Coleman-street, rendering any widening of these unnecessary, and relieve the lines of Gresham-street and of London-wall, Wormwood-street, and Houndsditch. It would form in addition an easy means for traffic reaching all the stations of the Great Northern Railways. The formation of this great thoroughfare would necessitate the removal of Christ's Hospital and the Money Order Office in St. Martin's-le-Grand, which, however, would be a matter of very minor importance compared to the demolition of the fine old training college of blue coat celebrity. Many lesser improvements are recommended, and valuable suggestions offered as to river traffic bridges and subways across public thoroughfares, also police regulations, and altogether the report is at once valuable and interesting.

This year will certainly be famous in the civic annals as one in which some of the most important of this century's City improvements have been completed, and how successfully the objects intended have been accomplished is apparent to everyone. The Holborn Viaduct, of which any Ædile might be proud, will, in a few days, be thrown unreservedly open to public traffic. As we have paid several visits to this grand work when in progress, and passed through its well-built and spacious subways, each can estimate for himself how thoroughly everything has been provided for, and how solid is the entire structure. When we contrast the broad level plateau that now meets the eye with the steep descent of Holborn-hill, the muddy or dusty crossing of Farringdon-street, on the other side the corresponding climb up to St. Sepulchre's Church, and, finally, the very unpleasant proximity of Newgate-street, with a dead meat market, and the contact of its wares with the shoulders, we have every cause to congratulate ourselves on the change. And now that all these have gone away among the traditions of London, we can only wonder that this state of things was suffered to endure so long. When Newgate-street has been widened through its entire length, the full benefit of this improved termination of the long line of Oxford-street and Holborn will not even yet be reaped. For not until some continuation of this great artery into remote Whitechapel, such as that proposed by Mr. Haywood, be carried out, will this great east and west thoroughfare have reached its natural and necessary limits.

Besides the two noble works now completed, the last portion of the Thames Embankment has made good progress, and the new street, which forms the junction of our magnificent water-side boulevard with the heart of the City, is also in a forward state, one portion being used for general traffic. The fine effect of the space opened up beside the civic palace by Mansion House-street naturally suggests very forcibly the often repeated query "why not demolish the block of buildings between the Poultry and Bucklersbury, and widen this narrow street, which strangulates the traffic passing east and west by way of Cheapside?" The miserably defective accommodation afforded by this contracted roadway, and the insufficiency of the cramped footpaths for the stream of passengers which flow uninterruptedly all day long, become more apparent every year. It is now high time that the precedent of Middle-row, Holborn, be extended to this obstruction, and a city so wealthy as our Babylon, and seemingly zealous in effecting necessary improvements, will, doubtless, include this also among their number, even at some cost.

Associated with City improvements is the Metropolitan District Railway. It is difficult to foresee what may be the result of the present agitation; whether the extension to the Mansion House be carried out or not, it is not at all probable that Parliament would sanction the abandonment of the line on to Tower-hill. A rumour is afloat that an attempt will be made by the London, Chatham, and Dover Railway, or the directors, to obtain powers for a new station, close to Holborn Viaduct, to replace the present inconvenient one at Ludgate-hill. For this purpose, it is proposed that the sum of £100,000 or thereabout, which the Government will pay for the company's telegraph, be appropriated, but as the moneys must in the first instance be paid over to the arbitrators, these gentlemen may naturally employ these funds for the reduction of the debt on capital account. From this source, the construction of these telegraphs was defrayed, so that in all probability the new station must wait for better times ere it becomes an accomplished fact. The East London Railway works have rendered necessary the final closing for foot traffic of the Thames Tunnel, which has been open for over twenty-six years. Though at best a dingy and depressing subway, it long held a foremost place among the sights of the metropolis, and indeed the many difficulties which had to be encountered in its construction, and the skill and patience brought to bear by its famous originator, have placed it high in the archives of engineering enterprise. Though on the north side some time must elapse before this line of railway, projected in 1863 by the late Mr. J. S. Burke, and authorised by Parliament in 1865, can be completed, the directors have given notice to the Board of Trade that the first section would be ready for inspection after the 15th inst.

Turning from *terra firma* to the great water highway in our midst, we have also to note good progress in the new great works which line its borders and span its current, with the single exception of the unlucky pneumatic tube at Whitehall—commencing from the west. Foremost among these is the southern embankment, which has been carried to its proposed limits; and now from Westminster Bridge a magnificent promenade, carried past the palace of the Primate and the historic Lollard's Tower, replaces the old net-work of dangerous slums. Here, too, is rapidly rising the handsome pile of the new hospital, which has been admirably arranged to prevent contagion spreading its subtle poison over the whole infirmary. By separating the buildings into many blocks quite apart from each other, infectious diseases are localised and confined to their narrowest limits, as far as skill and foresight can bind them. At the same time the outward effect of one grand structure is maintained. On the north side the embankment makes rapid progress towards completion. From Westminster to the heart of the City we shall soon have an unequalled thoroughfare, which will do much to relieve the crowded line of the Strand, Fleet-street, and Cheapside. Æsthetically viewed, the architectural features of the engineer's design cannot be found wanting in mass, in outlines, appropriate detail, or severe general beauty.

Spanning the river where the embankment ends, Blackfriars Bridge now begins to strike the eye in all its completeness, but until the temporary wooden substitute (a work itself of much engineering skill) be removed, we can scarcely judge how far the adjacent railway straight lattice girders will interfere with the effect of Mr. Cubitt's handsome structure. When contrasted with its gloomy neighbour of Southwark, Blackfriars Bridge is a standing proof of the advance which has been made in the decorative section of engineering art. The older bridge was the solution of a problem unattempted before its time, and, with one exception, its construction is perfect so far as the disposition of the metal in the arches is concerned. But everyone must feel that the general effect, if massive, is sombre, and in no way improved by the dingy shade of colour employed. In neither case is the constructive material in any way disguised, nor is it desirable in similar cases that any attempt should be made to give a false appearance of stone to an iron bridge. This has been done, it is true, in the very beautiful structure at Westminster to some extent, but here it was requisite that some harmony should be produced between the elaborate and florid style of the senatorial palace and the broad bridge at its doors. The present generation has produced no architecture as well as no poetry of the period, that is, no style which will in after ages be distinguished as English of the 19th century. It is expedient, therefore, to adopt a safe model in its entirety, and to adapt a pure style to the specific requirements of the moment. Ornate Gothic having been chosen for the Houses of Parliament, to have placed a strong palpable iron bridge of the present day in close propinquity to an imposing building designed in a style that carries the mind back a great while, would by the fitness of things have been a hideous anachronism. Blackfriars Bridge is not intimately connected with any such surroundings, and we can bring an independent judgment to admire the just taste of its outlines and details. Here again at top the piers, the granite pillars, eminently handsome in themselves, harmonise with the iron arches, but the capitals, exceedingly beautiful and delicately sculptured, seem at present somewhat too glaring. This time and our smoke will remove, and when statues in bronze come to form the surmounting finish, these capitals will be further toned down.

As we may expect that Mr. Haywood's bold scheme of a new bridge near the Tower will not be entertained otherwise than an improvement of the future, the question of dealing with London Bridge demands immediate and serious consideration. The hideous tinkering of iron cantilevers I have referred to is in no case admissible, though of what civic wisdom may be capable it is difficult to foresee. But, however effected, the enlargement of London Bridge is extremely desirable, that is, assuming, as we may do, the postponement of the greater project. This very necessary addition to the present width must not entail any disfigurement of the beautiful contours, but must harmonise with the graceful structure which was opened about thirty years ago. Lower down the river we come to a new means of communication between the busy districts on either bank, in the Tower Subway. Mr. Barlow's clever little underground passage—clever both in design and execution—makes rapid way, and, in addition, what is so important in every work of this nature, it promises to be a complete commercial success. Its cost of construction has been small, and its position ensures much traffic; hence the desired result, good dividends, may be confidently expected.

Before leaving the river there is another point I wish to refer to. It is obvious to all that many admirable sites are available on the embankment for magnificent buildings. This session was re-opened the question of where our new Palace of Justice should be located. Sir Charles Trevelyan's scheme, oriental in its magnificence, was much too costly to be entertained, but besides this extensive design the Chancellor of the Exchequer puts forth a more subdued plan for placing the new Law Courts between Howard-street and the embankment. Sir Roundell Palmer, however, opposed in the strongest terms the alteration of the determination already come to by Parliament, and we may anticipate a keen debate when the report drawn up by Mr. Lowe and Mr. Layard is laid before the House of Commons. Coming from such a source as the thrifty guardian of the national purse, we need not be anxious about reckless expenditure being requisite to give effect to his plan. In no case can we expect, if we deem it necessary to resell the ground already cleared for the Carey-street site, that we shall escape without loss. This, however, should scarcely be suffered to stand in the way of an important embellishment of our noble river. While the æsthetic phase of the question justly holds an important place in its consideration, the convenience of all interested is of the primary consequence. As for the lawyers, the foremost of them, Sir Roundell Palmer, strenuously upholds the original site as in every way most convenient for himself and his brethren of the wig and gown; and certainly the present position of the legal colonies favours this view of the case. As to the expense, Mr. Lowe puts the acquisition of the Howard-street site, together with the buildings he proposes to erect—in fact the law courts complete—at £1,600,000, but it is probable this sum will be considerably exceeded. If economy is of more moment than a stately pile which shall be worthy of its prominent site, a river frontage will expose any deficiency for which a straitened expenditure may be responsible. As to Carey-street, according to Mr. Lowe's estimate, £600,000 are necessary before the requisite additional ground be acquired, which, with a nice little extra figure of £400,000 for approaches, makes another million, and this, with £780,000 already expended, amounts to one and three quarter millions that must be spent without taking into account the erection of the buildings themselves. Putting out of question the most important division, of which lawyers are the best judges, it will be necessary to see the plan Mr. Lowe proposes for his buildings before we can judge if the embankment is a more judicious location than the other. If, in fine, more money could be devoted to this object, and the legal opposition cease, there is no question as to the fitness of the noble site on the embankment to grace a noble judicial palace, which should be the admiration of the thousands who will pass daily both along the thoroughfare at its base and on the river. We must, then, be content to wait till we know fully

what Mr. Lowe's plans are before we pronounce finally on "the battle of the sites."

A much more vital question is the water supply of our city. Agitation culminated in a special commission, who have taken evidence, medical and scientific, on the subject. The former goes to prove that there is no reason to regard the Thames water as injurious to health when proper care is taken in the matter of filtration, and the following are the conclusions of the committee:—While they consider Mr. Bateman's scheme. in an engineering point of view, as the most feasible and practicable, they are of opinion that as to quantity and quality the waters of the Thames and Lea, supplemented by what will be retained by works for storing up the flood waters of those rivers, will be amply sufficient for the present and prospective wants of the metropolis. It is strongly recommended that the existing works of the water companies be purchased, and that the necessary extensions to these be carried out by a responsible body who shall have the entire management of the water supply. To meet the charge of all this it is proposed that two rates be levied, one a domestic and special rate on all dwelling-houses, the other a public or general rate on all rateable property. A plan similar to this has been in operation in Manchester and Glasgow, and has worked very well.

(To be continued.)

THE OUDH CANAL.

THE Government of India has just issued orders approving the designs of Captain J. G. Forbes, R.E., for a canal project in Oudh and the adjoining districts, much larger than that of the Ganges canal. The river Sardah flows from Nepaul into Oudh through the malarious jungle caused by the drainage of the Himalayas. From that river water is to be taken off sufficient to irrigate 19,000 square miles between the Sardah and the Gogra on one side and the Deoha and Ganges on the other. Colonel Anderson, the Inspector-General of Irrigation, states that the cutting of the first 12 miles will cost half a million sterling and will be of greater magnitude than any yet carried out in India. The "Times" gives the following particulars of this undertaking:—The dam is to be made at Bumbassa, the canal head at Nuglah, 8 miles lower. A supply of 13,000 cubic feet a second is required, and if the Sardah cannot give this at Bumbassa and Maggaen, lower down, the Korreallie river will help. The main canal will run through Oudh for 80 miles, and then bifurcate into the Benares canal, 280 miles long, and the Jounpore canal, 235 miles. But the project embraces the western districts also. The whole is estimated to cost close on five millions sterling, and a return of 11 per cent. is estimated, after paying 4 per cent. charges. This is to be got, however, only by enforcing the severe provisions of Colonel Strachey's Bill, or charging the proprietors of irrigable but not actually irrigated lands 5½d. per acre. As so much of the canal will pass through Oudh, which has an abundant water supply from wells and marshes, Colonel Anderson takes a much less sanguine view of its prospects, nor does he expect the Oudh Talookdars or their tenants to take the water unless exceptionally low rates are imposed. The surveys for the proposed canal from Ragmahal to Calcutta are going on, and that land is being taken up for the canal from the Damooda at Raneegunge to Serampore or Howrah, on the south side of the Ganges and Hooghly. The line of canal in Sirhind, too, running chiefly through the Native States of Putiala and Nabha, is being surveyed. The cutting down of the expenditure on ordinary public works by so much as 1¼ million sterling a year will set engineers free for State railways and canals.

LOSSES IN ACTION.

AN article in the last number of the "Preussische Jahrbucher" draws an interesting comparison between the losses of the rival armies in the battle of Koniggratz and those sustained at the other principal battles of the last two centuries. It appears that the Prussians lost at Koniggratz, in dead, wounded, and missing, 359 officers, and 8,794 men, and the Austrians 1,147 officers, and 30,224 men. The proportion of the losses to the total force engaged on each side was, for the Prussians, 1-23rd; for the Austrians, 1-7th; for both together, 1-11th. In the battle of Malplaquet (1709), the proportion of losses was 1-5th; at Rossbach (1757), 1-25th; at Leuthen (1758), 1-11th; at Zorndorf (1758), 3-8ths; at Austerlitz (1805), 1-4th; at Eylau (1807), 1-4th; at Wagram (1809), 1-8th; at Borodino (1812), 1-3rd; at Leipsic (1813), 1-5th; at Belle Alliance (1815), 1-3rd; at Solferino (1859), 1-8th. The three greatest of the above battles, the article proceeds, are those of Leipsic, Koniggratz, and Wagram, at which the total number of troops engaged was 460,000, 430,000, and 320,000 respectively. The three bloodiest were Leipsic (90,000 men lost), Borodino (loss 74,000), and Belle Alliance (loss 61,000).

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, November 25.)

SINCE our last report the business transacted in chemicals has been of a very satisfactory nature, principally for home consumption, the majority of the large buyers having taken advantage of the present low prices in the staple articles to secure sufficient for their requirements during the ensuing year. The reduction in pyrites has created a more lively feeling amongst the alkali makers, and it will doubtless again have the tendency to stimulate them to an unnecessarily increased production. In minerals of all descriptions the amount of business negotiated during the past week has been unusually large, exclusive of the public sales, but more especially in lead, zinc, and copper ores, the standard of the latter having slightly advanced. In metals there is little of importance to report. A considerable amount of business has been done in pig iron during the week, and prices close very firm and steady. Manufactured iron quiet, buyers not having yet realised the advance. Copper is in moderate demand, and smelters are firm at present prices. Tin and spelter are at nominal values, with an average business. Lead is selling freely, and present prices are readily obtainable. Soda: large contracts have been concluded in soda ash and caustic soda for 1870 consumption, at present low rates, of from £7 to £7 5s. per ton for 48 Ash; and £13 to £13 5s. caustic at 60. Crystals have also met with heavy sales, at £3 15s. to £3 17s. 6d. Bi-carbonate more in request at £9 10s. Nitrate of soda: fluctuates between 15s. 6d. to 16s. Potash: muriates being still scarce command £7 5s. to £7 7s. 6d. for 80. Saltpetre: not much selling, at 23s. for Calcutta, and 27s. for English refined. Alum: having been well sold forward, is pretty firm at late quotations. Ammonia: sulphate remains steady at last week's prices, £17 to £17 10s. for best white, and £16 to £17 for grey. Copperas: somewhat more activity displayed in green and rusty, at 52s. Dry is in continued active request at 50s. Pyrites: for present consumption prices remain at previous quotations, but, for spring delivery, contracts have been entered into on easier terms. Lime: phosphates are more inquired for at 52s. 6d. for 65. Bleaching powder at £8 for contracts to £8 5s. for 35. Disinfectants, at 5s. 8d. per cwt. for firsts, meet with considerable favour. Manganese: rather under average sales, at 95s. for 70. Guano: Peruvian quiet, at £12 10s.

METALS.—Iron: Scotch pigs firm at 54s. 8d. to 54s. 9d. Cleveland quoted from 45s. to 45s. 6d. for forge, and 50s. for No. 1. Welsh bars, £6 10s. to £6 15s.; Staffordshire, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: English tough, £72 to £73; Chili slab, £68. Tin: prices are quite nominal, English ingots being quoted at from £120 to £123; Straits, £117 10s. to £119. Lead: firm. P.G. best English soft pig lead, £19. Spelter: not much doing. Silesian, special brands, £19 10s. to £19 15s.; English, £20 10s.; hard spelter, for export, £16 10s.

Legal Intelligence.

VICE CHANCELLOR'S COURT,
NOVEMBER 18.
(Before Sir W. M. JAMES.)
SALOM v. JASSMAN.

THIS was a motion for an injunction to restrain the defendant, who is a saddler in North Audley-street, from making and selling any horse clippers in infringement of a patent granted to the plaintiff, an optician in Regent-street, in March, 1868. The plaintiff's invention is a two-handled instrument formed of a knife or cutting plate of metal, fixed to a plate of metal edged like a comb, and constructed so that the knife in passing over the comb plate cuts off the hair. The defendant sells a similar instrument, made under a patent invented by a Mr. Rawlings, and sold as Rawlings's patent horse clipper. The defendant denies the validity of the plaintiff's patent, and says that it is neither new in idea nor a new combination.

After some discussion of the case, the motion for injunction was ordered to stand to the hearing of the cause, the defendant undertaking to keep an account.

Mr. Fry, Q.C., and Mr. Solomon appeared for the plaintiff; Mr. Eddis and Mr. Everitt for the defendant.

COURT OF EXCHEQUER, WESTMINSTER.
NOVEMBER 19.
(Sittings in Banco, before the LORD CHIEF BARON, Mr. Baron CHANNELL, Mr. Baron PIGOTT, and Mr. Baron CLEASBY.)
SAXBY AND ANOTHER v. MACKENZIE AND OTHERS.

THIS was an action brought by the plaintiffs for an alleged infringement of their patent, dated June 24, 1856, for improvements in railway signal apparatus. The action was tried before the Lord Chief Baron in June last, when a verdict was entered for the plaintiffs on all the issues.

Mr. Grove, Q.C., Mr. Keane, Q.C., Mr. Macrory, and Mr. Aston appeared for the plaintiffs; the Solicitor-General, Mr. Webster, Q.C., and Mr. O'Hara Moore appeared for the defendants.

A rule for a new trial to enter the verdict for the defendants was moved for and obtained by the Solicitor-General, and came on to be argued some days ago, and the arguments have been resumed from time to time.

The defendants contend that they do not infringe the plaintiffs' patent, because they do not lower their signals by the action of the same lever that moves the shunting points, and simultaneous with that motion use another lever for that purpose. For the plaintiffs it was urged that the plaintiffs' invention consisted of apparatus by means of which the lever that works a shunting point, in order to open or shut a line of rails, also works the signals, and that in such a way that certain stops are interposed to prevent contradictory signals from being given, and the requisite stop is released to allow the proper indicating signal to be given. The plaintiffs' invention, it was said, was a system that for the first time, in 1856, provided the means of working railway signals with perfect safety. This was effected by causing the lever that moves points at the same time to stop or lock up in a position indicating danger all signals which, if lowered, would cause any collision or accident by permitting a train to go upon a line obstructed in any way by any point or other obstacle.

The defendants used, it appeared, the same mechanical means for moving a point and stopping contradictory signals, and releasing the proper indicating signal, but they also used an additional lever to move the indicating signal, instead of allowing it to fall by the action of gravity, and contended, on that account, that their apparatus differed from that of the plaintiffs.

The arguments in this case were concluded on Wednesday last, and their lordships have reserved their judgment.

ROLLS' COURT, CHANCERY LANE.
NOVEMBER 23.
(Before the MASTER of the ROLLS.)
CANNINGTON v. NUTTALL.

THIS is a patent case and involves the question hether the defendant has invaded the plaintiff's isting patent rights in respect of certain improvements in glass furnaces, whereby the glass is melted n bulk, and pots are dispensed with. The case is being tried by jury, and seems likely to occupy some days.

Mr. Grove, Q.C., Mr. Fooks, Q.C., Mr. Theodore Aston, and Mr. Carpmael appear for the plaintiff Mr. Webster, Q.C., Mr. Jessel, Q.C., Mr. E. Macnaghten, and Mr. Herschell for the defendant.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

ERRATUM.—In the list of specifications printed in our last issue, No. 1392, Messrs. Wilkin and Clark's for radiating axles, was marked "patent abandoned." This is not the case, the error having crept in by reason of the patentees having obtained an extension of time for completing their patent, which they have now done.

RECEIVED.—M. W.—B. L.—W. R.—T. C. S.—J. B.—S. and P.—J. F.—J. P.—W. M'L.—J. H. D.—R. S.—J. L.—R. T. C.—E. M.—R. A.—L. P. S.—R. W.—R. S. G.—C. H.—W. J.—W. F.—H. D.—S. W. B.—W. H. H.—R. E.—G. W. H.—J. S.—R. T.—A. W. P.—H. G.—W. and C.—F. B. and Co.—G. R. T.—F. H.—E. L.—H. M.

Meetings for the Week.

TUES.—Institution of Civil Engineers.—Renewed Discussion upon Mr. Gaudard's paper on "The Strength and Resistance of Materials," and also on "The Public Works in the Province of Canterbury, New Zealand," by Mr. Edward Dobson, A.I.C.E., at 8 p.m.

THE well-known painter of German historical subjects, Overback, lately died at Rome, aged 80 years.

Naval, Military, and Gunnery Items.

The Pacific Steam Navigation Company have contracted for the building of two new steamers for their Liverpool and Valparaiso mail line.

By direction of the Admiralty the ship in the grounds of the Marine School at Greenwich Hospital, and used hitherto as a training-ship for the pupils, is to be sold by auction.

The Viceroy of Egypt has ordered from a leading French mechanical company an iron floating dock. The dock will be of large dimensions, and will weigh 4,600 tons.

We regret to announce that a destructive fire took place yesterday week in the shipbuilding yard of Messrs. Oswald and Co., Sunderland, which resulted in a loss of extensive machinery and property, valued at from £20,000 to £30,000. No lives were lost.

The experiments which were to have been made at the Proof Butt, Royal Arsenal, Woolwich, to test one of a number of the 7-inch Moncrieff gun-carriages, invented to fire over high parapets—now under course of construction in the Carriage Department—have been postponed *sine die*.

The Board of Trade have awarded a binocular glass to Captain Th. Olsen, of the Norwegian ship "Vikingen," of Langesund, in acknowledgment of his humanity and kindness to the master and crew, 19 in all, of the ship "Athleta," of Newcastle, whom he rescued at sea on October 9, 1869, when in lat. 43 49 N, and long. 29 52 W.

The First Lord of the Admiralty has requested Mr. Tite, M.P., architect of the City of London Corporation, to supervise the division of Woolwich Dockyard into plots, preparatory to its immediate sale. It is understood that this is a compliment to Mr. Tite's well-known abilities as an architect, and that his services will be entirely honorary.

The opening of the Suez Canal goes on with the greatest festivity, fetes and feasts being the order of the day. Ships of all nations have passed through, some sticking in the mud on the way, and others, those of light draught, passing freely through. It would seem that there is still money required to complete M. Lesseps' great work, but this will doubtless be forthcoming as nations realise the importance and practical value of the undertaking.

A large quantity of Aberdare steam coal continues to be received at Pembroke Dock for the use of the navy, and it is rumoured that early next year the Channel fleet will again be sent to Milford to coal. This is the result of the trial made a short time since, when the vessels of the fleet were coaled at Milford with the most satisfactory results, both as to the price of the fuel and the quality of the coal supplied.

Her Majesty has sanctioned the employment of British officers in Persia to aid in the organisation and drill of the Persian army. There will probably be four officers thus employed—one with the local rank of brigadier, as commander, and three with the rank of colonel. One of the latter will belong to each branch of the service. It is rumoured that Major Moore, of the Bombay Staff Corps, and Major Peyton, of the 7th Dragoon Guards, may be employed on this service.

The number of ships arrived at Falmouth, Queenstown, Plymouth, &c., from Saturday, November 13, to Friday, November 19, both included, amounted, according to "Dornbusch's Floating Cargoes Morning List," to a total of 243:—66 wheat, estimated 172,600 quarters; 51 maize, estimated 153,000 quarters; 14 barley, 5 rye, 1 beans, 2 dodderseed, 4 linseed, 4 rapeseed, 1 oilcake, 2 valonea, 1 palm nuts, 6 rice, 10 sugar, 7 coffee, 1 tobacco, 4 hides, 8 guano, 2 nitrate of soda, 7 boneash, 6 dyewood, 14 timber, 1 fustic, 2 sulphur, 1 oil, 6 fruit, 17 sundries.

The trustees of the Tyne Lifeboat Fund met at their offices in South Shields on yesterday week, when the Mayor of that borough, on their behalf, presented to Mr. Joseph Smith, a veteran Tyne pilot, and superintendent of the Tyne lifeboat 25 years, an illuminated address, and a purse containing £30 in gold, as a mark of their estimation of his valuable services as superintendent of the lifeboats within the time mentioned. While occupying that responsible position Mr. Smith had gone off to 207 wrecked vessels, and had assisted in rescuing 1,001 lives.

It appears from a Parliamentary return that the total amount of the Banda and Kirwee prize fund, after deducting law expenses (upwards of £58,000) and agency commission at 1½ per cent. (£9,374 odd), amounted in round numbers to £615,600. Of this one-twentieth (£30,780) was paid to the representatives of Lord Clyde and Sir George Whitlock in the proportion of four-fifths (£24,624) to the former and one-fifth (£6,156) to the latter, leaving for general distribution £584,800. Three distributions have been made, amounting in all to 750 rupees (£75) a share.

The Henry-Martini 0·45-inch bore breech-loading rifles, about to be placed in the hands of troops for trial, are in an advanced stage of completion. The ammunition for these experimental arms has been decided on, and is now in course of manufacture at Woolwich. It is the Boxer small-bore breech-loading ammunition, similar in form to that for the service Enfield Snider arms, but having a solid hardened bullet and a powder charge of 85 grains.

Miscellanea.

The "Borsen-Zeitung" states that Messrs. Grattoni and Brassey and Dr. Strousberg have jointly undertaken to tunnel the St Gothard, and have engaged to complete the gigantic undertaking in less than seven years.

The Southmolton (Devon) Local Board have contracted to dispose of the town sewage, hitherto discharged into a stream, for five years for a sum sufficient to pay the interest on the outlay for sewage works.

The Turkish Government have granted a concession for the construction of the Roumelian Railways, and it is intended to issue 75,000 obligations of 400f. each, entitling the holders to certain lottery prizes.

The permanent buildings for the first of the series of Annual International Exhibitions of Art and Industry in 1871 were commenced on the 15th instant at South Kensington. Messrs. Lucas Brothers are the contractors.

The honour of knighthood conferred upon Mr. William Fothergill Cooke, which was recently announced, was recommended to Her Majesty as a recognition of Sir William's "special services in connection with the practical introduction of the electric telegraph."

It appears that in the fiscal year ending June 30, 1869, 760,000,000 letters passed through the mails of the United States, being an increase of 40,000,000 over any previous year. This is about 20 letters per head for every man, woman, and child in the United States.

The Council of the Society of Arts have appointed a committee to consider and discuss questions, relating to mechanical inventions, which may appear to be of too technical a character to be brought before the Society at the Wednesday evening meetings.

The seventh yearly issue of the Railway, Banking, Mining, Insurance, and Commercial Almanack, and annual review of the material interests of the United Kingdom, will be published early in January, 1870. It will be edited, as usual, by Mr. W. Page Smith, whose name is a guarantee that it will be found as useful as its predecessors.

Numerous accounts from Scotland and the North of Ireland state that on Monday week, between seven and eight o'clock p.m., a magnificent auroro aorealis was observed stretching over the entire heaven from S.W. to N.E., in shape like an enormous rainbow. It was very broad and luminous, and presented a remarkable appearance.

The improvements in Florence are going on apace The squares are beginning to be planted. The great bare Piazza dell'Indipendenza has had a trench dug round it and filled with good black mould, in which trees are to be set. The Piazza San Spirito is being converted into a pretty garden, with trees, shrubberies, and flowers, and something of the same kind is doing at St. Marco's-square.

Germany has had its public competition for the best drama on the occasion of the Shakspeare jubilee. A triennial prize of £3,000 and a large gold medal are given away. The successful competitor at present is M. Emmanuel Giebel, his work being entitled "Sophonisba." The second prize was gained by the author of "The Countess," M. Henri Kruse, editor of the "Cologne Gazette."

The "Wall-street Journal" says that Mr. Drake, who put down the first petroleum oil well in America, and who at one time was worth £200,000, recently died in the poor-house. The first derrick and engine still stand over the well, and are carefully preserved. A monument is to be erected to his memory, which will contain a room in which the engine is to be placed.

Dr. Lacaze, who has left his fine collection of pictures to the Louvre, has bequeathed twelve thousand pounds to the Academy of Sciences of Paris, to found three biennial prizes, of £400 each, for the most important works on physiology, natural philosophy, and chemistry. The conditions of the bequest are that the prizes shall not be divisible, and that they shall be open to competition by foreigners as well as Frenchmen. Should they be won by scientific men of other nations, says the testator, the honour will still remain to France, that the prizes resulted from a French donation, and were awarded by a French Academy.

The Post-office department of the United States' Government, keeps a register of the time occupied in the transmission of the mails between San Francisco and the chief eastern cities. The average time between New York and San Francisco is 7 days 2 hours 23 minutes; but frequent trips have been made in less than 6 days and 16 hours. It is intended to reduce the schedule time, so as to bring it down by half a day on the average.

The Southern Embankment of the Thames, which reaches from Westminster Bridge almost up to that of Vauxhall, being now completed, it was opened on Wednesday by Sir John Thwaites, with some slight ceremonial. A procession was formed to the southern extremity, headed by a band, salvos of artillery were fired, and the church bells of St. Mary, Lambeth, rang out a succession of merry peals.

Experiments have recently been made at Usworth Pit, near Newcastle, with Mr. S. P. Bidder's coal-cutting machine. The result was eminently satisfactory. Twenty-five tons of coal were set free in the remarkably short space of 35 minutes. Unlike the ordinary hewing, the coal was left in very large pieces, and by the prevention of waste in this way alone the saving in certain collieries to coalowners must be immense.

In the old churchyard of Worth, Dorsetshire, is a tomb with the following inscription:—"Benjamin Jesty, of Downshay, died April 16, 1816, aged 79. He was born at Yetminster in this county, and was an upright, honest man, particularly noted for having been the first person known that introduced the cow-pox by inoculation, and who, for his great strength of mind, made the experiment from the cow on his wife and two sons in the year 1774." This man was therefore the first vaccinator.

The number of visitors to the South Kensington Museum during the week ending November 20, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 11,671; Meyrick and other galleries, 1,268; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,592; Meyrick and other galleries, 76; total, 14,607. Average of corresponding week in former years, 9,612. Total from opening of Museum, 8,959,371.

W. Turgan has just issued some new numbers of his valuable work, "Les Grandes Usines." They contain a most interesting description of the manufacture of Venetian glass and that of the factitious pearls which are used as a substitute for money in dealings with savage and uncivilised nations. The subject of the working of mines of silver, lead, iron, and coal, is also treated *in extenso*, and the various portions of the text illustrated by several very handsomely executed plates. At some future occasion we shall lay before our readers a *resume* of the contents we have alluded to.

According to official returns, the number of chamois killed this year in the mountains of Glaris is as follows:—25 in the Grossthal, 32 in the Sernithal, 10 in Mittelland, and 12 in the Kerentz country; making altogether 79. These figures show that the number of hunters goes on increasing, and that the slaughter of these animals becomes more and more numerous in a corresponding ratio. Thus this interesting race of inhabitants of the Upper Alps is fast approaching extinction, especially in all those districts where the shooting is free. The only remedy appears to be the enactment of some law to prevent it.

With the view of bringing Australian meats, and the various modes of cooking them, prominently before the working classes, several of the leading colonists have determined upon providing a banquet, which shall be prepared entirely by the wives of *bona fide* working men, and which will take place at Lambeth Baths on Wednesday, December 1. The Earl of Denbigh, if in town, will preside, and the list of stewards includes the names of many of the leading noblemen and Members of Parliament who take an interest in improving the social condition of the working classes. The guests are to be selected by the Working Men's Club and Institute Union, and it is intended that the working classes of London shall be fairly represented. Each of the invitations will be for a husband and wife.

The Austrian Government has introduced a novelty in postage, which might be introduced with great benefit in all countries. The object is to enable persons to send off, with the least possible trouble, messages of small importance, without the trouble of obtaining paper, pens, and envelopes. Cards of a fixed size are sold at all the post-offices for two kreutzers, one side being for the address and the other for the note, which may be written either with ink or with any kind of pencil. It is thrown into the box, and delivered without envelopes. A halfpenny post of this kind would certainly be very convenient, especially in large towns, and a man of business, carrying a few such cards in his pocket-book, would find them very useful. There is an additional advantage attaching to the card, namely, that of having the address and post-mark inseparably fixed to the note.

THE ninth decennial census of the United States will be taken in 1870. With a population sparsely scattered over a vast area, no attempt has hitherto been made to complete the enumeration in one day; in some cases it was allowed to spread over the whole year. It is thought that by proper arrangement the whole work of enumeration and reporting the schedules may be performed within a month. The cost of the census of 1860 exceeded 1,535,000 dols. It is doubted whether too much has not been attempted, and whether some of the subjects of inquiry might not be omitted. Some portions of the returns have been found of little or no scientific or practical value.

ANOTHER revolution in farm practice is about to be worked out. Mr. James Howard, M.P., has turned his attention to the question of drilling by steam power, and has had a drill, upon the Suffolk principle, constructed with a harrow in the rear. During last week the machine was regularly at work upon the farms of Messrs. Howard, Bedford, and upwards of 20 acres per day were drilled and harrowed; 16ft. is covered at a bout. On Friday week 15 acres of wheat were put in before dinner, when a heavy rain stopped the work. A self-propelling engine is employed to haul the drill. The apparatus is moved from field to field without the aid of horses, and is ready for work within the short space of an hour. By a very simple device the slack rope, working on a pulley at either side, turns round the drill and harrows when the end of the field is reached.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1361, 1362

BUILDINGS AND BUILDING MATERIALS—1338, 1339, 1357, 1366, 1399

CHEMISTRY AND PHOTOGRAPHY—None

CULTIVATION OF THE SOIL, including agricultural implements and machines—1338, 1336, 1365, 1369, 1380, 1383, 1387

ELECTRICAL APPARATUS—None

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1337, 1343, 1346, 1358, 1369, 1392, 1394

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1349, 1370, 1381, 1393

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1355, 1359, 1364, 1368, 1386, 1400

GENERAL MACHINERY—1333, 1375

LIGHTING, HEATING, AND VENTILATING—None

METALS, including apparatus for their manufacture—1350, 1372, 1391

MISCELLANEOUS—1332, 1334, 1341, 1344, 1348, 1352, 1365 1371, 1378, 1388, 1390, 1398

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1340, 1345, 1347, 1356, 1373, 1376, 1382, 1395, 1396, 1397

SHIPS AND BOATS, including their fittings—1351, 1384,

STEAM ENGINES—1331, 1354, 1374, 1377, 1385, 1389

WARFARE—1342, 1379

1331 F. JACKSON and T. CORBETT, Wigan. *Lubricators to steam engines.* Dated April 30, 1869.

The inventors employ a receiver or vessel fitted with a plug having a cup at the top, and bored partly down the centre to conduct the oil into the receiver or vessel, and partly upwards from the bottom to admit the steam and also to remove the condensed water. The holes in this plug and also in the conical tube (inside the receiver) in which it works are so arranged that in one position of the handle the passage communicating from the cup with the inside of the receiver or vessel is open and the other passages are closed. In this position the vessel is charged with oil or tallow.—Patent abandoned.

1332 F. BUJEAUD, Angouleme, France. *Bottle envelopes.* Dated April 30, 1869.

The straw, cane, rush, or other analogous material of which the bottle envelopes are to be made is arranged on carriages, and then sewn by means of the improved sewing machine, having two needles and two shuttles. When the sewing is effected, the inventor removes the sewed straw from the carriage and forms it into a cylinder by tying the free ends of the sewing threads, and then by tying in one of the ends about an inch from the extremity he obtains a conical envelope which serves to cover the bottle.—Patent completed.

1333 A. SLEIGH, Lancaster-road, Notting-hill. *Motive power.* Dated April 30, 1869.

The inventor fixes vertically two discs or wheels with spokes of the same diameter and size on one common horizontal axle at any desired distance apart, and unites those discs or wheels by transverse bars, so as to make them one wheel, which he calls the main wheel, the axle of which rests on and revolves in bearings supported by a perpendicular frame work. The periphery of the main wheel is divided into several equal segments; eight are adapted at present; externally to each of those segments, round the main wheel, oblong square blocks are adapted, which are termed segmental blocks, of any heavy substance.—Patent abandoned.

1334 R. F. BIGOT, Paris. *A level with mirror.* Dated April 30, 1869.

This consists of a looking glass with a plane surface. This glass is placed in a frame and is suspended in any suitable manner upon an elbow rod bent at a right angle, which is in its turn fixed to a cursor or slide sliding along the rod which carries the instrument. Two screws fix the elbow rod to the cursor. This rod may be moved up and down at will, so that the fiducial line or line of sight may be always at the height of the zero on the vernier or graduated scale.—Patent abandoned.

1335 J. R. JEFFERIES, Ipswich. *Horse rakes.* Dated April 30, 1869.

The inventor employs a frame of flat bar iron, which he furnishes with shafts and mounts on carrying wheels. These wheels turn on stud axes carried on cranked levers pivoting on the frame, to afford means of adjusting when desired the height of the frame, and therefore the position of the points of the rake teeth, in relation to the surface of the land. The front bar of the frame has two or more cylindrical bosses fixed upon it, a lever arm projecting forward is mounted on each of these bosses, and these arms carry a bar on which the rake teeth are supported and on which they are able to turn. Each of the lever arms above mentioned has another lever arm formed in one piece with it and projecting to the rear. These arms carry a bar passing along under the rake teeth and supporting them.—Patent completed.

1336 H. J. SEELS, Lincoln. *Harrows.* Dated April 30, 1869.

The inventor forms the harrow frame approximately of a triangular form, and at the leading angle he provides a swivel wheel, on the upright spindle of which is fixed an arm or long eye to which the draft chain of the implement is connected so that the position of the swivel wheel follows the direction of the draft. Near the back of the frame a horizontal axis is mounted upon it having at its ends arms on which other supporting wheels are carried on studs. There is also a lever handle fixed on the axis at its centre, by depressing or raising which the inclination of the arms carrying the wheels is varied; when these arms are vertical or nearly so, then the wheels are depressed so far below the frame as to carry the points of the teeth clear of the surface of the land, but when the arms are, by raising the lever handle, brought to a horizontal or nearly horizontal position, then the harrow teeth penetrate the land to the full depth of which the implement is capable, and the harrow when drawn along the ground acts in the manner of an ordinary harrow.—Patent completed.

1337 R. CRAIG, Dalkeith. *Manufacture of paper.* Dated April 30, 1869.

This invention consists in certain improvements in the machinery of the Fourdrinier paper-making machine. As such machine and cylinder are used at present, there is only one press roll which is usually in a position immediately under the cylinder. The inventor, however, in addition to the single press roll now used, places at least one additional press roll situated at a distance of about 1ft. in front of the first-mentioned press roll.—Patent completed.

1338 R. WARD, Newcastle-on-Tyne. *Ovens.* Dated April 30, 1869.

The inventor constructs a furnace underneath the apparatus, the heat from which operates upon the under side of a bed plate, first by immediate action and next by means of a flue which passes round it. Upon the bed plate in the centre he erects a tube in a vertical direction, into which the heat is conveyed after having traversed the under side of the bed plate. Round this table he places any desirable number of movable shelves for receiving the articles to be subjected to heat, these shelves being constructed with a hole in the centre to receive the vertical tube. Each shelf may thus be caused to revolve round the tube for the purpose of conveniently receiving or removing the articles to be treated.—Patent completed.

1339 E. TUTTE, Fareham. *Hollow walls.* Dated April 30, 1869.

In order to tie the double wall together the inventor employs wall ties consisting of thin plates usually of slate or cast iron, and generally of a width slightly exceeding the thickness of a brick, and of a length sufficient to extend across the air space in the wall and to enter the brickwork on either side. The wall ties may be perforated at either end, so that a mortar may hold to them firmly. As the wall is being built they are introduced at distances apart into the vertical joints, and their width being by preference as before mentioned somewhat more than the thickness of a brick, the lower edge of each wall tie then rests on the course below it, whilst the course above it bears upon its upper edge. Thus the wall ties become fixed very securely in this brickwork, and great strength is given to the structure.—Patent completed.

1340 J. SMITH, Rathgar, Dublin. *Communicating in trains.* Dated April 30, 1869.

This consists in having a water pipe or pipes attached to each carriage with a convenient means of uniting them by means of a hose and union joint, so as to make a watertight or nearly watertight coupling. When such pipes are so joined, a free communication will be effected along the whole length of the train.—Patent abandoned.

1341 T. GREENWOOD, Leeds. *Cutting joints.* Dated May 1, 1869.

The inventor constructs a framing or bed having slides formed along each side, upon which slides is a table holding the two pieces of wood to be acted upon. This table has two opposite inclined surfaces placed at any desired angle to each other, depending upon the angle at which the two boards require to be joined together, such angle formed by the inclined surfaces being if requisite rendered adjustable. Upon these inclined surfaces are placed the boards on which the dovetail joint is to be cut, which boards have previously had a true edge formed to be acted upon by the cutters. The exact required length of the boards is determined by causing such edges of the board in passing down the inclined surfaces to come against adjustable gauge blocks with inclined surfaces situated upon a transverse bar carried by the bed of the machine. When in this position the boards are held securely against the angular surfaces of the table by two lever cramps made to act by means of a screw upon a saddle piece resting on the board, or any other convenient known mode of cramping may be employed. The table is caused to travel along the bed of the machine by means of two screws mounted in the framing or bed, and rotated simultaneously by means of a hand wheel and suitable gearing or by a self-acting feed motion.—Patent completed.

1342 J. MACKIE, St. James-street, S.W. *Breech-loaders.* Dated May 1, 1869.

This relates to letters patent dated May 7, 1860 (No. 1128). The inventor forms what is called the action of the gun so that when the breech is closed and the gun ready for firing, the breech end of the barrels being close up to the false breech and firmly held there by the eccentric head of the lever, the hook which corresponds with the hook of Dougall's lock-fast gun, and which is at the front end of the lump instead of resting against the hinge pin as in the lockfast, is at a little distance behind it. The cavity in the lump in which the head of the lever works closes down upon a solid piece left in the action of the gun, and so arranged that the solid piece and the eccentric head of the lever together exactly fit and fill the cavity.—Patent abandoned.

1343 J. WILSON, Stockport. *Bobbins.* Dated May 1, 1869.

This relates to the tubular bobbins without ends used in all such machines where "presser flyers" are employed, and consists principally in forming such bobbins from a piece of sheet iron cut to a suitable width, and bent by means of rollers or dies into a cylindrical or tubular form. —Patent completed.

1344 W. B. ROBINS, South Molton-street. *Syringes.* Dated May 1, 1869.

The inventor constructs a pump or syringe capable of delivering a constant stream in the following manner:— The apparatus consists of a barrel in which a piston works. This piston has a tubular rod through which the delivery takes place, and it terminates in a jet or rose at which the water escapes. The rod works through a stuffing box at the end of the barrel and has a handle upon it which is grasped by the hand in working it to and fro. The inlet or suction pipe is connected with the barrel at or near the stuffing-box end and the water is drawn into the barrel during the inward stroke. When the outward stroke commences this water, being prevented from returning by the suction valve, is allowed to pass from the front to the back of the piston by passages in the piston rod, over which the piston, which is loose on the rod, plays, acting like a valve. During the inward stroke the piston stands over these passages closing them, but as soon as the outward stroke of the piston rod commences the stop on the rod which had been propelling the piston leaves it, and the rod slides through the piston until another stop comes against it and causes it to commence its return. This motion of the piston rod independently of the piston, opens the passages in the rod and then the water passes by these passages to the back of the piston.—Patent completed.

1345 E. and T. WALTHAM, Stockwell. *Road locomotives.* Dated May 1, 1869.

The frame or body of the engine is adapted to carry upon it the load which is to be transported and also a steam boiler, by preference an upright boiler such as is known as "Field's Boiler." This frame or body is supported by two locking or swivelling frames, one at the front the other behind, and each of these frames has two supporting wheels, which are the road wheels of the engine. Each locking frame turns upon a perch pin, and the frame or body is supported by friction rollers running on a circular track on the locking frames. The locking of the leading frame is effected by any suitable arrangement of steering gear, and the two frames are geared together by toothed arcs so that they turn simultaneously. Either locking frame carries upon it two steam cylinders driving by means of connecting rods an axis having corresponding cranks, and from this axis motion is transmitted to the road wheels by gearing suitably arranged to allow free play to the springs interposed between the frame or body and the axles. There are two tooth rings on each road wheel, one with external the other with internal teeth, the driving pinion is between them and is able to be put into gear either with one or with the other by moving a block carrying the pinion axis in a suitable guide slot.—Patent completed.

1346 J. P. BALM, Halifax, and R. NEWTON, Keighley. *Spinning frames.* Dated May 1, 1869.

This consists in giving a transverse motion or a reciprocatory endwise movement of the bottom front carrying roller, thus producing a frictional sliding of the same against the top roller. Also in covering one or both of the front carrying rollers with either india-rubber, leather, or other suitable substance to produce adhesion on the rovings as they pass through or between them to the drawing rollers.—Patent completed.

1347 J. B. BLAKE, Alton, Hants. *Velocipedes.* Dated May 1, 1869.

This relates to velocipedes with three wheels, namely, two running wheels and one steering wheel. The running wheels are fixed on an axis fitted with cranks in the usual way, but the axle of the steering wheel is formed with a spherical swell about the centre of its length, and in this spherical part the nave of the steering wheel fits, thus enabling the wheel to be moved sideways without changing the position of the axle. The wheel may be maintained in a vertical position by making the steering spindle forked so as to embrace each side of the nave of the wheel and allow freedom of movement sideways on the axle. The steering wheel is connected to its axle by a pin fitting in a slot.—Patent abandoned.

1348 G. RITCHIE, Folkestone. *Stop hinges.* Dated May 1, 1869.

The inventor constructs a hinge for this purpose of a plate of metal adapted to be fixed to one of the pieces or parts to be connected by screws or other fastenings and having a boss upon it through which the pin of the hinge is passed. On either side of the boss a metal plate is applied; these plates are adapted to be fixed to the other of the two bars, pieces, or parts, to be connected, one on either side of its extremity, by screws or other fasten-

ing. The hinge pin passes through the ends of the side plates at the corners of the plates, and the plates are secured by riveting the ends of the hinge pin.—Patent completed.

1349 W. BROUGHTON, South-street, Finsbury, and T. STEVEN, Glasgow. *Cooking range.* Dated May 1, 1869.

This relates, first, to arrangements for holding or placing the screw nut used in uniting the parts of cooking ranges and other fireplaces; second, to constructing, arranging, or combining together the parts of cooking ranges; third, to constructing and arranging the hood or "back draught" in an improved manner; fourth, to employing a double shovel for supplying fuel into the middle of a fire; fifth, to casting of the oven with the shell forming the outside of the flue in the same piece; sixth, to arranging a cooking spit horizontally in the oven and the application of the turning power thereto; seventh, to turning cooking spits, ventilators, and other appliances by motive power apparatus.—Patent completed.

1350 J. CONWAY, Broad-street, Ratcliff. *Forges.* Dated May 1, 1869.

Instead of forming the tuyere pit or well-hole of the hearth of the forge with a close bottom in the usual way, the inventor forms it with an open bottom or makes an opening therein when the hearth has been already formed in the usual way, in which opening, as the case may be, he fits a cast-iron grate and frame of a rectangular or other shape, this grate being removable from the frame at pleasure and reversible therein so that when one end thereof has been burnt away the opposite end can be turned to the tuyere.—Patent completed.

1351 R. SAUNDERS, Croydon, S. *Cable stoppers.* Dated May 1, 1869.

The cable stopper or controller is constructed, arranged, and combined with the elastic devices in such a manner that the entire apparatus occupies but little more space than an ordinary stopper, and may be taken away and stowed below with the anchors when the latter are no longer required. In carrying out the invention the stopper proper or controller may be of any suitable construction, but, instead of being rigidly secured to the decks as is now generally the case, it is to be placed on a metal plate, in which may be made grooves or other guides for the stopper to work upon.—Patent completed.

1352 C. T. LIERNUR, Frankfort-on-the-Maine. *Treating sewage.* Dated May 3, 1869.

This consists in various improvements in the details of M. Liernur's previously patented pneumatic sewerage system, the principal advantage of which over other systems is, according to the inventor, that while by the latter only one portion of the excrements is utilised, the other being left to cause annoyance, by his system the whole of the excrement is deodorised and usefully employed.—Patent completed.

1353 P. BARRY, Lombard-street. *Printing machine.* Dated May 3, 1869.

The inventor prefers to arrange in connection with the feed apparatus and over the table whereon the sheets are piled a bar or roller, the surface of which is partly or entirely covered with porous india-rubber, preferably of the kind now known as sponge rubber, but he may employ other similarly soft, porous, and durable material, which, when brought in contact with the paper, will separate the upper sheet from the others without soiling or otherwise injuring the paper. The inventor attaches this rubber in any suitable manner to the bar or roller before mentioned, which is arranged at the end of the sheet to be presented to the grippers, and which may extend entirely across the same. Where a bar is used it is necessary that the same should be provided with means whereby it will adapt itself to the varying thickness or height of the pile or layer of sheets on the table, and the bar must also have at proper intervals a motion which will separate the upper sheet from the other sheets below it, and present its edge to the grippers or tapes which then seize it and carry it forward to the printing bed or rollers.—Patent completed.

1354 J. SHACKLETON, Bradford. *Utilising waste steam.* Dated May 3, 1869.

The inventor employs a self-acting regulator valve to the ordinary exhaust pipe of the steam engine, and also any suitable arrangement of piping connected to the exhaust pipe between the valve and the steam engine, for conducting the exhaust steam to the place and for the purposes required. This valve is constructed similar to an ordinary mushroom stop valve, but the valve is under the action of a spiral spring, which is regulated or adjusted by a set screw to any desirable amount of pressure, so that the exhaust steam will open the valve and escape by the ordinary exhaust pipe.—Patent completed.

1355 S. H. HODGES, Bristol. *Boot heels.* Dated May 3, 1869.

A column, having a shoulder or flange at the upper end thereof, is fixed by means of suitable supports in a vertical position, the same being hollow and having in the interior thereof a spiral or other spring. A solid piston or plunger is placed in the hollow portion of the column, in which it is free to have an upward and downward motion above the spring, and is kept in its desired position by means of suitable projections and grooves formed on and in the piston or plunger and column respectively, or by means of any other suitable or analogous contrivance. A block is fixed to the head or upper part of the piston or plunger, such block being perforated with circular or suitable holes corresponding in number to that of the nails which it is intended shall be inserted in the heels to be manufactured. In each of the holes is placed a metallic pin, the length of such pins being equal to the thickness of the block. A block, in which is formed the heel die,i s attached by means of a suitable hinge to the piston block, so that it can be lifted and turned over on one side, leaving the upper face of the latter exposed.—Patent completed.

1356 H. WILLIAMS, Portwood-street, Liverpool. *Velocipedes.* Dated May 3, 1869.

The invention chiefly consists in having the fore or driving wheel of great diameter. This fore or driving wheel is supported from the axis by a wrought-iron or steel forked eye rod, which is fitted into the bearing socket in the beam or frame. This wheel is driven by double cranks on each side of the wheel worked by the rider by means of treadles or levers working on pins secured to brackets attached to the forked eye rod before mentioned. These treadles are nicely balanced by means of counter weights placed on the opposite end of the treadles to that from which the impetus is given in order to reduce the pressure or weight against the back stroke of the cranks. The balanced ends of these treadles are brought to bear on the under side of the cranks and impel them.—Patent abandoned.

1357 J. B. NIMMO, Edinburgh. *Lever door spring.* Dated May 3, 1869.

The apparatus or contrivance employed consists of two levers acting in gear with a bevelled or other wheel or pinion, and both resting on centre bearings. They operate by means of a compensation balance weight or weights suspended from the two levers. The top of the spindle of the pinion is squared, and on this is fitted an iron strap which supports the door or gate, and which is attached in the usual way. The spindle and pinion or wheel are best made in one piece, but may also be made separately and keyed together. The whole is fitted into a cast-iron case or frame, which is fitted into and flush with the floor. —Patent completed.

1358 B. HUNT, Serle-street, Lincoln's Inn. *Spinning hemp.* (A communication.) Dated May 3, 1869.

The material turns as well as the flyer, but the barrel on which it is wound does not turn, that is to say, that the sliver turns in the same direction and at the same speed as the flyer, and the thread passing from the latter is wound on a barrel turning on its own axis so as merely to take up the thread as it is spun, but completely independent of the rotary movement of the flyer which effects the twisting.—Patent completed.

1359 D. P. WRIGHT and C. BUTLER, Birmingham. *Paraffin lamps.* Dated May 3, 1869.

This consists in using a thin sheet metal base formed into a bell mouth or spreading shape, by preference serrated, perforated, or vandyked on its lower edge for air way, and into this the inventors fit a perforated convexed disc, to which disc a concentric tube is secured or formed for receiving the rectangular cotton holder and regulator, the lower end of the tube before mentioned being screwed or otherwise in the ordinary way for screwing into the oil vessel. The spreading or bell mouth base contracts and terminates upwards with a perforated concentric disc formed of the same or applied within the top edge or flange and shoulder below, which is by preference a row of perforations, and around the flange is placed a bezel or gallery for supporting a glass shade having a concentric row of perforations.—Patent completed.

1360 F. W. KASELOWSKY, Bielefield, Prussia. *Separating fibre.* Dated May 3, 1869.

This relates to letters patent dated October 4, 1866 (No. 2,564), the object being to break up and more effectually separate than heretofore the "boon" or woody part of flax and other like fibres from the "lint" or useful part of the fibres without breaking or wasting the useful fibres. This object is attained by the use of a novel arrangement of blades made of steel, iron, or other suitable substance, between which the fibres are passed in order that they may undergo a breaking and scraping operation.—Patent completed.

1361 P. SOUTHERN, Aspull, Wigan. *Furnaces.* Dated May 3, 1869.

The inventor employs circular firebars placed transversely of the furnace. These bars at their ends are supported in bearings on the side plates of a frame which is mounted on wheels so that it can be run in and out of the furnace, and this frame also carries the hopper containing the fuel. The circular firebars are corrugated with longitudinal and also with transverse corrugations passing around them, and have each a slow revolving motion imparted to them so that they shall carry forward the fuel from the hopper continuously into and through the furnace.—Patent abandoned.

1362 W. SEED, Preston. *Furnaces.* Dated May 4, 1869.

This consists in the use of a self-feeding rotating internal circular grate supported on rollers and turned slowly round by steam or other power. The fuel is supplied at one side to the interior of this internal circular grate, and is gradually consumed as the grate rotates, the clinkers being collected in a chamber within the internal circular grate; the products of combustion are conveyed from the furnace to the flues of a steam boiler, or to the flues of a heating apparatus, or to any other apparatus to which the furnace may be applied.—Patent completed.

1363 E. THOMAS, sen., and E. THOMAS, jun., Melford, and J. MORRIS, Welshpool, Montgomeryshire. *Agricultural implement for forming ridges.* Dated May 4, 1869.

This implement consists of a framework composed of two long bars placed parallelly or side by side, and maintained or held in that position by shorter or crossbars, staves, or bolts. The two parallel bars have handles or tails similar to those of a plough. The framework thus formed carries two iron plough bodies by means of two horizontal bars which project on each side of the framework. The plough bodies are formed with shares and shield boards, which incline inwards or towards each other in such manner that when in use they push the soil from the outside of the implement towards its centre, so as to form a complete ridge. The plough bodies are made to slide upon the horizontal bars, so that the width of the ridge may be varied as may be desired. A wheel mounted on an axle is provided at the fore part of the implement, and its axle is carried in two slides, in which slides it may be fixed at any desired height, by an arrangement of levers. In this way the height of the wheel may be adjusted in accordance with the size of the ridge.—Patent completed.

1364 C. TOPHAM, Coleman-street, Bunhill-row. *Mince knife.* Dated May 4, 1869.

This consists, first, in the construction and use of a peculiar knife box or box for securely holding the cutting or dividing blades in such manner that the upper plate of the box has a number of slots into which are passed the tangs of the knife blades. These tangs are so formed that, at their lower ends, they have at one side a projection which fits into a recess in one of the side plates of the box, such side plate being a fixed plate, so that, when the opposite or movable side plate is secured in its place by screws or other means of fastening the knives are fixed in such a manner as to be ready for use.—Patent completed.

1365 R. WAPPENSTEIN, Manchester. *Omnibus register.* Dated May 4, 1869.

The inventor employs for each journey or stage a meter having two sets of dials and fingers, one set for the inside of the omnibus, and the other set for the outside, and the dials are marked to indicate units, tens, and for calculating hundreds and thousands. The meter corresponds with a stationary dial having two series of numbers and two fingers turning on arbors independent of each other, and one of the series of numbers and one finger are used for the inside of the omnibus, and the other series and finger for the outside, and the numbers are 1 to 23 or other number higher than can be carried according to the size of the omnibus.—Patent completed.

1366 T. COCKCROFT, Hebden-bridge. *Window sashes.* Dated May 4, 1869.

This consists in coupling and suspending the two parts or sheets of a sash together by one cord and pulley at each side of the window, and thereby dispensing with sash weights, and consequently all preparations for their movements behind the frame, and the making of pockets for access thereto, also only requiring two pulleys and cords to each sash or window of two sheets instead of four as heretofore.—Patent completed.

1367 The time for filing this specification was extended by the Lord Chancellor. The abstract will probably appear in our next number.

1368 R. FENNELLY, Wellington Chambers, London-bridge, E.C. *Cases for meat.* Dated May 4, 1869.

The inventors employ a case of wood lined internally with felt or non-conducting material. Within this is placed a double case of sheet metal. The interior of this case is suitably fitted up to receive the meat to be conveyed from one place to another, and the space between the double sides of the metal case is to receive a cooling medium.—Patent abandoned.

1369 T. PERKINS, Hitchin. *Reaping machines.* Dated May 4, 1869.

The inventor employs for actuating the clutch by which the acting parts of the machine are thrown in and out of gear with the driving wheel a lever arm at the rear end of an axis, which, at its forward end, is provided with a lever handle within reach of a driver sitting on the seat upon the pole. The forward end of the axis is supported by a bearing on the pole, or it might be a shaft which carries the seat, whilst the rear end of the axis is supported by a bearing or bearings on the framing of the machine. Or a lever, supported in a bearing upon the pole or shaft, might otherwise be caused to work the engaging and disengaging clutch, as, for example, by employing a bell crank to give motion by a connecting rod to another bell crank that acts upon the clutch.—Patent completed.

1370 W. E. GEDGE, Wellington-street, W.C. *Raising and preserving beer.* (A communication.) Dated May 4, 1869.

This apparatus works under the pressure of carbonic acid gas, the pressure varying according to circumstances. It is composed, first, of a vase termed the acido, surmounted by a stopper for the introduction of the liquid; at the upper part of this vase is a tube which places it in communication with a generator, and an equilibrium of pressure is maintained by means of india-rubber tubing fitted at the lower part, and through which the acid flows into the generator. Second, of a vase termed the generator containing carbonate of lime. At the lower part of this vase is a cork termed the purging or blow-off cock. This generating vase is surmounted by a valve with flexible membrane, the movement of which permits a lever of a weight regulated for a given pressure to determine with precision the introduction of the acid by the tube coming from the acido vase into the generator by means of a throttle pressure exercised by the weighted lever on the tube coming from the acido vase in order to constantly maintain the proper pressure for working the apparatus.—Patent abandoned.

1371 A. and E. FAU, Castres, France. *Washing skins.* Dated May 4, 1869.

The inventors submit woolly skins, clogged with thistles, clot burs or goose grass, to a preliminary soaking in water. They then place one or several of the skins on a cylindrical drum preferably of a conical shape, and movable or rotary, or upon inclined planes, or any kind of surfaces, movable or fixed. And they direct on to these skins one or several jets of water under pressure obtained by means of a natural or an artificial fall, or of pumps worked by any available motive power.—Patent completed.

1372 J. TALL, Southwark, and A. WILLIAMS, Great George-street, Westminster. *Shaping metal.* Dated May 4, 1869.

This consists in straightening, flattening, bending, or curving metallic sheets, plates, bands, bars, or rods by first heating them, and then, while in this state, clamping or securely holding them by the ends in a machine or apparatus in which they are gradually allowed to cool. —Patent completed.

1373 A. V. NEWTON, Chancery-lane. *Railway carriage wheels.* (A communication.) Dated May 4, 1869.

This consists in constructing the body of the wheel of two main cast-iron sections, which, when united or brought together, form a body which is divided transversely to its axis, and in so fitting these two main sections on the axle and combining with them a wrought-iron or a steel or other suitable tyre as that the friction of the sections on the axle is or may be made to hold them in place, and, by a peculiar construction of the outer peripheries of the sections and inner peripheries of the tyre, and otherwise suitably forming the sections. The tyre is crowded or wedged on the sections, and a tightness of fit secured for it, without shrinkage of the tyre, by simply forcing the sections together or pressing up the one section against the other.—Patent completed.

1374 W. E. NEWTON, Chancery-lane. *Forcing engines* (A communication.) Dated May 4, 1869.

This relates to a new kind of engine, the principal element of which is a hollow screw or helix, having its axis placed in an inclined position and arranged to rotate in suitable bearings. When used as a motor the spiral passage of the screw or helix is to such extent supplied or filled with water or other liquid that the lower portion of each turn of the helix contains the water or other liquid to such a depth as to form in the upper portion thereof a chamber for steam or vapour. The steam or vapour in the chamber thus formed in the several turns of the screw or helix acts in such a manner both by its direct pressure and expansive force upon the spiral surfaces of the screw or helix as to produce its rotary motion about its axis, and as this rotation is produced the steam or vapour and the water or liquid pass upward through the spiral passage of the screw or helix, at the top of which the steam or vapour escapes to the atmosphere or to a condenser, while the water or liquid enters a central passage formed through

the screw or helix and descends to the bottom thereof.—Patent completed.

1375 A. C. F. FRANKLIN, Abingdon-street, S.W., and E. DUBOIS, Primrose-street, Bishopsgate. *Gas engines.* Dated May 4, 1869.

This consists in using the gas on one side only of the piston or at one end of the cylinder, the other end of the cylinder being left open so that the piston is driven in one direction by the force of the gas, and in the other direction by the atmospheric pressure consequent upon a partial vacuum produced by the sudden escape of the gas under pressure from the cylinder at the end of the spoke.—Patent abandoned.

1376 T. SIBLEY, Ashton-under-Lyne. *Velocipedes.* Dated May 5, 1869.

The inventor makes the front or driving wheel with its axle fixed at right angles to the length way of the frame, and makes the back wheel into the guide wheel by arranging it so that it can be turned as required. The forked parts for carrying the bearings of the wheels are cranked or bent outwards so that the frame may be shortened, and so that a tendency will be given to the guide wheel to keep in a straight line.—Patent abandoned.

1377 D. ADAMSON, Newton Moor, near Chester. *Steam engines.* Dated May 5, 1869.

This consists, first, in various improved cylindrical and segmental valves, both with and without cut-off valves. Second, in the improved portable and other steam boilers. And, last, in apparatus for blending flanges on portions of steam boilers.—Patent completed.

1378 J. F. KENT, Thornton Heath, S. *Mortising machine.* Dated May 5, 1869.

This consists in fixing the cutting instruments upon a rectangular frame working in vertical guides upon an upright stand, and actuated by a lever supported upon a fixed stud bearing secured to the said stand, in which the frame works with an up and down movement, in connection with which an horizontal bench or table is employed provided with a travelling bed or movement worked by a rack and pinion, hand wheel, and ratchet motion (in gear with the lever) for bringing the work forward to the cutters as may be required, so that upon the wood being placed upon the bench regulated by a gauge plate, and brought forward to be mortised or tenoned, the ordinary cutting instruments are caused to operate upon the work by the descent of the lever in connection therewith.—Patent abandoned.

1379 G. CLARK, Northumberland-street, W.C. *Cartridges.* Dated May 5, 1869.

This consists, first, in a method of adhesion of paper or cloth to sheet metal, forming what may be termed metallic paper or cloth, by the following means:—First, by covering the metal with a coating of varnish, which when dry, will harden and firmly adhere to the metal without cracking, such as gold size or any other combination of resinous materials producing the same results then to cover the paper or cloth with paste or gum mucilage, and apply the paper so covered, whilst in a wet state, to the varnished surface of the metal; second, in the construction of a strong case. The tube or case proper may be made of a coil of the above named metallic paper or cloth, or it may be a welded or drawn metal tube. On the first plan the inner edge of the coil should be kept in place with a small rivet. Or the tube and its base may be punched up in dies out of a disc of metal all in one in the way already known and practised. Or the tube may be made of a length of metal tubing having a metal disc soldered or brazed on one end as the base.—Patent abandoned.

1380 W. M'KEAN, Paisley. *Cattle food.* Dated May 5, 1869.

The glutinous, fatty, and other components of the grain remaining after the usual more or less complete separation of the starch are collected and drained, and the mixture thus obtained is put into cloths or bags which are laid in shallow boxes, trays, or frames, to give them a suitable form. The mixture in the cloths or bags is then submitted to severe pressure in any convenient press, boards or metal plates being placed between the bags at intervals; and the pressure not only expresses the moisture almost entirely, but also causes the material to adhere together in the form of a solid cake. The cake thus obtained is finished by drying or baking it in a stove or oven, and is then ready for sale.—Patent completed.

1381 E. H. RICHMOND, King William-street, E.C. *Preserving meat.* Dated May 5, 1869.

The vessel for preserving the meat consists of a rectangular or other shaped tank or vessel formed of plates of galvanised iron. The sides of the tank are perforated, and the top and bottom plates are formed solid, an opening or manhole being left through the top of the tank for access to the inside, which is fitted with two, three, or more rows of shelves fixed to two opposite sides of the tank, and extending from end to end thereof. The inventor proposes to fix the shelves one above the other about 4ft. apart, leaving a clear space between them in the middle of the tank for the persons to stow away the meat that is to be preserved.—Patent abandoned.

1382 A. COCKE, Water lane, E.C. *Carriage ventilators.* Dated May 5, 1869.

The inventor forms gratings or other passages, by preference around the roof lamps, for the escape of air from the compartment, and surrounds such passages with a shield, over which he applies a cowl capable of turning on a centre, so that the outlet thereof may be contrary to the direction of motion of the carriage or of the wind, but this cowl, in place of fitting near the lower edge thereof to the shield, is opened out at the part thereof opposite to the outlet therefrom in order that air may freely flow through the cowl. The lower part of this cowl overhangs the shield to an extent sufficient to prevent rain passing in that direction.—Patent completed.

1383 H. HIGHTON, Brighton. *Making artificial stone.* Dated May 5, 1869.

The inventor uses for the purpose of making artificial stone, sand and gravel made artificially by crushing granite or other hard stone by Blake's or other suitable mechanical stone crushers, by which the surfaces of the sand and gravel are left rough and the edges sharp and angular.—Patent abandoned.

1384 C. MOORE, Sketty, Swansea. *Screw propeller.* Dated May 5, 1869.

This consists in the peculiar formation and action of a double-threaded screw propeller for ships of half a convolution, which is brought to a body at the propelling shaft between the forward and aft sternpost. The leading edges of both threads or blades are formed to join in the centre of both ends of the said shaft and form a closed curved line curling in opposite directions. The threads or blades themselves are concave and convex on each surface, balance each other, and are shaped in such a manner that the chief propelling surface of each falls towards the lines of junction, and that the streams of water thrown off by the propeller diverge, thereby preventing churning of the water near the centre of motion, and always leaving the rudder in comparatively quiet water.—Patent completed.

1385 C. J. GALLOWAY and J. H. BECKWITH, Manchester *Steam valves.* Dated May 5, 1869.

This refers to letters patent dated July 14, 1868 (No. 2221). The inventors connect the arms by means of a rod. to a piston, fitting accurately into a cylinder containing oil or other fluid, which piston has one or more apertures through it, through which, when the piston is moved backwards or forwards by the motion of the arm, the fluid will be caused to pass from the one side of the piston to the other. By this means the piston, in whatever position it may be, will offer considerable resistance to any motion being imparted to it, unless such motion is of a very slow nature, such as it receives from the governor.—Patent completed.

1386 J. E. PHILLIPS, Grantham. *Sewing machines.* Dated May 5, 1869.

This relates, first, to that class of sewing machines in which a revolving shuttle is employed. The inventor employs two shafts or axes one above and one below the cloth plate of the machine, and gives motion thereto by means of toothed pinions fixed on the ends of such shafts or axes and driven by a toothed ring or wheel, as is now common with some descriptions of sewing machines, upon the end of the lower axis. He fixes a revolving shuttle carrier at the back of the shuttle driver, employs a cam to give motion to the feed lever. By this arrangement a superior hand machine is obtained.—Patent completed.

1387 R. H. RAY, Saffron Walden. *Reaping and mowing machines.* Dated May 5, 1869.

Reaping and mowing machines are fitted with two sets of knives in order that the grain or grass may be cut while the machine is travelling up or down the field. The frame of the machine is constructed preferably of iron of I-shape in section; it is formed with an opening for the main bearing wheel to work in. The main bearing wheel is of sufficient width for all or nearly all of the driving mechanism to be enclosed within it.—Patent abandoned.

1388 T. WELTON, Grafton-street, S.W. *Curing by gaseous charcoal.* Dated May 5, 1869.

The inventor takes charcoal, either animal or vegetable as may be found most suitable, and grinds it into a powder or such sized piece as may be requisite and puts it into a proper vessel. He heats it and by so doing expels the atmospheric air; he then admits to it while so heated such gas as may be required, or a mixture of gases or vapour of metal or metals or drugs or vapour of phosphorous bromine, ammonia, iodine, or other materials, which the charcoal by a well-known law will then absorb in various quantities according to the gas and the other named materials used. Such charcoal when so prepared may then be used as a dentrific or cataplasm or anæsthetic, or for other curative purposes.—Patent completed.

1389 E. N. HUDSON, Percy-terrace, Bayswater. *Velocipedes.* Dated May 6, 1869.

The inventor forms a framed carriage, the lower parallel sides of which have bearings in the after part thereof resting upon other suitable bearings of a crank axle running through and rigidly connected with the two driving wheels of the carriage. He then forms in the fore part of the carriage a socket through which he runs a forked bearing for the purpose of holding the guiding wheel of the vehicle by a short axle through the box or centre thereof or by other suitable attachments, while the steering of the vehicle is effected and managed by means of a transverse crosshead, bar, or key pivoted on and attached to the top of the forked bearing.—Patent completed.

1390 H. E. NEWTON, Chancery-lane. *Enlarging drawings, &c.* (A communication.) Dated May 6, 1869.

The apparatus consists of a suitable framework or table, on the top of which are grooves which form guides for four sets of small wheels or rollers destined to carry two horizontal rectangular platforms or drawing boards, on which the drawing or basso-relievo to be enlarged or diminished is placed. At one end of the machine, but in the centre of its width, is mounted a vertical spindle having its bearings in the cross pieces of the framework. The lower part of this spindle is enlarged so as to permit of a vertical slot being cut in it to receive one end of a short connecting rod (the other end being pivoted to a motor wheel by a ball and socket joint) which is held there by means of a pin or bolt.—Patent abandoned.

1391 C. D. ABEL, Southampton-buildings. (A communication.) *Manufacture of iron.* Dated May 6, 1869.

This consists in mixing with molten cast iron pulverised carbonaceous matter either alone or together with pulverised oxides in such proportions and in a such a manner as to produce at once a solid conglomerate mass of such cast-iron and carbonaceous matter, which is then treated in a furnace either with or without the addition of oxidising substances for the production of either wrought-iron or steel therefrom.—Patent abandoned.

1392 J. TOLSON, Dalton, Huddersfield. *Carding cards.* Dated May 6, 1869.

This relates to letters patent dated January 30, 1869, and consists in the application to the cleaning apparatus of a roller clothed or covered with either cards, felt, or some other material of a soft, yielding, or elastic nature, the roller to be turned round by suitable gearing from the cleaning apparatus or the power which gives motion to the comb cylinder (or other cleaning apparatus), the roller being caused to rest and press upon, and by such contact communicate rotary motion to, the card cylinder or card roller of a carding engine required to be cleaned.—Patent completed.

1393 W. BENNETT, Aston, and J. CURRALL, Birmingham *Kitchen ranges.* Dated May 6, 1869.

This consists, first, in giving to the bottom of the grates of kitchen ranges a rising and falling motion by means of a vertical screw, which also raises and lowers the ash pan at the same time. Second, in giving to the bottoms of the grates of kitchen ranges a rising and falling motion by means of racks on the sides of the grate. Third, of a box or hollow chamber placed on the top of the fall-bar of the grate. Fourth, of the following arrangement of the parts of a kitchen range for cottages and small houses. The range consists either of an oven on one side of the fireplace and a boiler on the other, or an oven on each side, or an oven only on one side with a sham oven on the other side. Fifth, of a rising and falling dust preventer, serving also as a stand or table. Lastly, of a draw plate or blower somewhat similar to the ordinary draw plate in form, but provided with a button or turn by which it can be fixed to the back plate of the grate.—Patent abandoned.

1394 I. and G. BATTINSON and T. WHITEHEAD, Halifax. *Combing wool.* Dated May 6, 1869.

The inventors impart to the rollers and leather belt or apron a rising and falling motion so that a constantly changing surface or part of such belt or apron is presented for the passage of the wool or fibre. The formation of a groove or channel is thus prevented, and the belt or apron works evenly over its whole surface. This is effected by use of the apparatus constructed as follows:—The spindles of the two fluted or drawing-off rollers are elongated, and at the foot of one is a gear wheel for giving motion thereto. On the spindle of the outer fluted roller, and about midway between the bottom of the roller and the gear wheel, is a collar resting on an eccentric. The eccentric is on a cross shaft worked from the "noil" shaft or other convenient part of the machine. As the eccentric revolves, it lifts or raises the outer spindle and roller thereon. The other fluted roller over which the belt or apron works is provided with collars or flanges extending over a portion of the diameter of the outer roller, on the upper end of which the collar or flange rests, so that, as the outer spindle and roller is raised, it at the same time raises the other fluted roller and the belt or apron thereon. The eccentric having passed its highest lift the spindles, rollers, and apron descend by gravitation, and by the eccentric acting on a second collar.—Patent completed.

1395 W. GALLOWAY, Craigie. *Railway brakes.* Dated May 6, 1869.

This consists in attaching a pipe to a cylinder connected with the boiler of the engine which draws the train, or to a vessel or receiver in which air and water are compressed to the required extent. At a convenient position on the carriages composing the train, cylinders having pistons in them are situated. These are in connection with the pipe hereinbefore referred to, the pipe extending throughout the train. To the piston rods of the several cylinders are coupled the links for actuating the brake blocks.—Patent completed.

1396 W. GALLOWAY, Craigie. *Communicating in trains.* Dated May 6, 1869.

This consists in carrying a pipe from the engine, which pipe extends throughout the train of vehicles. Suitable couplings or joints are formed at the ends of the pipe at the extremities of each carriage, so that they can be with facility connected or disconnected. To the engine which draws the train a cylinder with a piston in it is attached. The spaces in the cylinder on one or both sides of the piston are filled with water, and water also fills the pipe throughout the train. In the compartments of the carriages means for opening cocks or valves connected with the pipe are situated, so that on opening any one of the cocks or valves some of the water is forced out by the piston, thus diminishing the quantity of water throughout the pipe, and enabling the pressure of the steam in the boiler acting upon the upper or one side o the piston to depress it.—Patent completed.

1397 J. NEEDHAM, Chiswick. *Velocipedes.* Dated May 6, 1869.

The inventor carries the seat upon a fulcrum so as to constitute a lever, and he connects thereto either in front or behind two rods passing down and connected at the lower ends to the cranks or treadles.—Patent abandoned.

1398 G. KENT, High Holborn. *Refrigerator.* (A communication.) Dated May 6, 1869.

The inventor constructs a box inside of which he places another box, the inner box being sufficiently smaller than the outer one to allow of an air space around the sides, ends, and bottoms of the inner box, the sides of which are covered with wool, felt, or other non-conductor. The whole is then lined with zinc, galvanised iron, or other appropriate material, and made watertight, thereby forming a receptacle within which to place the article to be preserved.—Patent abandoned.

1399 J. M. HART, Cheapside. *Strong rooms and safes.* Dated May 6, 1869.

This relates, first, to means of constructing safes or depositories for security, and to the construction of parts of locks. Second, to means for securing the door to the frame of safes or depositories, strong rooms, and such like places when locked, and for resisting the tendency to warping of the parts under extreme heat or otherwise.—Patent completed.

1400 G. T. BOUSFIELD, Loughborough Park, Brixton. *Braces.* (A communication.) Dated May 6, 1869.

This invention is based upon the discovery that suspender ends can be constructed of strong felt or cloth so firmly fitted that it does not ravel when cut, without the necessity of binding or turning in the cut edges, and that the articles produced are free from the defects of the older kinds of suspender ends above referred to, this new manufacture of suspender ends being attended with the following advantages, viz., the articles can be cut by means of dies to any desired form, they do not ravel at the cut edges, and therefore do not require the edges to be bound or to be turned in and sewed, they do not smell offensively, nor stretch, as india-rubber web suspender ends do, they do not stain the clothing, nor become discoloured or stiff.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated November 16, 1869.

3299 G. Cherpit, Manchester. Improvements in the construction of healds for looms.

3300 W. H. Tucker, Southampton-street, Strand. Improvements in locks.

3301 W. Lancaster, Manchester. Improvements in furnaces for steam boilers and other purposes.

3302 W. Srigley, Burbage, near Buxton, Derbyshire. A friction engine, whereby motive power is produced.
3303 M. Sautter, Rue de la Chaussee d'Antin, Paris. Improved reloading cartridge shell.
3304 H. H. Violet, Tours, department of Indre et Loire, France. Improvements in adherent stoppers, applicable to every species of bottle.
3305 C. Asbury, Balsall Heath, Worcestershire. Improvements in steam boilers.
3306 J. G. Garrard, Bishop's Stortford, Herts. Improvements in the construction of buffers adapted for railway carriages and other vehicles, and as a substitute for weight springs used therewith, and for checking the recoil of heavy guns.
3307 W. Niell, jun., Bold, Lancashire. Improvements in blast engines.
3308 J. Oppenheimer, Manchester. Improvements in fixing and staying telegraph posts.
3309 F. Delacroix, Boulevard de Strasbourg, Paris. An improved metallic manometer.
3310 C. Ching, Castle-street, Long Acre. Improvements in the boilers of hot water apparatus for supplying baths and other purposes.

Dated November 17, 1869.

3311 P. Negrin, Marseilles, France. An improved arrangement for regulating the flow of liquids through pipes, valves, cocks, or other conducts.
3312 S. J. Mackie, Kensington. Improvements in the construction and propulsion of floating vessels.
3313 J. Crofts, R. Dawson, and J. King, Hunslet-lane, Leeds. An improvement in apparatus for combing wool or other fibres.
3314 T. Marshall, Clyde-place, Glasgow. A composition for the prevention of fouling of ships' bottoms and other articles in continuous or frequent contact with water, which is called ships' anti-fouling composition.
3315 T. and H. Weston, Birmingham. Improvements in the manufacture and coating or casing of metallic tubes and rods.
3316 J. Willis, Stocksbridge Works, near Sheffield. Improvements in the manufacture of umbrellas.
3317 E. Bazin, Angers, Maine et Loire, A. Ruiz, Rue d'Argenson, and E. Le Pelletier, Rue Lepic, France. Improvements in spinning looms, and in the spindles employed therein.
3318 W. H. Perkin, Sudbury, Middlesex. Improvements in the manufacture of colouring matter suitable for dyeing and printing.

Dated November 18, 1869.

3319 K. Ogden, Manchester. An improved deodorising receptacle or sarcophagus for containing dead bodies or coffins having bodies therein.
3320 G. R. Sweetser and G. Wadman, Essex-road, Islington. Improvements in machinery for working wood.
3321 G. B. d'Adelsward, Boulevard Bonne Nouvelle, Paris. An improved apparatus for taking, still hot, the dross out of high furnaces.
3322 J. Woodward, Queen's Foundry, New Islington, Ancoats, Manchester. Improvements in gas and water or other liquid meters.
3323 E. Korting, Oakley-road, Islington. Improvements in apparatus for feeding boilers and for raising and forcing fluids generally.
3324 C. Faure, Strand. Improvements in galvanic batteries.
3325 J. P. Kerr and W. M'Gee, Paisley, Renfrewshire. Improvements in apparatus for winding thread or yarn upon pirns.
3326 G. H. Kenworthy and T. Knowles, Ashton-under-Lyne. Improvements in machinery or apparatus for preparing cotton or other fibrous substances for carding.
3327 M. Shelley, Georges-square, Hoxton-square, Hoxton. An improved vent peg for preserving liquors of all kinds.
3328 H. A. Hammond, Cannon-street, City. An improved chimney cowl.
3329 G. Petrie, Rochdale. Improvements in the preparation of ashes for the manufacture of manure, and in the separation of cinders therefrom, which improvements are also applicable to the preparation of materials used in the manufacture of bricks and tiles.
3330 T. Llewellyn, Great Portland-street. An improved construction of cutter applicable to the squaring, planing, grooving, and rabbetting of wood.

Dated November 19, 1869.

3331 S. Mendel, Manchester. An improved mode of packing bales of cotton and other fabrics.
3332 J. Dockray, Quebec Foundry, Leeds. Improvements in machinery for drying, dressing, and finishing thread, twine, cords, and ropes.
3333 J. Hartley and Z. Sugden, Halifax. Improvements in wrought-iron boilers for hot water apparatus.
3334 T. E. Lundy and J. L. Dunham, City-road. New or improved means of communication between passengers in cabs, private carriages, omnibuses, tramroad cars, and other such like vehicles, and the drivers or conductors thereof.
3335 G. F. Cornelius, Great Queen-street, Westminster. Improvements in the manufacture of paint and varnish.
3336 R. Clews, Dundee. Improvements for weaving textile fabrics.
3337 R. K. Miller and A. B. Herbert, Edinburgh. Improvements in pumps.
3338 J. Orson, Glasgow. Improvements in machinery or apparatus for goffering and plaiting textile fabrics.
3339 W. N. M'Cartney, Glasgow. An improved railway carriage for passengers.
3340 W. and M. Bayliss, Cannon-street, City. Certain improved means for making or producing cast-iron earth screws for the lower parts of fence, telegraph, and other posts or supports, and which said improvements are also applicable for other purposes.
3341 A. M. Clark, Chancery-lane. An improved revolving battery gun.

Dated November 20, 1868.

3342 I. Hayford and J. F. Paul, Boston, Suffolk, Massachusetts, U.S.A. Certain improvements in the mode of laying or constructing wooden pavements for streets, &c., as well as a new and useful process for preparing wood for pavements.
3343 W., J., and F. W. Edmondson, and R. Cunliffe, Manchester. Certain improvements in machinery for engraving cylinders used in printing.
3344 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the means and apparatus for utilising streams, subterranean and other springs, lakes, ponds, and other surface waters, as motive power.
3345 J. Cochrane, Grange, Stourbridge, Worcestershire. Improvements in pipes, tubes, or conduits for the conveyance of letters, parcels, and other objects by pneumatic agency.
3346 H. Wilson, Stockton-on-Tees, Durham. Improvements in lubricating apparatus for steam engines, steam hammers, and other mechanism in which steam is the motive power.
3347 B. Guiseppe, Milan, Italy. A new cylindric vertical boiler for the formation of the steam and for heating of the water for maintaining the same boiler.
3348 L. Folliet, Rue Feydeau, Paris. A new grease box called Folliet's grease box.
3349 J. Taylor, Wigan, Lancashire. Improvements in the construction of furnaces.
3350 J. Belicard, Manchester. Improvements in the manufacture of metal healds for weaving.
3351 T. Aitken, Irwell Vale Mill, Helmshore, near Manchester. An improvement in washer cloth to be used in spinning or similar machinery.
3352 W. Temlett, Union-street, Borough, Surrey. Improvements in banjos and certain other stringed instruments.
3353 T. R. Hetherington, Manchester. Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.
3354 D. Morgan, Burntisland, North Britain. Improvements in the manufacture of lubricating oil or grease.
3355 T. F. Lynch, Aldersgate-street, City. Improvements in bottles for holding poisons and other preparations.
3356 S. H. Salom, Regent-street. An improved apparatus or instrument for clipping or shearing the hair of horses and other animals.
3357 A. B. Childs, Mark-lane, City. Improvements in machinery for cleaning, scouring, and decorticating wheat and other kinds of grain, and also for hulling, cleaning, and polishing rice.
3358 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for distributing type.
3359 J. H. Fraser, Bromley-by-Bow. Improvements in boilers.
3360 S. L. Loomis, South Byron, Tennessee, New York, U.S.A. A new, useful, and improved sash tightener and holder.
3361 Sir J. Macneill, Kensington. Improvements in lucifer match and fusee boxes or cases, and in frictional surfaces for igniting lucifer matches and fusees.
3362 J. Moseley, Newcastle-upon-Tyne. Improvements in the mode of warming feet, and in apparatus for this purpose.
3363 J. Burroughs, jun., Newark, New Jersey, U.S.A. Improvements in electro-magnetic machines, and in magnets for the same, and for other purposes.

Dated November 22, 1869.

3364 R. Wilson, Patricroft, near Manchester. Improvements in the construction of hydraulic presses and other hydraulic machinery.
3365 S. W. Wilkinson and J. E. Dooley, Stockport, Cheshire. Improvements in the construction of pillar post office and other stationary or portable letter boxes and bags.
3366 G. H. Wilkes, Campbell-terrace, Wick-road, South Hackney. Supporting clothes' lines.
3367 J. Bourne, Birmingham. Improvements in gauges for gauging the water in steam boilers, and for other like purposes.
3368 J. Bottomley, Bradford, and S. Emsley, Oakenshaw Mills, Low Moor, near Bradford, Yorkshire. Improvements in spinning fibrous substances.
3369 J., J., and H. Ingham, Thornton, near Bradford, and C. Smith, Horton, near Bradford, Yorkshire. Improvements in shuttles for weaving.
3370 R. Hennell, Sussex-gardens. Improvements in the construction of pavements for streets, bridges, and other places, and in the means of taking up such pavements with facility.
3371 F. Hawkings, Harrow-road. Improvements in fire-escapes.
3372 G. Ritchie, Tyrwhitt-road, Lewisham-road, Kent, and J. Ritchie, Stonefield-street, Barnsbury. Improvements in tents, weather protectors, sunshades, and umbrellas.
3373 J. Thomlinson, Abbey-street, Carlisle. Improvements in the manufacture of cements.
3374 J. Brooks, Sherlock-street, Birmingham. Improvements in fastenings applicable to ladies' stays, gloves, boots, and other similar articles.
3375 E. E. Allen, Pelham-place, Brompton. Improvements in the construction of tramways, and in engines and carriages employed thereon.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," November 23, 1869

2058 J. Wright
2077 J. Gessert
2080 C. L. Caldesi
2085 J. Bannehr and H. Matthews
2093 C. A. Bates
2098 C. D. Abel
2100 E. Pettitt
2109 W. P. Bain
2111 R. Craig
2120 T. Richards
2131 G. Lowry
2135 C. de Bergue
2143 J. E. Millar
2152 R. B. Evered and R. Hurst
2155 P. Murray
2157 H. Mege
2167 C. J. Harcourt
2170 J. H. Johnson
2176 W. E. Gedge
2178 R. Schloesser and J. Irving
2180 B. Hunt
2182 J. B. Fondu
2185 R. G. Fisher
2196 J. H. Johnson
2198 G. Finnegan
2204 W. R. Lake
2205 W. Brookes
2208 A. H. Brandon
2213 H. E. Newton
2216 F. M. Mole
2227 W. A. Gilbee
2235 W. R. Lake
2239 E. Stevens
2252 G. N. Blane
2262 J. and J. Hyde
2265 C. Cochrane
2309 T. Ramsay
2363 I. Brown
2396 W. Wright
2400 J. Tenwick
2428 T. Sagar and T. Richmond
2471 G. Metcalf
2526 C. Cerisier
2589 A. M. Davis
2644 C. H. Murray
2645 W. E. Newton
2735 W. A. Gilbee
2964 W. Bennett and J. Currall
3101 T. Hoey
3117 H. A. Bonneville
3150 C. Sacre, S. Perkins, and W. Smellie
3163 J. Dewar
3164 J. Dewar
3190 E. Snell
3196 H. Wilde
3228 C. Mole
3296 H. A. Bonneville

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed November 19, 1869.

1570 S. Jackson
1578 C. J. Foster
1580 J. Hudson and C. Catlow
1585 E. T. Hughes
1594 B. F. Weatherdon
1596 M. H. de Goesbriand
1598 G. Salt and W. Inglis
1599 A. Barclay
1602 J. Dick
1609 L. Roman
1697 J. Fletcher
1806 J. Hill
2364 W. E. Newton
2440 H. Pinkus
2486 W. R. Lake

Sealed November 23, 1869.

1592 W. Furness
1593 W. Mitchell
1608 A. M'Neile and J. Slater
1614 H. D. M'Master and A. Dale
1615 T. Vaughan and E. Watteeu
1619 C. F. Chew
1621 C. Hanson and J. Bottomley
1624 G. H. Ellis
1632 F. A. Barrow
1636 T. Bradford
1639 B. T. Newnham
1653 J. Frazer and L. and R. Simon
1672 B. Littler
1685 F. A. Calvert
1781 H. W. Hammond
1798 W. A. Gilbee
1807 R. Duckworth, W. Greenwood, J. Pearson, and J. Langtree
1813 C. Mather
1851 R. Hornsby and J. E. Phillips
1852 R. Hornsby and J. E. Phillips
1957 W. R. Lake
2015 G. Palmer
2289 H. S. Heyman
2342 W. Brown
2547 W. R. Lake
2556 J. Holdsworth
2666 S. Simpson
2719 N. J. Dor
2807 G. T. Bousfield
2819 J. Buchanan
2894 J. Clayton
2948 J. H. W. Biggs

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2990 W. R. Lake
2995 J. Nichols
3016 J. Bolvin
3033 J. H. A. Gruson
3034 T. Greenwood
3035 J. H. A. Gruson
3036 W. A. Gibbs
3040 W. Chambers
3048 J. Robertson
3060 E. Morewood
3050 J. Howard and E. T. Bousfield
3062 J. Barker
3063 P. Gledhill
3079 W. H. P. Gore and R. Green
3129 H. Timmins
3145 W. Brookes
3327 W. R. Lake
3341 W. Gilbey

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3113 G. A. Buchholz
3124 W. Bottomley
3127 J. Townsend

LIST OF SPECIFICATIONS PUBLISHED

For the week ending November 20, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
760	0 4	991	0 8	1025	0 8	1122	0 4	1149	0 4	1174	0 4
840	1 4	996	0 8	1031	0 8	1123	0 4	1151	0 4	1175	0 4
919	0 8	1000	0 8	1039	1 0	1124	0 4	1154	0 4	1176	0 4
920	0 8	1001	1 4	1045	0 10	1125	0 4	1155	0 4	1179	0 4
926	1 4	1002	0 8	1046	0 6	1126	0 4	1157	0 6	1181	0 4
935	0 10	1004	1 0	1048	1 2	1127	0 4	1158	0 8	1182	0 4
936	1 10	1012	0 10	1072	1 2	1129	0 4	1159	0 6	1183	0 4
938	1 0	1014	1 0	1094	1 0	1138	0 4	1161	0 4	1185	0 4
960	0 10	1015	2 2	1100	0 6	1139	0 4	1162	0 4	1186	0 4
966	3 2	1016	1 8	1102	0 10	1142	0 4	1164	0 4	1187	0 4
970	1 10	1017	0 8	1112	0 10	1143	0 4	1165	0 6	1193	0 4
971	1 4	1018	0 8	1115	0 4	1144	0 4	1170	0 4	1202	0 4
975	0 8	1020	1 0	1116	0 4	1146	0 4	1172	0 4	1215	0 8
976	1 6	1021	0 8	1118	0 4	1147	0 4	1173	0 4	1380	0 4
981	1 0	1024	0 8	1120	0 4	1148	0 4				

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2623	3147	3208	3224	3232	3240	3246	3254
3077	3163	3212	3228	3234	3242	3248	3256
3081	3204	3214	3230	3238	3244	3252	3258
3107	3206	3220					

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department, 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, DECEMBER 3, 1869.

NEW PORT ON THE FRENCH COAST.

THAT the present ports of Boulogne and Calais are little better than useless for the purpose of shelter in bad weather, is known to everyone who has crossed the Channel. The story is still fresh in everyone's mind of the English mail steamer that left Dover, and, after ineffectual attempts to enter either of the harbours of Calais or Boulogne, was compelled to return to the shore from which she started. So much for French marine engineering. Nor is our own much better. It is no less true than disgraceful that of all the branches of the profession, that relating to harbours is the most backward. Look at the gigantic failures that have been perpetrated, involving an enormous waste of money! There is no fault to be found with the constructive details—they are right enough; but the plain fact is, that we build harbours which are sources of actual dread to the mariner rather than of protection. The perils of a voyage, long or short, are frequently nothing to those of "getting the ship in." With the view therefore of establishing a port on the opposite side of the Channel which shall be in reality a port of refuge, a valuable contemporary informs us that there is a project on foot, by the company of Waring Brothers, to build a harbour at Audresselles, a place about a couple of miles from Cape Gris-Nez. This harbour is intended to shelter any vessel, whatever water she may draw, and the plans have been laid before the Minister of Public Works. It will be readily imagined that the inhabitants of those marine towns which have so long enjoyed a monopoly of John Bull's patronage and money are dead against the scheme. They have accordingly memorialised the Minister on the subject, alleging, in terms of bitter remonstrance, that the establishment of a port at Audresselles would entail ruin upon their own commerce and general misery upon his Majesty's subjects in those parts. In their opinion, the closing of our dockyards and the Admiralty reductions are nothing to it. While, on the one hand, there is not the slightest doubt that his Majesty is willing to listen to the complaints of his subjects, yet, at the same time, they must base their case upon something better than mere self-interest. It will not do to request that a concession be refused to an English firm to establish a port at a certain place merely because it will interfere with the traffic carried on elsewhere. One of two circumstances must be demonstrated—either that the proposed work is unnecessary, or that it is inadequate. Let us see if the memorialists can make out their case, and in the first place take a glance at the navigation of the opposite coast.

In stormy and tempestuous weather, ships navigating the shores in question make for the open sea, a general statement which speaks volumes for the state of the French harbours. Should the change be so sudden that they have not time to "run for it," they endeavour to beat up for the harbour of Boulogne, supposing the storm to be from the south, west, or south-west. If the wind is from the opposite quarters, they must try and make for Calais. As a rule, therefore, one or other of these ports is generally accessible, at least according to the evidence of the French captains, who, on the other hand, assert that the harbour at Audresselles could not be reached in stormy weather by any ship without her incurring the danger of striking upon the rocks surrounding Cape Gris-Nez, or going to pieces among the numerous reefs in the locality. The interested inhabitants of Calais and Boulogne remark, moreover, that the establishment of a port at Audresselles would lure vessels to their destruction, as the captains and skippers would make the attempt to enter, rather than put to sea. Again, the prevailing winds in the Channel are unfavourable to the situation of the proposed harbour—a point which, if true, ought to be held fatal to the intended scheme. This portion of the memorial is confined to a consideration of the question on the grounds of security of navigation, which are founded upon the observation of the winds and other local meteorological phenomena, the configuration of the coast line, and the geographical position of Audresselles itself. It also petitions for a rejection of the scheme, since, without affording any real protection in times of tempest, it holds out a delusive hope to those who may be rash enough to trust to it. It must be admitted that the memorialists have not allowed the grass to grow beneath their feet. But there is another view to be taken of the matter which more particularly touches the inhabitants of the existing ports. They are afraid that the term "port of refuge" is only a pretext to hide the real character of the project, which is to establish a "port of commerce" on French territory. This fear has its origin in one of the clauses proposed by the company, in which it is stated that the quays are to be reserved exclusively for the use of the monster packet boats which it is the object of the company to establish. It is for the Imperial Administration to decide whether this would be for the material advantage or disadvantage of the two nations, at the same time that due regard is paid to existing interests. If, however, the position of Audresselles is such that it is calculated to serve as a real port of refuge, it cannot be denied that the French coast is greatly in want of it, and the sooner it is built and tenanted the better for ourselves and our neighbours also.

THE BRITISH ASSOCIATION AND THE SEWAGE QUESTION.

THOSE who are the least acquainted with the operations of the British Association are aware that in many departments of applied science it has long been, and is still, doing good work. It is now giving practical attention to the all-important question of the treatment and utilisation of sewage. At the meeting of the Association at Norwich a grant of £10 was made to enable a committee to collect preliminary information. This work having been effected, and reports having been obtained respecting the methods of dealing with town refuse practised in most civilised countries, the committee was reappointed at the meeting of the British Association this year at Exeter. The importance of the inquiry led to a further grant of £50 being made towards a fuller investigation of the subject. We need not remind our readers that £50 is a mere trifle, and utterly inadequate to the prosecution of an inquiry of such magnitude and importance. But the British Association is a purely scientific body, and has no funds at its disposal applicable to the purpose, or adequate to its requirements. It is, however, important that the committee should take advantage of the opportunity thus created by the British Association to investigate the entire subject in all its bearings—whether chemical, physiological, or engineering, sanitary, municipal, or agricultural—and in a manner worthy of the body they represent. As far as personal services are concerned, the committee freely and generously offer these. But in order to properly carry out such an inquiry with a practical end, numerous observations, experiments, and analyses are essential. These cannot be accomplished—especially the analyses—without the aid of efficient and highly-paid assistants. Besides, the committee will, no doubt, find themselves obliged to purchase expensive apparatus, and to practically investigate any proposed improvements which may be brought under their notice. To do all this well and properly funds are unquestionably necessary, and having no source whereon to draw, the committee have circularised the municipal authorities of the various towns in Great Britain and Ireland, asking for subscriptions towards this important object. This circular letter will be found on another page; in it the committee suggest a contribution of £5 5s. where the population does not exceed 10,000, between that number and 25,000 £10 10s. is suggested, from 25,000 to 50,000 they name £21, and so on *pro rata* for every increase of 25,000 of population.

We earnestly call attention to this matter, and urge upon the public the necessity of helping—each in his degree—to promote this important investigation, which we may be sure will be properly pursued. The names of the gentlemen who have kindly consented to act upon the committee are a guarantee for this; these names will be found appended to the circular to which we have referred. We trust the committee will be well supported in their endeavours to elucidate a question presenting such important features of social and scientific interest. They desire, not only to ascertain, as far as possible, the causes of the sanitary inefficiency of existing works, but also to inquire into every suggestion which affords promise of practical utility, in order that this investigation may be searching, the report practical, and any recommendations that may be made authoritative. At the present time it is of the first importance that a full and complete investigation of the question should be made by the light of the knowledge and experience now gained in the several departments of chemistry, physiology, and engineering. We commend the suggestions of the committee to the municipal authorities, not doubting that they will see the wisdom and policy of giving a generous response to the appeal, and in heartily aiding by all means in their power to promote the good end which the investigation has in view, viz., the health and welfare of the nation.

TRIAL OF THE "DRUID."

THE fact of the "Druid" gunboat having recently had a trial was referred to by us last week in connection with the narrow escape that vessel had from disaster on account of her compass refusing to act. We now purpose noticing the trial itself and its results. The "Druid" has not yet come into the hands of Government, so that the run in question was only a contractor's trial. But it was invested with a special interest in consequence of the Admiralty authorities having directed that it should be regarded as a competitive trial to test the merits of the Griffiths propeller as against those of the Vansittart (late Lowe) propeller. The "Druid" is fitted with the Griffiths propeller, and the trial of the Vansittart propeller was to follow. The result of the competition is looked forward to with much interest, as Mrs. Henrietta Vansittart is the daughter of the late Mr. Lowe, who, so far back as 1838, introduced the system of screw propulsion to the notice of the Admiralty. Since her father's decease Mrs. Vansittart has devoted herself to the task of perfecting the invention. A few months ago the Vansittart propeller was tried on board the "Cadmus," one of the corvettes attached to the flying squadron, but the accident which happened to that vessel on her voyage down Channel forbade the further prosecution of the test at that time. Hence the permission of the

Admiralty to renew the test with the "Druid," a similar class of vessel. The engines and boilers of the "Druid" are by Messrs. Maudslay, Sons, and Field; the former being constructed on the horizontal principle, with jacketed cylinders, and having surface condensers. The boilers are four in number, with 16 furnaces, the boilers being fitted with super-heating apparatus, with flattened tubes, so that, as arranged, the engines can be worked with super-heated steam or not. The screw, as before stated, was a Griffiths, having been manufactured by the firm above-named. The diameter is 15ft.; the pitch was 15ft. 2in., length 2ft., and the immersion of the upper edge, 6in.

On the present occasion the "Druid's" draught of water was 12ft. 9in. forward and 16ft. 4in. aft. The ship was fully rigged, and had all her guns, about 300 tons of coals, besides other stores, with a large quantity of iron ballast on board, together with about 200 officers and men. The sea was smooth, and the force of the wind from 1 to 3. Six runs were made at full boiler power, giving an average of 12·98 knots; at half boiler power the average was 11·29 knots —the average number of revolutions per minute being 96 50. This was within a fraction of the estimated speed of the vessel. On making the circles the "Druid" proved herself a very handy ship, answering her helm in the readiest manner. Thus, so far as the engines and ship were concerned, everything was satisfactory; but it was found almost impossible to retain the necessary supply of steam, as the boilers primed badly, as they had done on a previous occasion, when the fires had to be drawn. Besides this, the "Druid" was found to vibrate to an unusual extent during the runs at full boiler power. At half-boiler power—which is commonly supposed to be the usual power employed on ordinary occasions while cruising—the vibration was not so severe, although then very palpable. There can be little doubt about the result of this unsatisfactory state of things—the influence of this vibration must rapidly tell on the vessel. Three months at sea would necessitate a regular overhauling and repair in the dock. We await the trial of the Vansittart propeller, and shall then place the results before our readers for comparison with those of the Griffiths screw as given above.

MANUFACTURE OF INDIAN INK.

A VERY large proportion of our readers are probably in the habit of using what we term Indian ink, or, at any rate, have used it during some portion of their lifetime. The term, although very ancient, is a complete misnomer. That employed by the French, *encre de Chine*, is the more correct and the one which has some tangible reference to the country whence this indispensable accessory to the drawing office is exported to our shores. A brief account of the method of manufacturing it in the ancient land of Kathay will not be without interest, the more especially as all attempts to prepare it of an equal quality, in this country or on the continent, has altogether failed. In times so remote as almost to carry us back to the ages of fable, the Chinese executed their specimens of caligraphy through the agency of a piece of bamboo dipped in a kind of black varnish. Subsequently, while the same *stylus* was retained, the liquid was represented by a syrupy fluid, in which particles of a black stone reduced to an impalpable powder were held in mechanical suspension. Later still, the ink assumed the appearance and nature of solid black balls, prepared from lampblack, and ever since their introduction this branch of industry has been gradually improved until it attained its present state of perfection. At the present day, the Chinese keep their ink in sticks, rub it with water or tea, and write by means of very fine pointed pencils dipped in it. The quality of the ink varies considerably, and depends upon the purity of the ingredients of which it is composed, and the care and skill displayed in its preparation. Among the best substances from which to obtain the lampblack are—firstly, pig's fat; secondly, ordinary oils and fats; and thirdly, resinous woods and resins themselves.* Tolerably good inks are also made from the lampblack produced by the combustion of pine trees, and some other descriptions of timber indigenous to the country.

The materials from which the lampblack is procured are placed in a furnace about a hundred feet in length, and five in breadth, along the sides and top of which it condenses. That which condenses at the extremity of the furnace is the best adapted for the manufacture of the ink, while the rest, which is deposited near the neighbourhood of the combustion, is too coarse in grain to be employed for the purpose. This evidently results from two causes. One is the quality of the material, and the other the relative rapidity with which it is consumed. Having obtained the lampblack, the next step is to prepare a particular kind of paste or glue with which to form a compact and solid substance. The preparation of this glue requires a great deal of care, and is one of the most important operations connected with the whole process. The best description is made from the horns of deer. After removing the outer skin, the horns are macerated for a period of seven days in rice water, and then subjected to a long and exhausting ebullition. It is only during the cold season of the year that this process is carried on, as hot weather would cause the fermentation of the glue and retard the operation. It must not be imagined that the lampblack is fit for use directly it is taken out of the furnace. On the contrary, it requires to be sifted through silken bags, so that the grains may all be of the same size, or otherwise the ink would not be homogeneous. This preliminary condition being ensured, a certain quantity of the glue is melted and poured over an equal quantity of the other ingredient, and the whole thoroughly kneaded and incorporated by the hands. Occasionally a small portion of Chinese varnish is added, and the mixture transferred to an iron mortar, where it is beaten up with some degree of violence. The whole of the value of the future product depends, as is usual in all similar instances, upon the intimacy of the mixture, but, at the same time, the operation must not be protracted to too great a length. It is the duty of the manufacturer to time the process, and when, through negligence or ignorance, the proper time has been exceeded, the error is rectified by enveloping the ink in paper, and holding it before a slow fire, which restores to it its elasticity, and prevents it splitting. In spite, however, of this partial remedy, the ink so treated is never equal in quality to that which has not been subjected to such treatment. From the mortar the mixture passes into the hand of the moulder. The moulds are formed of wood, with a cavity corresponding to the form it is desired to give to the ink. Within certain limits the smaller the cakes the better, as there is less chance of their splitting or warping during the time they are drying. Thus, the best cakes of Indian ink are never of a very large size. As soon as the cakes have acquired a firm and solid consistency, they are removed from the moulds and dried. The desiccation is effected by enveloping the ink in very fine paper, and surrounding it by cinders or powdered chalk. When the latter desiccator is used care must be taken that it does not abstract the humidity from the cake with too great rapidity, or the latter will become brittle, and lose its superior quality. The cakes, together with the absorbent envelopes, are placed in a small stove, and kept exposed to a gentle heat for several days. Some manufacturers do not take the trouble to perform this last drying process, but leave the cakes to dry by simple exposure to the air.

* For a full account of this process see an excellent work by M. Paul Champion, "Industries Anciennes et Modernes de l'Empire Chinois."

The author of the work to which we have alluded gives some practical suggestions for distinguishing good from bad Indian ink, which will, we do not doubt, be very acceptable to our readers. Ink of a superior quality rubs easily and marks upon paper, without leaving any apparent trace of solid matter. The best cakes have a brownish hue when rubbed. A black, grey, or blue tinge indicates ink of an inferior quality. The brown tinge will remain in cakes for many years after manufacture, and is visible in some very ancient specimens that exist in China. Another somewhat curious test will determine the quality of Indian ink. If a ca e of good quality be struck gently on a hard substance, the sound should be sharp. If it be flat, it is a sign that it is not homogeneous in consistency, and belongs to second class description. Moreover, the heaviest ink is the most valuable. The Chinese say that the value of lampblack depends upon its lightness, and that of ink upon its heaviness, being in the inverse ratio one to the other. As the ink gets older, so, like wine, it improves in quality. It becomes harder without at the same time becoming brittle, and acquires a brilliancy that is highly prized by connoisseurs. Strictly speaking, it ought not to be used for three years after manufacture. Whenever it happens that old ink loses its value by absorbing damp, it may be re-prepared by grinding it with a mixture of glue and water, but the operation is not always successful. In order to keep Indian ink—in other words to preserve it—it should be placed in a well-aired situation, exposed now and then to the action of the sun, and rubbed frequently on the surface to prevent it losing its polish.

The manufacture of Chinese ink, to give it its proper term, is carried on upon a very large scale at Shanghai, where a very superior description is prepared. The cause of the difference in quality between the various inks made in China results from the non-employment of a constant material for the production of the lampblack. In order to impart an agreeable odour to the production, the Chinese add a small portion of musk and camphor, from the Isle of Borneo, two articles which are exceedingly dear in the celestial empire. Ordinary Chinese ink for home use is not scented in any manner whatever. The gilded mystic letters that are so attractive to young pupils and students are first formed by the action of the mould. When the cake is dry, the letters are traced over with a solution of gelatine in water, and the gold or copper is laid on with a fine brush. Like their neighbours, the Japanese manufacture Indian ink, but consider it of a quality inferior to that which they obtain from the mainland. Not having given so much attention to the matter as the celestials, they are not so well versed in the manner of preparing the lampblack, which is the real secret of the whole art.

NOTICES OF BOOKS.

IT will be no new thing to our readers to be informed that some of the most beautifully delicate and elegant figures can be produced by the lathe. But it will be new to them to learn that a volume of such figures —and nothing else—has been published. And yet this is the case, and well worthy of notice they are for their variety and beauty. The little volume before us* consists of thirty exquisite photographs, giving specimens of fancy turning by an American amateur. The figures were cut on the lathe by a deli-

* "Specimens of Fancy Turning." By an Amateur. Philadelphia: Henry Carey Baird, 406, Walnut-street. London: E. and F. N. Spon, 48, Charing Cross. 1869.

cate pointed tool, kept in position by guides, and pressed at the back by a fine spiral spring. The tool is arranged so that it can be drawn back at any moment by the turner. The interesting process by which the amateur in question—who simply affixes the initials "E. J. W." to a brief introduction—is exceedingly simple. A highly enamelled card is covered with Indian ink, which is laid on by a camel's hair brush. The card is then fastened to the face of a chuck, and the spring tool allowed to cut through the blackened surface of the card, exposing to view the white under-surface of the card. Care is necessary, in selecting the Indian ink, to secure a pure black. Two or three coats laid lengthwise and then crosswise on the card ensures a deep smooth black ground. The author of the elegant examples before us states that his object is only to show the powers of the lathe, and to stimulate others to carry on more completely and systematically similar illustrations, commencing with circles, and advancing with the eccentric, oval, geometric, straight line, and rose engine chucks, both simple and combined. The collection of examples under notice is well worthy the attention of everyone who posesses a lathe.

The long-felt want of a comprehensive collection of illustrations and descriptions of mechanical movements has been supplied by Mr. H. T. Brown, the editor of the "American Artizan." In a very compact form, and in a handy sized volume, we have over five hundred mechanical movements,* embracing all those which are most important in dynamics, hydraulics, hydrostatics, pneumatics, steam engines, mill gearing, and machinery in general. The collection includes many movements never before published, and several which have only recently come into use. The arrangement of the work greatly facilitates reference, the movements being placed on one page, whilst a brief description of them is given on the other. There is also an index which completes the utility of the volume, which will be found very useful by artisans, inventors, and students of mechanics.

Seeing that legislation has of late had a very practical bearing on the working classes, and seeing also that it is likely to affect them still more directly during the next session, Mr. James Samuelson, who is editor of the "Quarterly Journal of Science," and President of the Liverpool Operative Trades Hall, has presented working men with a graphic and instructive picture of one of their order abroad. In the little work before us† the author describes the German working man, his institutions for self-culture, and his unions for material progress. The object Mr. Samuelson had in view in visiting the institutions he describes was to afford our own operatives such information concerning them as appeared likely to be of service in the establishment of trade institutions of an improved kind in England. It is to be anticipated that the proposed special legislation for Trades' Unions will raise the self-respect of our artisans, and will induce them to make greater efforts to cultivate and refine their moral and intellectual character and pursuits. Mr. Samuelson includes in his book a notice of the amusements of working men, which are matters of collateral interest, and of equal importance. The examples given of the means of self-help, education, and art-culture are interesting and instructive, and we trust that every intelligent working man who is interested in promoting the moral and intellectual welfare of his fellows will carefully read Mr. Samuelson's book, for from it he will gather how much can be done by the working classes, by themselves for themselves, if they will only set about it in real earnest. It is not to be done if there is only a half-heartedness, still less can anything be effected if petty jealousies and envyings are allowed to creep in, neither must everyone be a manager. We know of a society of working men which was started about a year since for self-improvement, and in which we took an interest. Books and funds were solicited from outside, and were given; but the whole arrangement and management were undertaken by working men. All went on very smoothly at first, but by degrees it became evident that there were too many masters, and in a few months the society collapsed. Those who read Mr. Samuelson's book will see how this might have been avoided and good results have ensued.

"The Timber Trades' Price Book" is the name of a useful pocket volume of tables and prices, by Mr. W. Richardson, and which has just been published by Messrs. Longmans and Co. We have from time to time had to notice several useful works of a like character by the same author. In the present instance the author gives a set of eight tables and a brief description of each. This absence of all elaborate explanation adds to the usefulness of the book to those who require to make frequent reference to it; and for such it is intended. The practical character and usefulness of Mr. Richardson's previous works is a guarantee of the thoroughly reliable nature of the present production, which we commend to all engaged in the timber trade.

The first to hand of our usual series of annuals is "Pettitt's Annual Diary for 1870,"‡ which comes before us with considerable alterations from previous years, which will be found improvements by its subscribers, who, indeed, must be numerous to enable the publishers to offer such a well-equipped pocket companion for one shilling. This is the twentieth year of its issue, and its success has warranted the enlargement of the almanack, the addition of the mean temperature of every day in the year, together with meteorological and astronomical notes of the month. The daily temperature and the notes furnish the only reliable guide to the weather that science can afford. It is a good sign to see that absurd attempts at weather predictions are being gradually ignored by respectable publishers. We may further state that fresh information has also been added, which will be found useful for reference, and an enlarged monthly form for cash account will be found very serviceable.

The fourth volume of Cassell's technical series has just been published by Messrs. Cassell, Petter, and Galpin, of La Belle Sauvage - yard, Ludgate - hill. It is on systematic drawing and shading, and, like the rest of the series, is progressive and practical. It is by Mr. Charles Ryan, master of the Leamington School of Art, and it embodies a deal of useful information upon the subject of drawing and the materials required. It is illustrated by a number of diagrams, and, with the others of the series, should find a place wherever technical education is being promoted. Messrs. Cassell and Co. have also published a little treatise on vegetable physiology, which was written by Dr. Lankester as part of a series of lessons for reading in schools. The subject is treated in a series of easy lessons, from which we learn the organic, inorganic, and metallic elements of plants, their components, their functions, their germination and nutrition, and their reproduction and decay. It is a useful little book, which will suggest the proper method of studying the great facts of vegetable physiology. "Cassell's Household Guide" is one of the latest productions of this enterprising firm. The first part is before us, and well deserves the attention of every family. It supplies in a plain practical manner all the varied information required in a household, whether large or small, and will amply repay the small amount it costs. Besides woodcuts, it is illustrated by admirably executed chromo-lithographs.

* Five Hundred and Seven Mechanical Movements." By HENRY T. BROWN, Editor of the "American Artizan." London: TRUBNER and Co., 60, Paternoster-row. 1870.

† "The German Working Man." By JAMES SAMUELSON. London: LONGMANS, GREEN, and Co. 1869.

‡ Published by T. PETTIT and Co., 23, Frith-street, W.

TELEGRAPHIC NOTES.

THE project for a German-American Telegraph cable appears to have been brought to a successful issue. The arrangement, as it at present stands, is that the concession from the North German Confederation of all telegrams for America, not otherwise expressly directed by the sender to be sent by some other route, as well as the right to carry German and English messages, will be effected by a German-English Company shortly to be formed. The concession has been purchased for this new company. The caution money (100,000 thalers) has been deposited, and the necessary contracts and arrangements are being made. A three-wire cable is to be laid from North Germany to Lowestoft, two conductors to be used for German-English messages, and the third exclusively for German-American messages. This third wire is to be connected with one of the Anglo-American wires from Telegraph-street to the United States, which is agreed to be appropriated, but not exclusively, for the transmission of German-American correspondence. The messages will be sent in the order of reception at the terminal and intermediate stations, as required by the International Telegraph Convention. The Anglo-American and Newfoundland Companies are to give a rebate to the German Company on messages passing through the new cable and the Atlantic lines, but the chief source of revenue of the new company is expected to be the German-English traffic, which has increased enormously of late years. The Act of Parliament passed last session specially excepted from the Postmaster-General's monopoly telegrams to and from foreign countries.

We understand that an exclusive concession has been granted by the Spanish Government to Messrs. Graham and Hean, of London, for forty years for a submarine cable from Manilla to Hong Kong and Singapore, and for a telegraph system for the whole of the interior of the island of Luzon; also for all the communications from the island of Luzon to the whole of the other Spanish possessions in thePhilippine Islands.

The whole of the speech of the Emperor of the French was transmitted from Paris to the offices of the Submarine Telegraph, in Threadneedle-street, in fourteen minutes. Five wires were used. We may add that the translation was unusually good, and it was most accurately transmitted.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

TO COLOUR MICA—BLACK FOR PORCELAIN PAINTERS—SOLUTIONS RAISED TO HIGH TEMPERATURES BY STEAM AT 212DEG.—RED DYE FOR WOOL.

WE have more than once noticed the spectacles made of mica intended to protect the eyes of workmen from fragments of metal or stone, and also those of furnace workers from the effects of heat. In the case of these latter, objections have been raised to the whiteness of the mica, and it became desirable to give the spectacles a bluish colour. This was at first accomplished by sticking very thin coloured gelatine on them, but a better plan has been suggested by Dr. Schwarz. What is known by painters on porcelain as "copper lustre" is an organic compound of bismuth with a small amount of gold. When this is put on porcelain and burnt in with a gentle heat it gives a copper-red lustrous mirror. The same solution painted very thin and equally on the mica, and then dried, may be burnt in by the heat of a spirit lamp, and will show by reflected light the same copper-red colour; but by transmitted light, as when the spectacles are worn, the colour seen is a bright blue, which does not at all interfere with vision. Platinum and gold glaze applied in the same way, and burnt in, exhibit a silvery or golden lustre by

reflected light, but by transmitted show grey or greenish blue colour. Dr. Schwarz points out that these effects may lend themselves to a variety of ornamental and decorative purposes.

In connection with porcelain painting we may notice the mention by Böttger of the use of iridium and rhodium compounds for producing an intense black upon porcelain. The material commonly used, which he tells us is a mixture of oxide of iron and oxide of copper, gives very unsatisfactory results. Iridium has now been in use in the royal porcelain works at Berlin for some time. The cost of the new colour will be very considerable, but a little of it will go a long way.

In a paper communicated to the "Chemical News," Mr. Peter Spence mentions the interesting fact that saline solutions can be raised to a high temperature by the use of steam at 212deg. Fah. only. A solution of nitrate of soda, which has a boiling point of 250deg. Fah., was placed in a jacketed pan, and steam was let into the intervening space until the solution was raised to nearly 212deg. The steam was then shut off, and an open pipe was immersed in the solution, and steam thrown directly into the liquor. In a short time the liquor was found to have reached the temperature of 250deg. Fah. The discovery was of immense practical value to Mr. Spence, and will be to every manufacturer who has to boil down large quantities of saline solutions or to digest materials with high boiling points for a long time, since it shows that a naked fire may be entirely dispensed with. It appears from the author's observations that the temperatures to which the solutions can be raised are in the exact ratio of their specific gravities, and have no connection with the temperature of the steam, which never exceeds 212deg. Fah. The greater the specific gravity the higher the boiling point, and whatever the boiling point of the solution, to that point, or very nearly, will steam of 212deg. raise it.

A good and bright red colour, we read, may be obtained on wool by the use of lac dye in the following way. In the first place, a tolerably stiff paste is made of the lac dye and sulphuric acid, and this is allowed to stand for a day. For dyeing ten pounds of wool one pound of tartar, two-thirds of a pound of salts of tin, and three-quarters of a pound of the paste just mentioned are required. The wool must be boiled in the bath for three-quarters of an hour, after which, as a matter of course, it must be carefully rinsed and dried.

SHIPPING IN 1868.

THE vessels built in the United Kingdom, and first registered in 1868, were 1,019 with an aggregate tonnage of 316,197 tons, including seven vessels of 2,005 tons, transferred to the British Possessions. 635, of 88,285 tons, were built of timber; 350, of 206,840 tons, of iron; 34, of 21,072 tons, composite. 102 vessels, with an aggregate tonnage of 46,131 tons, were built in the United Kingdom for foreigners, and not registered in the United Kingdom; of war vessels, two sailing vessels of 1,117 tons, and nine steam vessels of 9,137 tons; and of mercantile vessels, 24 sailing vessels of 7,554 tons, and 67 steam vessels of 28,323 tons. The registered vessels belonging to the United Kingdom at the end of the year 1868 were 24,701 sailing vessels of 4,798,178 tons, and 2,934 steam vessels of 900,596 tons, making a total of 27,635 vessels of 5,698,774 tons, with crews (exclusive of masters) estimated at 248,995. This is after deducting vessels wrecked or broken up. Compared with the return for the end of the year 1867 it shows a decrease of 283 in the number of vessels, but an increase of 28,424 tons. There were also at the end of 1868 809 registered vessels of 81,756 tons belonging to the Channel Islands, and 11,897 registered vessels of 1,456,386 tons belonging to British Possessions, making a total of 40,341 vessels of 7,236,916 tons, manned by crews estimated at 340,516 in number.

BREECHLOADERS.

THE following list of the various breech-loading systems which have been adopted by the armies of the European states appears in the "Eastern Budget":—England—For the conversion of old rifles, the Snider; for new rifles, the Martini-Henry. France—For the conversion of some old percussion muskets, the Snider; for the new rifles, the Chassepot; a metal cartridge is now being made for the latter weapon, the old paper cartridge not being considered satisfactory. Russia—The Kruka for conversions, the 50,000 rifles already converted according to the Karte system having proved failures; Russia has also ordered 30,000 Berdan rifles from America, some of which have already arrived. Sweden and Denmark—The Remington, with Austrian barrels. Norway—Not settled. Italy—Pettiti; similar to the Chassepot (for conversions only). Switzerland—For conversions, the Millbank-Amsler; for new rifles, the Vetterli; Switzerland also possesses 10,000 Peabody rifles. Turkey—The Snider, for conversions. Belgium—The Albini. Spain—The Remington. North-German Bund—The needle gun. Bavaria—For conversions, the Lindner-Podelwils; for new rifles, the Werder. Holland—The Snider, for conversions. Montenegro has obtained 2,000 Kruka rifles from Russia. Austria—For conversions, the Wanzl; for new rifles, the Wernal. Papal States—The Chassepot. Roumania—The Peabody.

THE HEIGHT OF THE BAROMETER IN RELATION TO THE DIRECTION AND FORCE OF THE WIND AT LONDON.*

By MR. RICHARD STRACHAN, F.M.S.

IF it be admitted that every wind has its weather, then a foreknowledge of the weather may be considered possible when the wind can be foretold, whether for brief or advanced periods of futurity. As regards the wind itself there are two things to take into account, the direction whence it comes and the force with which it blows. An inquiry might be instituted as to the indications of the wind's future proximate changes afforded by its veering and alteration of force during assumed intervals of time immediately preceding. In other words, the records of anemometers might be discussed with a view of deducing rules for foretelling wind-changes. Moreover, as the temperature of the air is an element of weather, the records of the thermometer might be consulted to ascertain whether it affords any indications, and under what circumstances, of the coming wind. Further, as the barometer shows that the weight or pressure of the air is subject to ceaseless fluctuation, inquiry may be made whether it can indicate the proximate changes of wind. The barometer has, indeed, been the recognised exponent of weather-changes almost ever since its first invention, and numerous and various are the rules empirically put forth for the interpretation of its action and readings. It must be clear to anyone who thinks about it that such rules can only be legitimately framed from careful investigations of records of barometrical observations conjoined with simultaneous observations of the wind's direction and force, or careful notation of the actual weather-conditions. This, no doubt, has been done to a great extent; but that it has not been overdone will, I imagine, be admitted by most meteorologists. In this manner it occurred to me that an investigation into the relation of barometrical pressure to the direction and force of wind would not be a work of supererogation, and might be attended with some interesting results. Accordingly, I have collated the meteorological observations made by myself, in London, on a systematic plan, from November, 1860, to the end of April, 1869. The 9 A.M. observations being continuous were all used; and to them were added those taken at other hours when the force of wind was what is termed a gale or storm, because there was a deficiency of observations for strong winds, which these additions even have not made numerous enough.

It may be well to state at the outset that all the barometrical observations had been reduced to 32deg. Fah. and the sea-level, that the direction of the wind was always carefully taken by true and not compass bearings, and that grades of force were noted according to Admiral Sir F. Beaufort's scale, 0 to 12. I have not been in the habit of making special records of storms, and, consequently, I have very few entries of forces 10, 11, and 12. What I have have been lumped together under 10.

In the first place the barometrical observations were grouped according to the months, for each grade of wind force, and under each of the sixteen principal points of the horizon in which they occurred. From these groupings it was manifest that, with the same estimated force and direction of wind, the atmospheric pressure may at times be an inch and upwards higher than at others, irrespective of any particular direction or any particular force. Thus, with light winds, with which the barometer usually reads high, the following very low pressures occurred:—

Months.	Force 1.		Force 2.		Force 3.		Force 4.		Force 5.	
	P.	W.	P.	W.	P	W.	P.	W.	P.	W.
January	29·04	E.S.E.	29·18	W.	29·08	S.W.	29·02	W.	29·10	E.N.E.
February	29·45	N.	28·90	W.S.W.	29·17	S.	29·22	N.	29·24	S.
March..........	29·05	S.	29·15	E.S.E.	29·13	N.N.E.	29·45	S.E.	29·13	W.S.W.
April	29·70	E.	29·45	N.	29·49	W.	29·64	W.	29·78	N.
May............	29·54	N.E.	29·56	N.N.W.	29·59	E	29·50	E.	29·68	W.S.W.
June	29·70	E.	29·51	W.	29·31	E.	29·48	S.	29·47	W.
July............	29·68	S.S.E.	29·60	W.	29·58	S.S.E.	29·34	S.S.W.	29·43	W.
August	29·55	S.S.W.	29·36	W.S.W.	29·41	S.S.E.	29·51	W.	29·53	W.
September......	29·55	E.	29·38	S.S.W.	28·99	W.S.W.	29·22	S.W.	29·24	S.W.
October	29·35	S.W.	29·03	E.	29·18	S.E.	29·06	W.S.W.	29·25	W.
November ...	28·80	W.S.W.	29·29	W.N.W.	28·78	S.W.	29·38	S.S.W.	29·39	W.N.W.
December	29·89	E.N.E.	28·97	S.S.E.	29·41	W.	29·57	S.W.	29·29	W.
Lowest of all	28·80	W.S.W.	28·90	W.S.W.	28·78	S.W.	29·02	W.	29·10	E.N.E.

In this table, except N.W., all the directions of wind are represented. Winds with westing are represented 33 times; winds with easting, 19 times. Considering the winds with southing and northing, the numbers are 29 and 11 respectively. Hence light and moderate winds with southing and westing are more frequently accompanied with low pressures than any other direction of winds having similar force, and they are also subject to the lowest of all pressures.

Strong winds are, on the whole, usually attended by lower pressures than light winds; nevertheless the groupings revealed instances of high pressure under every direction of such winds, and showed differences of pressure for winds of the same direction and force equally as great as those exhibited for the light winds. Thus, with strong winds, the following high pressures occurred:—

Months.	Force 6.		Force 7.		Force 8.		Force 9.		Force 10.	
	P.	W.	P.	W.	P.	W.	P.	W.	P.	W.
January	30·31	S.W.	30·01	E.	29·89	S.W.	29·72	S.S.W.	29·75	W.S.W.
February	30·28	W.	30·24	N.	29·85	W.	29·95	W.	29·65	W.S.W.
March	30·09	W.	29·99	N.W.	29·93	E.	29·77	E.		
April	30·27	E.	30·45	E.	30·12	W.	29·70	W.		
May	30·00	S.W.	30·27	W.	29·94	E.				
June	29·89	S.S.W.	....	....	29·72	S.W.				
July............	30·31	N.N.E.	29·82	S.W.						
August	29·99	W.	30·18	N.W.	29·86	W.				
September ...	30·15	N.E.	29·91	W.S.W.	29·57	S.W.				
October	30·36	E.S.E.	30·23	E.	29·92	S.W.	29·91	S.S.W.		
November......	30·22	W.	29·90	E.	30·00	W.	29·67	S.W.	29·30	S.W.
December......	30·45	E.N.E.	30·05	S.W.	30·17	S.W.	29·77	S.S.W.	30·07	W.
Highest of all	30·45	E.N.E.	30·45	E.	30·17	S.W.	29·95	W.	30·07	W.

* Proceedings of the Meteorological Society.

In this table, winds from S. to S.E. are not represented at all. Winds with westing occur 32 times; with easting, 12 times; with southing, 19 times; and with northing, 6 times. Hence it seems that strong winds with southing and westing are more frequently accompanied by high pressure than similar winds from other directions; but we must also recollect that the wind blows most frequently from between S. and W. The highest pressures, in this class, are apparently due to easterly winds. It is also noticeable that, with the strongest winds (force 8 and upwards), instances of the pressure amounting to 30in. are certainly rare.

The next step was to take the averages of the monthly groups. These averages did not appear to afford any indication of a law connecting the atmospheric pressure with the various directions of winds having the same grade of force, probably because the observations, so numerously classed or subdivided, were in each case too few for the purpose. When, however, the total observations of pressure for each grade of force of wind were meaned according to direction, annual or general averages resulted which appear worthy of some consideration. They are given in the following table:—

OBSERVATIONS OF WIND REFERRED TO SIXTEEN POINTS.

Force 0-12; O. = number of observations; P. = pressure.

Force.	N.		N.N.E.		N.E.		E.N.E.	
	O.	P.	O.	P.	O.	P.	O.	P.
1	63	30·11	21	30·09	61	30·06	30	30·08
2	59	30·04	46	30·08	53	30·08	45	30·05
3	38	30·06	23	30·13	42	30·09	21	29·96
4	25	30·00	15	30·02	40	30·12	15	29·99
5	9	30·02	4	30·18	7	30·23	7	29·93
6	4	29·78	5	30·06	6	29·84	4	29·80
7	6	29·77	1	30·24	...	......	1	29·99
8	1	29·49	...	......	...	......	1	29·94
9	1	29·87	...	......	...	......	...	......
10 to 12	...	......	...	......	...	......	...	......
Total	206	30·04	115	30·09	209	30·08	124	30·02
Total referred to 8 points	310	30·06	...	......	329	30·07	...	......

Force.	E.		E.S.E.		S.E.		S.S.E.	
	O.	P.	O.	P.	O.	P.	O.	P.
1	96	30·04	15	29·93	25	30·05	9	30·02
2	93	30·06	17	29·80	20	30·00	17	29·83
3	49	30·06	9	30·05	17	29·93	17	29·81
4	33	30·03	6	29·97	3	29·89	9	29·87
5	5	29·94	3	30·09	1	30·03	2	29·78
6	6	29·94	2	30·25	1	29·48	1	29·36
7	7	30·07	...	......	...	......	...	......
8	1	29·93	...	......	...	......	...	......
9	1	29·77	...	......	...	......	...	......
10 to 12..........	...	......	...	......	...	......	...	......
Total	291	30·04	52	29·93	67	29·99	55	29·85
Total referred to 8 points	379	30·03	...	......	120	29·95	...	......

Force.	S.		S.S.W.		S.W.		W.S.W.	
	O.	P.	O.	P.	O.	P.	O.	P.
1	53	30·00	16	29·97	38	30·00	44	29·96
2	42	29·88	29	29·82	78	29·98	77	29·97
3	31	29·73	26	29·79	62	29·94	65	29·92
4	10	29·75	19	29·73	66	29·87	49	29·83
5	8	29·59	9	29·86	35	29·86	25	29·74
6	13	29·64	6	29·71	33	29·86	27	29·60
7	3	29·66	3	29·64	24	29·68	21	29·69
8	1	29·25	3	29·62	16	29·64	6	29·51
9	1	29·30	5	29·64	12	29·39	2	29·61
10 to 12..........	...	......	2	29·25	4	29·13	3	29·27
Total	162	29·84	118	29·79	368	29·87	319	29·85
Total referred to 8 points	249	29·83	...	......	586	29·86	...	......

OBSERVATIONS OF WIND REFERRED TO SIXTEEN POINTS.

Force 0-12; O. = number of observations; P. = pressure.

Force.	W.		W.N.W.		N.W.		N.N.W.		Calm.	
	O.	P.	O.	P.	O.	P.	O.	P.	O.	P.
1	113	30·07	13	30·07	45	30·06	17	30·11	90	30·6
2	149	30·03	35	29·99	55	30·06	33	29·95		
3	95	29·96	35	29·98	40	30·00	21	30·08		
4	94	29·90	14	29·98	21	29·88	15	30·04		
5	42	29·83	12	29·88	11	29·98	5	30·12		
6	31	29·87	7	29·71	16	29·78	1	29·96		
7	14	29·73	4	29·52	7	29·87				
8	9	29·78	5	29·53	2	29·43				
9	5	29·52	1	29·34	2	29·32				
10 to 12	1	30·07	...	......	...	......				
Total ...	554	29·96	126	29·93	199	29·98	92	30·08		
Total referred to 8 points	777	29·94	...	......	308	29·99				

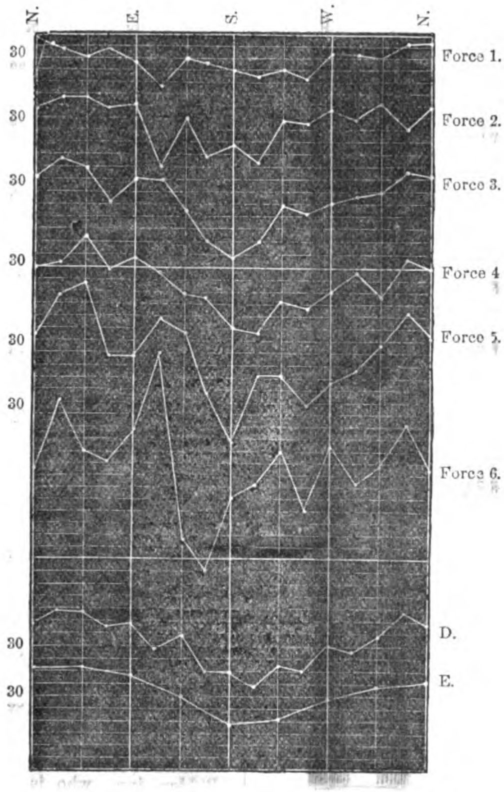
The averages, shown graphically, approximate to curves, having their maxima about N.N.E. or N.E., and their minima at S. and S.S.W. Much of the irregularity of the tracings upon the accompanying diagram may be attributed to paucity of observations under certain directions of wind. The flattest curve appears to be with force 1, and the curvature seems to increase with the force. This tells us that there is more motion in the barometer with equatorial than with polar winds, for a given increase of force. The curve (D) of pressure for direction of wind, irrespective of force, is very similar to the others, and comes out more symmetrically when the observations are referred to eight points only of the compass (curve E).

The whole of the observations of the barometer were next grouped for each grade of the wind's force without regard to direction, with the following results, against which are placed similar results obtained by an investigator unknown to me, who worked up the observations made by Mr. Rogerson, at Greenwich, in 1835-36, and published a short paper on the subject in the "Nautical Magazine" for 1853.

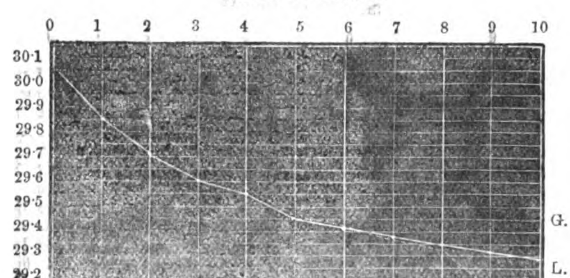
Force.	Years 1860-69.		Years 1835-36.	
	Pressure.	Observations.	Pressure.	Observations.
0.	30·06	90	......	...
1.	30·03	659	30·19	102
2.	30·01	848	30·03	255
3.	29·97	591	29·98	355
4.	29·93	434	29·92	196
5.	29·90	186	29·87	247
6.	29·79	163	29·77	139
7.	29·74	91	29·67	82
8.	29·63	45	29·54	45
9.	29·49	30	29·49	14
10.	29·28	10	29·48	19

These two sets of results are shown graphically in the diagram, marked L and G respectively. They are in close accord with each other, and show a striking decrease in the average atmospheric pressure with the increase of the wind's force.

The average height of the barometer at London is 29·957 inches, from 3,147 observations, the total number employed in this investigation. The resultant of all the observations of the wind's directions, irrespective of force, has been calculated, and found to be W. ½ S.

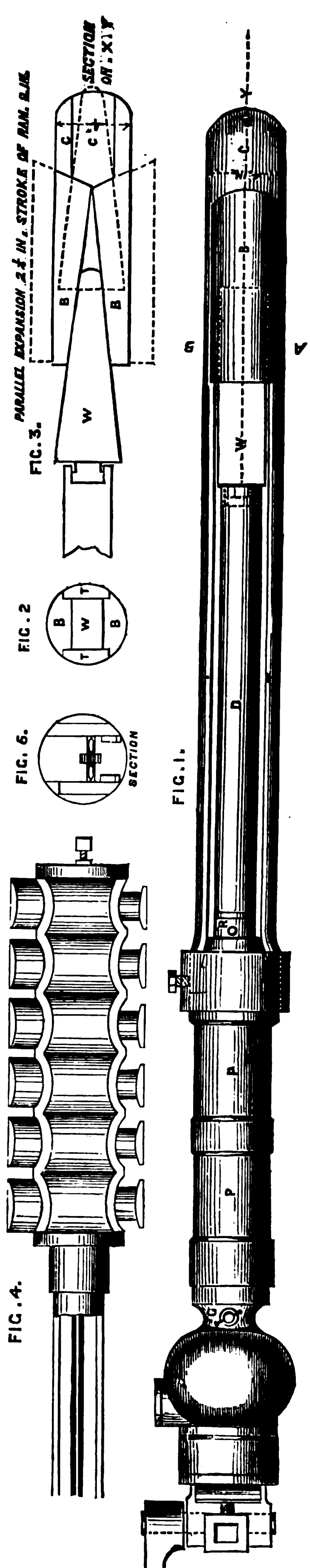


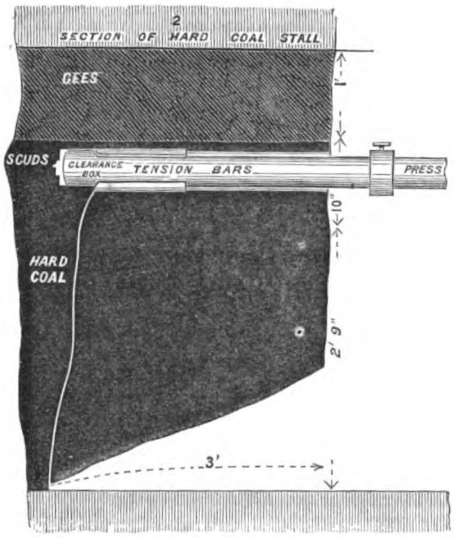
GRADE OF FORCE.

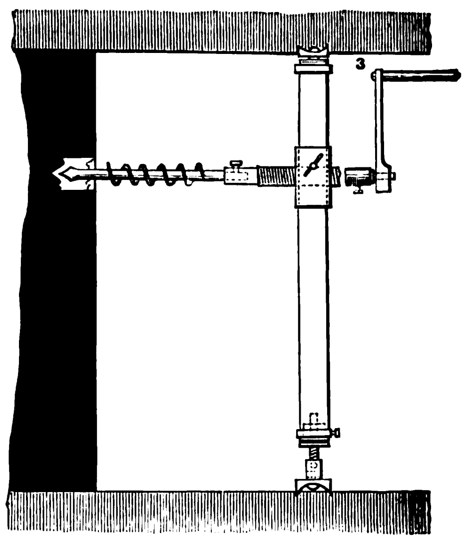


HYDRAULIC COAL-GETTING MACHINERY.

BY MR. J. GRAFTON JONES.







HYDRAULIC COAL-GETTING MACHINERY.

THE feeling that blasting with gunpowder in collieries should be prohibited by legislative enactment continually gains ground with the public, and the success which has attended the practical trials with the wedging machines at the Harecastle and Shipley Collieries is gradually convincing even men accustomed to colliery working that the idea of substituting mechanical for explosive action in the breaking down of coal is not so completely Utopian as was at first supposed. A most interesting paper on the use of hydraulic machines for breaking down coal was read at a recent meeting of the Midland Institute of Mining Engineers, by Mr. Lupton, and we are now enabled to give diagrams of Mr. James Grafton Jones's machine. To facilitate description of these machines, and enable their contemplated sphere of action to be more readily undeistood, Mr. Lupton briefly mentions the principal methods in which coal is got from the solid. According to the first method, the face of the coal is undercut, and the coal either falls by its own weight, or is forced down by the weight of the superincumbent strata. The second method is when the holing is made above the coal, or when the coal is undercut, and will not fall without the application of power. In this case the coal is often blown down by the use of gunpowder, and in other cases where the use of powder injures the coal, or is dangerous by reason of the probable presence of fire-damp, the coal is brought down, or forced up, as the case may be, by means of wedges, driven in by hand hammers. The third method is practised in South Wales, North Staffordshire, and other places where the coal is divided by numerous slines or slips into irregularly shaped masses. At these slines the coal can be so easily separated from the solid that holing is sometimes altogether unnecessary, and here the coal can be got by judiciously placed shots, and by the use of the crowbar and hand-driven wedges. The fourth method is in driving headings, where it is common to hole at the end, and to cut one side, and then to break down the coal by means of gunpowder. In the last three cases it is proposed to supplant to some extent the use of powder and hand hammer-driven wedges by the use of hydraulic machinery. There are three patentees of this description of coal-breaking machinery—Mr. James Grafton Jones, Mr. Charles John Chubb, and Mr. Samuel Parker Bidder, jun., who is associated with Mr. John Jones. Mr. Grafton Jones's patent is dated June, 1867; Mr. Chubb's, May, 1868; and Mr. Bidder's, November, 1868.

The principle of the machine illustrated in the accompanying engravings, for which we are indebted to the "Mining Journal," and which is one of those referred to in the patent of Mr. J. Grafton Jones, of June, 1867, consists in driving a wedge by means of a hydraulic press between two blocks of steel, which are rendered incapable of any but lateral movement by means of tension bars connecting them with the press. In fig. 1, P is the press; R, the ram; TT, the tension bars; BB, pressing block; W, wedge; C, the clearance box, in one piece with the tension bars. The diameter of the clearance box is 4in., and the length of the tension bars and clearance box 3ft. 6in. D is a movable distance piece. The capabilities of the machine were carefully and thoroughly tested by Mr. Lupton, at the Shipley Colliery, in Derbyshire. The Hard coal is there worked on the long wall system, in banks of from 80yds. to 100yds. in length, and the section is—roof bind; Gees, or inferior stone Cannel (used for packs), 1ft.; Scuds (soft coal, 4in.; smut parting, 0; soft coal, 6in.), 10in.; hard coal, 2ft. 9in.=4ft. 7in. The subjoined diagrams show section of a stall on the left side of the gate-road, where a length of 20yds. was holed 3ft. under. At a point, 15yds from the gate end, a hole was drilled in the Scuds, 3ft. long and 4½in. in diameter. The tension bars, with the pressing blocks and wedge, and with the press attached, were then inserted into the hole; the sprags having been removed, the pump was worked by one man, the pump handle projecting sufficiently far from the coal to enable him to work with safety. A few minutes' pumping forced in the wedge between the pressing blocks sufficiently to make the coals bump and crack ominously, and before the ram had reached the end of its stroke the coal was broken down for a length of 10yds., the Gees and Scuds above the parting remaining up. Another hole was then drilled in the Scuds at the point B, in the middle of the length of nine yards remaining between this fall and the gate end. The machine was set to work as before, and this time the length of nine yards was forced down, bringing with it the Scuds and Gees. The remaining part of the bank, 18yds. in length, was then holed, and the machine applied as before, in a hole drilled at the point C in the Scuds. The whole length was brought down at once, the Gees and Scud above the parting remaining up. These experiments being made with the aid of men who had never handled such machines before, and with a drilling apparatus not suited to the position in which the holes had to be drilled, occupied a long time; but it is Mr. Lupton's opinion that two men, accustomed to the work, and with the improved drilling apparatus since constructed, could have easily performed all the operations required in drilling one hole and fixing the machine in 45 minutes, thus taking from two to three hours, and obtaining three falls. The usual time that it would take two men to wedge down as much coal as was done by the machine in these three experiments is between one and a half and two days.

The Shipley Soft coal is worked on the end, and is holed from 3ft. to 4ft. under; it requires to be blown down with gunpowder, and this operation makes a good deal of slack, and fills the air with fumes, objectionable both on the score of health and comfort. Five experiments were made in some Soft coal stalls; the holes were bored 3ft. in, near the roof, and the machines applied as before. The first time, owing to a fault in the coal, a lump of only one ton was broken down. The second time a length of 33ft. of face, and weighing about from 12 to 15 tons, was brought down; the other times, lumps of coal of from 2 to 4 or 5 tons were brought down. In considering the value of these experiments, it must be remembered that the machines were applied without that judgment that experience alone can give, and which would enable much more surprising results to be obtained. In the same stall where these experiments were tried, Mr. Lupton saw two shots fired, each time bringing down a small quantity of coal, not exceeding 1 ton or 30 cwts.

Having brought the experiments at Shipley to a satisfactory conclusion, the invitation of Mr. P. Cooper was taken advantage of to make further experiments at the Holmes Colliery. The first experiment was similar to those already described: a hole was drilled near the roof of a stall in which the coal was holed for a few yards, and one minute's gentle pumping sufficed to fetch down about 5 yards of face. Experiments were then made to see if the

coal could be got without previously holing it; these experiments cannot be said to have as yet resulted in entire success, although enough was done to encourage the writer to continue his experiments in the endeavour to accomplish that most desirable object.

In addition to the wedge-machine, one of another design was used in the foregoing experiments, and proved equally effective. This machine is shown in figs. 4 and 5. It is constructed from a solid round bar of steel, 4½in. diameter and 7½in. long; six holes, 2⅜in. diameter, are bored transversely through this bar. These holes serve for cylinders for as many rams on each side; a hole, ⅛in. diameter, bored longitudinally through the bar, connects these cylinders. To a projection at one end of the bar is screwed a tube 2¼in. external diameter and 17in. long, on to the end of which is fixed a force-pump, made by Tangye. The water from the pump is carried through a copper tube with a very small bore, which is inside the 2¼in. tube above mentioned, and is screwed into the bar carrying the rams; the 2¼in. tube, together with the cast-iron globe to which the pump is fixed, serve as an air-tight reservoir for the water required by the pumps. By working the pump, the rams on either side are gradually forced out from the bar; the rams on one side have a stroke of only ⅛in., and are prevented from coming out of the bar by collars strong enough to stand the pressure. The rams on the opposite side have a stroke of 1⅝in., and the cylinders of these rams have an escape hole for the water, so as to avoid all danger of forcing the rams out of them. It will be seen that by this system of having rams on both sides of the bar no strain is thrown on it. Before this plan was invented rams were placed on one side of the bar only; the bar had thus to sustain the pressure of the rams, wherever, owing to unevenness of the hole, the bar was not supported by the coal, and as a result it was often strained or broken. The spindle that carries the pump-handle, and the short lever (1in. long) that works the pump-plunger, is placed in brackets which can revolve, so that the man who works the pump can have the handle in any position that he chooses. One man can apply a pressure equal to about 10 tons on the square inch by means of this pump. The area of each ram is 4·4 square inches, thus each has a force equal to 44 tons, and all six have a combined force equal to 264 tons.

The area of the ram in the wedge machine is very nearly 6 square inches, and, with a pressure of 10 tons on the inch, it has a force of 60 tons. The stroke is 9in., and the expansion (with the present construction of wedge) 2¼in., thus the power of the ram is multiplied by 4, giving a total bursting force of 240 tons. When the rams in either machines have completed their stroke, by turning the cock C, communication is opened between the pressure-pipe and the air-tight reservoir; the vacuum in this then sucks back the rams, enabling the instruments to be easily withdrawn.

Mr. Grafton Jones has also constructed a modification of the machine last described, the advantage of which consists in doing away with the force-pumps, which sometimes get out of order, and in their place is substituted a screw-ram, which advances into the reservoir of water, and so forces out the short rams on the bar. It is intended also to apply this modification to the wedge machine.

In considering the relative merits of the hydraulic machines, it is impossible to say which is the best, because each one may be found to be the best adapted for one mine, and the worst for another. Where a large amount of expansion is requisite, and only a moderate pressure necessary, the wedge machine will, perhaps, be found the most suitable; but where only a small amount of expansion is required (in some cases less than 1in. is sufficient), and at the same time a very great pressure is necessary, as in the case of breaking down coals that have been undercut, Mr. Lupton thinks the ram machine is the best, because there is less friction in moving the rams than in moving the wedge, and the machine being all in one piece is more handy, and less liable to damage. The application of the screw-pump will be a great improvement. It may also be a good plan to make the rams at the end of the instrument of larger diameter than those near the front of the hole, as more power and a shorter stroke is required at the back of the hole. To conclude, in every case where he has seen the machines tried, they have effectually done at least as much work as powder would have done under similar circumstances, and owing to the gradual manner in which the power is applied, more coal is generally got than could have been done with powder; and although it is not claimed that an acre of coal can be worked more cheaply with these machines than with powder, there is no doubt that less slack is made, and that the condition of the mine is more healthy; whilst where the coal is got by the ordinary plan of wedging, it is the opinion of the writer that a great saving of labour may be in many cases effected by the use of these machines.

MESSRS. J. REID and Co., of Port Glasgow, have contracted to build three steamers of large tonnage for the East India trade, *via* the Suez Canal.

PREHISTORIC MAN.

A SOMEWHAT remarkable discovery of human and animal remains has been communicated by Professor Capellini, of Bologna, to the "Gazzetta dell' Emilia." The Professor, on his return from Denmark, whither he had gone to be present at the International Prehistoric Congress, was rendered so zealous by what he had heard there that he was induced to make many excursions in the neighbourhood of Spezzia. In the course of these excursions he visited many caverns, and in one of these he was successful in discovering traces of prehistoric man. This was in a grotto in the island of Palmeria, the access to which was difficult and dangerous. Here he caused excavations to be made, and the result was the discovery of numerous flint and stone implements, the workmanship of which showed they belonged to the earliest period of the stone age. Besides these wrought implements and various other objects brought into the cavern by its human occupants, he found a considerable quantity of bones of animals mingled with bones of human beings. The condition of these latter bones, he says, "would justify the inference that the grotto had been inhabited by anthropophagi, and that the Italians of that epoch were cannibals, like their contemporaries in Belgium, France, and Denmark. Among the human bones I found those of women, and part of the jawbone of a child some seven or eight years of age. Some of these bones were entire, others were partially calcined. In the centre of the cave it was possible to discern traces of a fire-place. Whoever has busied himself in prehistoric researches, whoever has read Spring's excellent work on the Chauvaux cavern in Belgium, and the writings of other authors on the subject of the caverns in France, will not hesitate to admit that the discoveries in the island of Palmeria prove that the Italians were, as I have said, man-eaters. For the present, it will be sufficient for me to direct the attention of naturalists to the subject. The Cyclopeans spoken of in the fable were probably these cannibals."

GUNNERY EXPERIMENTS AT SHOEBURYNESS.

SIX rounds from the Vavasseur 7in. steel gun were fired yesterday week at Shoeburyness, to try a new modification of the coned-head gear of the screw shaft compressor for checking recoil. In former trials the coned head of the shaft was packed with wood and worked in a wrought-iron female cone; but, in the present case, the coned head was packed with strips of copper about 3in. wide, and worked in a cast-iron female cone, the alteration having been made in consequence of a suggestion that metal working in metal might be preferable for the naval service. The six rounds were barely sufficient to determine the final value of this method of obtaining the second frictional surface for the gearing, but they went far enough to show that the copper might, by wearing surface the porous cast iron, and thus diminish the adhesion or friction, as did, indeed, result in the last round of the practice to the extent of lengthening the recoil by some inches. Mr. Vavasseur contemplates applying a clutch, so as to ensure by mechanical means the absolute cohesion of the two cones. At the previous trial at Shoebury the times of flight but not the ranges with this gun were obtained. On this occasion the ranges were got; but owing to the fog, the times of flight could not be observed. The ranges and accuracy of shooting—which compare exactly with the 7in. 6½-ton service muzzle-loading Woolwich gun, the rifling being the same in twist—were very good, being equal, or, possibly, a trifle in excess of the service ranges. The average of the service 7in. gun at 6deg. 58min. is, with 22lb. of powder and 115lb. projectiles, 3,400yds., as reduced to the plane of the range. The mean of the three Vavasseur ranges is 3,487yds. at 7deg. of elevation with the same charge of powder; but a small deduction has to be made for the height of the position of the gun—namely, 16ft. above the plane of the range. The amount of deflection was only 5yds. in a flight of two miles. The following are the details as given in the "Standard," the elevation being 7deg. throughout:—

Round.	Charge.	Shot.	Compressor at	Recoil. ft.in.	Range. Yards.	Deflection. Right Yards.
1.	... 14lb.	108lb.	... 3¼	... 0·7	... 3232	... 11·4
2.	... 14lb.	114¾lb.	... 2½	... 2·7	... 3103	... 13·6
3.	... 14lb.	114¾lb.	... 2¾	... 2·6½	... 3063	... 15·6
4.	... 22lb.	114¾lb.	... 2½	... 3·7	... 3497	... 15·0
5.	... 22lb.	114¾lb.	... 2¼	... 3·1	... 3475	... 20·0
6.	... 22lb.	114¾lb.	... 2¼	... 4·2	... 3490	... 20·2

Slight differences in the last three recoils were produced by the yielding of the holding chains and pivot of the slide, the soft earth of the marsh never affording a firm bed. A total of more than a hundred rounds have now been fired, and the gun-carriage and compressor remain in excellent order, without showing the slightest sign of wear.

WHITWORTH EXHIBITIONS.

THE £25 exhibitions which Sir Joseph Whitworth offered last year, previous to the competition for the £100 scholarships, proved so successful in bringing together a number of students who, by the aid of the exhibition, had been able to devote a considerable time to their preparation for the examination for the scholarships, that Sir Joseph has this year offered 60 £25 exhibitions, in preparation for the 1871 competition. We see by the "Society of Arts Journal" that these exhibitions have only just been awarded as follows:—

	No. of Exhibitions.
Bath, Proprietary College	1
Birkenhead, Collegiate Institution and Proprietary School	1
Bolton, Science and Art Institution . .	1
Belfast, Queen's College	1
Birmingham, Birmingham and Midland Institute	1
Birmingham, Grammar School . . .	1
Bristol, Trade and Mining School . .	2
Cambridge, University	2
Cardiff, the Mayor	1
Cheltenham, the College	1
Clifton, the College	1
Crewe, Mechanics' Institute	1
Cork, Queen's College	1
Darlington, the Mayor	1
Derby, Derby School	1
Dublin, Trinity College Engineering School	1
Dundalk, Chairman of the Town Commissioners	1
Durham, University	1
Edinburgh, University	1
Edinburgh, High School	1
Edinburgh, Watt Institute	1
Galway, Queen's College	1
Glasgow, University	1
Glasgow, Anderson's University . . .	1
Glasgow, Mechanics' Institute . . .	1
Halifax, Working Men's College . . .	1
Harrow, Harrow School	1
Leeds, Grammar School	1
Leeds, Mechanics' Institute	1
Huddersfield, Mechanics' Institute . .	1
Kilmarnock, the Provost	1
Liverpool, Liverpool Institute . . .	1
Liverpool, Northern Institute . . .	1
Liverpool, Free Library Classes . . .	1
London, University College	1
London, City of London School . . .	1
London, Christ's Hospital	1
London, King's College	1
London, St. Peter's Collegiate School . .	1
London, Birkbeck Institute, Southampton-buildings	1
Manchester, Owen's College	2
Manchester, Owen's College (Evening-Classes)	3
Manchester, Free Grammar School . . .	1
Manchester, Mechanics' Institute . . .	1
Manchester, Salford Working Men's College	1
Marlborough, School	1
Newcastle-on-Tyne, the Mayor . . .	1
Northampton, the Mayor	1
Nottingham, High School	1
Nottingham, Mechanics' Institute . . .	1
Oldham, Lyceum	1
Oxford, University	2
Plymouth, the Mayor	1
Preston, the Institution, Avenham . . .	1
Rossall, School	1
Sherborne, the King's School	1
Southampton, the Hartley Institution . .	1
Stockbridge, Queenwood College . . .	1
Sheffield, the Mayor	2
Woolwich, &c	1
Wokingham, Wellington College . . .	1
Wolverton, the Institute	1
Worcester, the Mayor	1
Awarded on the results of the competition for Scholarships, 1869	10

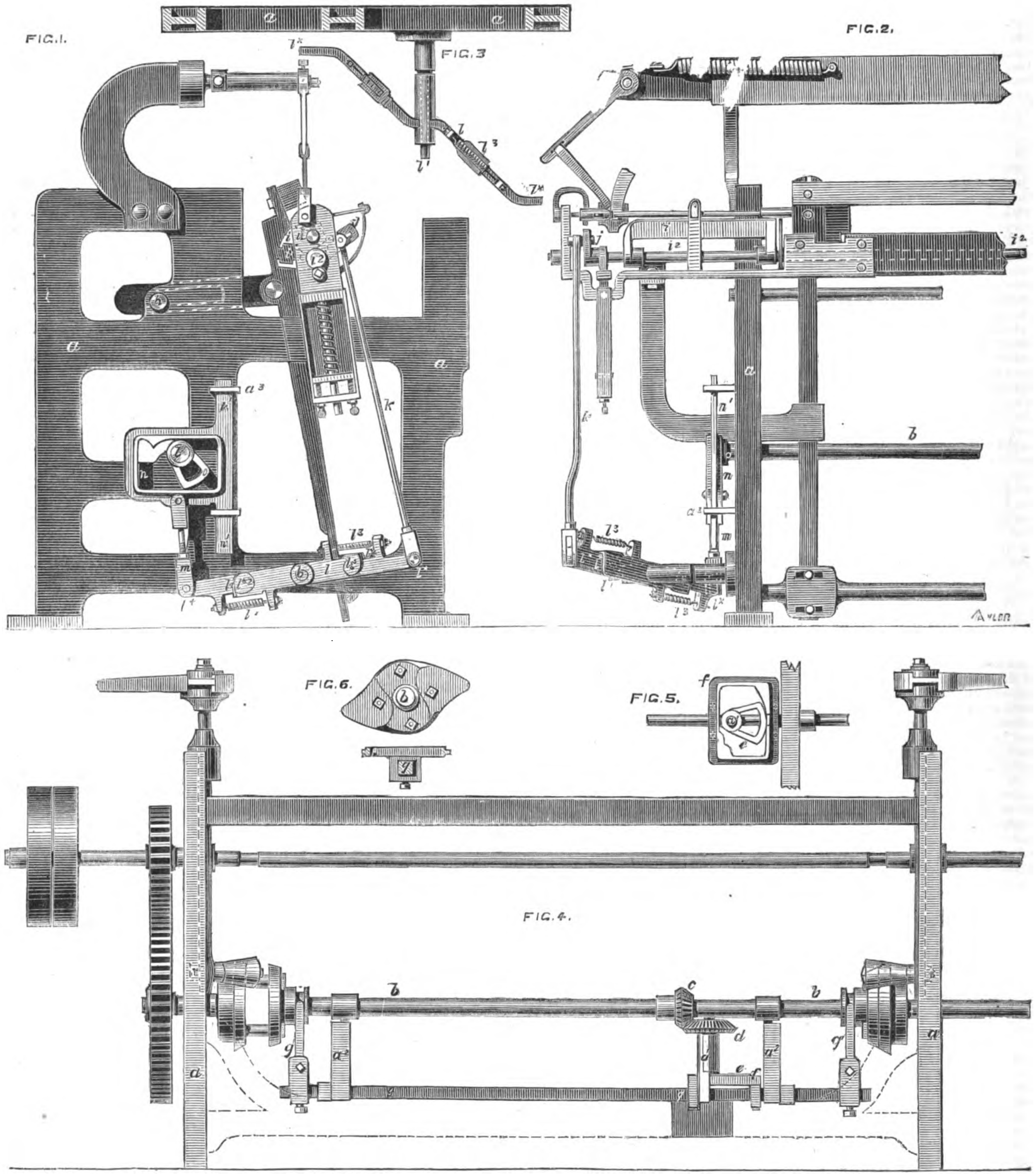
It is to be hoped that the competition of 1871 will be as well attended as this year's was.

IMPROVEMENTS IN LOOMS FOR WEAVING.

MR. GEORGE HODGSON, of Thornton-road, Bradford, Yorkshire, in conjunction with Mr. H. Bottomley and Mr E. Cockroft, has patented a combination of means for effecting variations in the order of selection of shuttles in looms for weaving. The boxes at each end of the batten are affixed to a common axis, which is supported to rock in bearings carried by the batten or going parts, and has applied to it an arm, which by connecting rod and pin joints is attached to one end of an elastic ended lever, the other end of which is by connecting rod and pin joints connected to a frame or fork applied to a rocking arm or lever with means of adjustment as to position for variations of distance of motion obtained. This frame or fork receives and is actuated by a cam or tappet on the tappet shaft

IMPROVED LOOM FOR WEAVING.

BY MESSRS. HODGSON, BOTTOMLEY, AND



Each arm of the elastic ended lever is formed in two parts hinged together, with the part of one arm or one end of the lever capable of turning on its hinge joint in the opposite direction to that of the other. Each arm or end of this lever is held from turning on its hinge joint with a certain degree of rigidity against a stop to each part by springs, yet so as to yield in the event of the shuttle sticking part in the box and part in the shed, or of other stoppage. Upon the tappet shaft is a small bevel tooth wheel of (say) 30 teeth, to gear into another of (say) 60 teeth, upon another axis upon which is also applied a tappet to work in a square casting or frame, or between arms. The square casting or frame is applied on a square rod, which is capable of endway motion, and which carries forks to move the arms of the picker shafts into or out of the way of the picking tappets according to the order of picking for the time desired.

In our engraving fig. 1 shows a portion of the end view of a loom; fig. 2, a portion of one end of the front of a loom; and fig. 3, a plan view of parts separately to illustrate one portion of the invention. *a a* indicates the framing of the loom; *h*, the main or crank shaft; and *b*, the cam or tappet shaft; *i* shows one of the vibratory shuttle boxes, each of which is formed with two shuttle chambers i^1 i^1, and both boxes *i* are affixed to a common axis i^2, so as to be capable of rocking with that axis. The axis i^2 is supported for this purpose in bearings carried by the batten, and it has applied to it the arm *j*, the outer end of which is, by a connecting rod *k*, connected to one end of the lever *l*, which is supported to turn upon a fixed stud or projection l^1, and at its other end is connected by the connecting rod *m* and pin joints to the frame *n*. This frame *n* is formed with arms n^1 n^1, which are capable of sliding in the stationary guides a^3 a^3, as motion is given to the frame *n* by the rotation within it of the cam or tappet *o* on the cam or tappet shaft *b*. It will be seen that each arm of the lever *l* is formed elastic by being formed in two parts capable of turning each in one direction, but each in the opposite direction to that of the other on pins l^2. The parts l^x of each end of the lever *l* are held to act with a certain degree of rigidity by means of the springs l^3 drawing them against the parts l^4, yet so as to admit of their yielding in the event of the shuttle sticking. By the use of cards or pattern surface for actuating the tappet increased variation in the weaving may be effected.

Fig. 4 shows by a back view of some of the

parts of a loom another portion of the invention applied; fig. 5 shows a plan view, and fig. 6 a sectional view of some of these parts of the apparatus separately. *a a* indicates the framing; *b*, the tappet shaft, upon which is applied the small bevelled toothed wheel *c* of (say) 30 teeth, which gear into the teeth of the bevelled tooth wheel *d* of (say) 60 teeth. This wheel *d* is affixed upon one end of a short shaft d^1, which is supported so as to be capable of freely revolving in a bearing provided for it in the cross framing a^1. At the lower end of this shaft d^1 is affixed the tappet *e* in position as it revolves to actuate the frame *f* affixed to the rod *g*, which is supported in a pair of castings, arms, or guides a^2 a^2, so as to be capable of endway motion therein. This rod *g* carries forks g^1 g^1, which embrace the necks of the respective tappets to move them out of the way of the picking cones.

The want of such a loom as we have described has long been greatly felt in the worsted trade, and we congratulate Mr. Hodgson and his co-inventors upon having supplied the deficiency. The loom is at work weaving reps or pick and pick goods. It is very simple and easy of management both for weavers and overlookers. Indeed, there is no more difficulty in the management of this loom than in an ordinary circular box-loom, when the weaver becomes accustomed to it, which he does very quickly. The simplicity of its motions we have no doubt will cause it to come into general use.

MANUFACTURE OF GAS ON A SMALL SCALE.

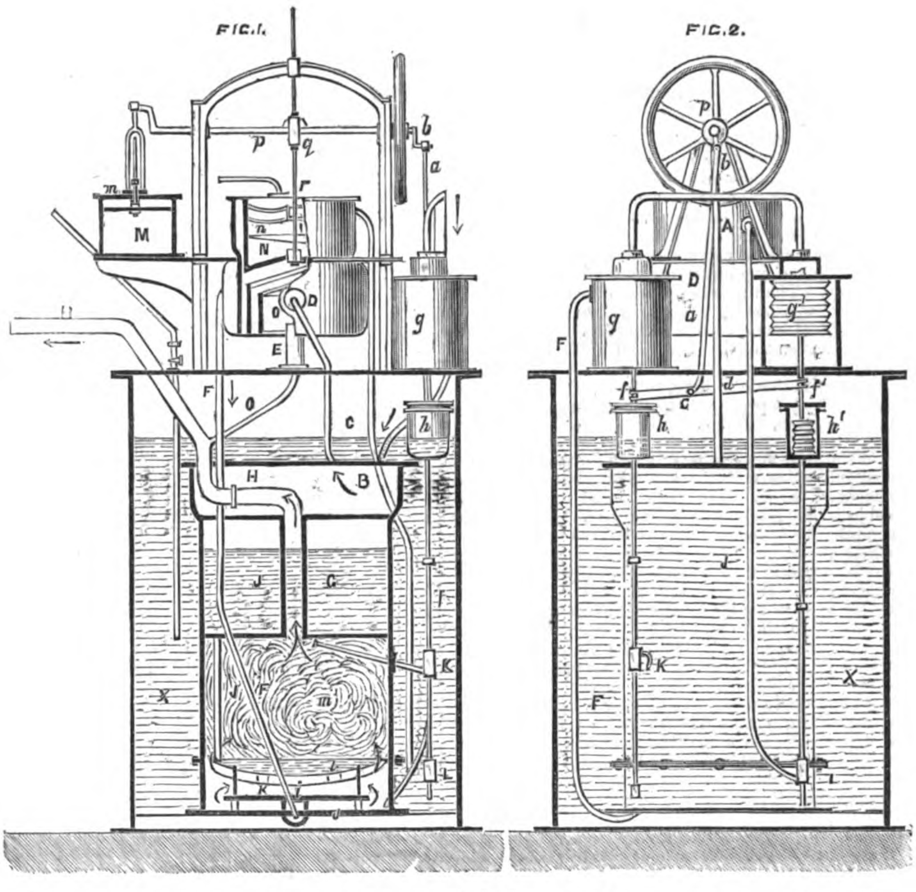
THERE are unquestionably many localities, isolated districts, and detached buildings of various descriptions which it would not be feasible to light by gas by the ordinary process of manufacture. The demand would be too small to warrant the large expense that must of necessity be incurred. To meet the requirements of such cases portable gas-making machines have been constructed, which can be erected at a small outlay, and answer their purposes very successfully. The majority of these make the gas from coal, which, in some instances, forbids their being adopted. A French engineer, M. Lafrogne, has recently patented a small gas-making machine, founded upon the principle of the carburetting of the atmospheric air,* and possessing the following prominent features:—The apparatus is connected with a prime mover, which derives its motive power from a small portion of the gas itself, while, at the same time, it feeds the recipient or vessel in which is placed the carburetting element, which is generally one of the hydrocarburets. A system of valves is arranged by which the air is drawn in, heated in an annular space provided for it, and subsequently transferred to a reservoir, where it is stored under a pressure nearly constant. It becomes saturated with the carburetted vapours by traversing a series of layers of flannel, sawdust, and iron filings, which, by capillary attraction, imbibe and become impregnated with the hydrocarburet, which is thrown upon them by a small pneumatic injector worked by the motive power. After being thoroughly saturated with the carburetted gas the air passes away through an outflow pipe, ready for the purposes of illumination. This small machine is represented in figs. 1 and 2. Fig. 1 is a vertical section, and fig. 2 a side elevation. The motive power consists of a cylinder M, furnished with a piston *m*, and a cold air chamber *n*. This last contains a hollow piston N, or movable box, which is also surrounded with a cold air receptacle. The movements of these two pistons N and *m* are so arranged that when the expanded air has raised the piston *m*, the other rises rapidly to draw in the warm air in the cold part of the vessel *n*, which assists the down stroke of *m*. In the lower portion of the chamber *n* is placed a furnace O furnished with a chimney *o*, heated by the cock E fastened on the tube O, a branch of the outlet pipe H. The piston rod of the cylinder M is connected by a small crank (see fig. 1) to the shaft *p*, and governs the movements of the rod *r* of the hollow piston or box in the chamber *n*. It is this rod *r* that works the valves already alluded to as the means whereby the air is drawn into the apparatus.

Referring to fig. 2, it will be seen that the prime mover imparts motion to the rod *a* through the crank *b*, and that this motion causes the balance

* We extract the cut and particulars from our valuable contemporary "Le Genie Industriel."

APPARATUS FOR THE MANUFACTURE OF GAS.

BY M. LAFROGNE.



rod *c* to oscillate about its centre *d*. This oscillation, in its turn, produces the alternate ascent and descent of the two piston rods *f* and f^1, and thereby causes the corresponding opening and shutting of the four valves *g* g^1, and *h* h^1. Of these the first two are valves of aspiration, and send the air into the body of the apparatus. The duty of the other two will be pointed out presently. After the air has passed by the tube A into the upper part B of the apparatus, which, in fact, constitutes the regulating reservoir, it escapes by the pipe C, and fills the whole of the annular space D which surrounds the burner E. The object of causing the air to enter this space is that it becomes heated, and is thus rendered in a better condition for subsequently becoming carburetted. It escapes from the annular space by the tube F, by which it is conveyed into the carburetting chamber. The tube F is double. In the inner one is carried on the circulation of the hot air, and the space between them is packed with sawdust or other non-conducting substance, so that the air may not be cooled in passing from the annular chamber D to the carburetting receptacle. On leaving the tube F the air traverses the small flannel caps, and then circulates among the plates *j* *k* and *l*, in the direction shown by the arrows. These plates are so arranged as to divide or break the current of air, and thus compel it to become saturated with the hydrocarburet. Above the top plate *l* is the space m^1 filled with wool and sawdust, which are impregnated with that substance. Through this space the non-carburetted air passes by the tube G into the pipe H, whence it is distributed for the purposes of consumption. The hydrocarburet occupies the reservoir J and flows through the pipe J^1 to saturate the absorbing mass m^1, and moisten the plates j^1 *k* and *l*. In addition to this supply the small pump *k* furnishes an extra quantity when required by the small valve *h* has not yet been defined, is that h^1. It serves alluded to previously. The other valve, whose duty to draw cold water into the lower part of the external case *x* by means of the pump L. When it is required to work the apparatus, the first step is to fill the reservoir J with the hydrocarburet selected, and give the wheel a few turns with the hand. In a very short time gas is generated, the burner E is lighted, and the machine continues self-acting. The use of this apparatus is not confined solely to illuminating purposes, but it is equally well adapted for those of heating. In the latter case a worm is introduced into the apparatus through which the air circulates.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

(*Concluded from page 393.*)

THE old antagonism of defence and attack still goes on, but rapid as is the progress in both destruction, if for a short space outstripped by its competitor, is soon far ahead again. With great toil we succeed in opposing a more effective resistance to a force which as surely baffles our efforts. We have reached solid iron plates of 10in. in thickness, but a stronger material is only wanted to give a greatly increased power of penetration to our already formidable cannon and projectiles. Sir Joseph Whitworth has been at work on this problem, and by employing great hydraulic power in forcing cast steel while in a half fluid state into strong iron moulds, he anticipates obtaining its solution. The result of these researches is looked forward to with much interest. If perfectly successful what becomes of our vaunted fleet of armour-encased ships? Employ this same wonderful metal for your ships may be the answer, and so the battle goes on. Nor are we at all sure we have got exactly correct notions of what description of ships is best adapted to carry our heavy gun and to enable us to employ their deadliest effect against a foe. Here the turret principle threatens to displace the broadside, and from the accounts of the Channel fleet on the late cruise the performance of the "Monarch" seems to indicate the class of vessel on which our chief reliance must be placed in naval warfare. When the "Captain," now building at Birkenhead, in Messrs. Laird Brothers' yard, for which Captain Cowper Coles is responsible, has been fairly tried, the question of turrets versus broadside vessels in which that gentleman has so indefatigably supported his side for years will be settled. The course the First Lord of the Admiralty has adopted will leave no excuse as to being misled about the character of our fleet of ironclads, and, as far as we can judge from the accounts, the success of by far the greater number was very equivocal indeed. Putting the

"Monarch" out of court, as this vessel is an adaptation of Captain Coles's system, there is little we can call successful with the exception of the "Bellerophon" and "Hercules," while the "Inconstant" has been nearly torn to pieces by her machinery. It is, however, some consolation that we are better off than any of our neighbours, and we have every reason to believe that in the new turret ship "Captain" we have obtained a superior power of destruction, combined with increased powers of resistance, and, as regards the vessel itself, that we have a ship that will stand up tolerably stiff when our broadsides are making what the sailors call heavy weather, and are unable to take any very certain aim at a foe.

In the commercial marine we have gone on building for the last year at a tolerable rate, and our northern yards have reaped the benefit of the enterprise of our merchant shipowners. Both our navies are interested in the successful voyage across the Atlantic of the great Bermuda floating dock. This gigantic structure was safely towed by two of H.M. steamers, and one light frigate acted as convoy all the way. The time chosen was of course when the calmest weather of the year might be looked for. The signal success of the undertaking, from the commencement of the dock itself to its being safely moored at its destination, will afford a precedent for the construction of others, to be employed wherever this method is preferable to the ordinary system of brick or stone.

We still hear of new schemes for improving our communication with the continent, but no advance has been made. The first official report on the subject has lately been published. It has been compiled by Colonel Tyler, who has examined the whole question. The number of passengers between England and France increases annually to a considerable degree. In 1868 nearly 309,500 persons crossed by the various routes in about the following proportions:—By Calais one-half, by Boulogne one-third, and by Dieppe and Havre the remaining sixth. This shows how much the sea passage is dreaded, as we may conclude the bulk of the passers over went to Paris, or farther south, or vice versa, thus necessitating taking the capital en route. It is dislike to the sea alone that has caused so many to avoid the preferable journey by Dieppe. Owing to the want of better harbour accommodation it is found impossible to employ vessels of greater length than from 200ft. to 240ft., or drawing more water than 7ft. or 8ft., and even then vessels cannot at all times enter the French harbours. While condemning the style of vessel employed of necessity at present, Colonel Tyler recommends that a proper pier be constructed at Boulogne, as more suitable than Calais, and this can be effected for £500,000. The accommodation necessary would be secured on the French side by a judicious extension of the west pier at Boulogne, while at Dover for £100,000 the improvements required in the jetties for embarkation and disembarkation could be made. By employing steamers capable of moving in either direction with equal facility, the difficulty of turning in small harbours would be avoided, and the existing harbours of Boulogne and Dover slightly modified would be available for improved steamers. This scheme is proposed for the temporary improvement of a wretchedly uncomfortable service, if the two governments are disinclined to carry out Mr. Fowler's plan of a Channel ferry, which that gentleman estimated at £2,000,000, inclusive of steamers.

In connection with railways the most important and prominent feature of the past year has been the question of the tariff, and a keen controversy, opened up in a great measure by our late president's startling and forcible statement as to non-paying weights, has been maintained on this subject. Its importance is very great, since it involves the whole question of railway management, and raises considerable doubts as to the fitness of the present means to the end. While railway companies cannot be expected to carry goods and passengers at rates which cannot pay interest on the capital sunk in the undertakings, fares injudiciously low adopted to serve a merely temporary purpose accustom the public to this tariff. When the existing cause, be it a "beggar my neighbour" rivalry, or a bait to lure the public to settle in greater or less numbers at a little distance from large towns, is removed, and the more legitimate equilibrium restored, this same public considers itself ill-used. The gist of the whole matter lies in the fact that in many cases the difference between receipt and expenditure leaves no margin in many cases for a return on the capital invested. No doubt much money has been spent foolishly in the construction of many unnecessary and mischievous branch lines, and even when such were advisable much of the expense incurred might have been avoided by the adoption of a road more in proportion to the traffic it was designed to accommodate. Rivalry culminating in the heavy expense of competing schemes, and the enormous expenditure known as parliamentary expenses, have thrown a heavy burden on the backs of railway companies, which the travelling public must ultimately support. Thus immense capital invested, heavy working expenses, and above all many branch establishments which continually and heavily drag on the parent house, together with dissatisfied customers, form the chief difficulties directors have to encounter. How can greater receipts be obtained? Offer your goods at much lower figures, and an immense increase of custom will fill your empty coffers, say some quidnuncs. But it has been demonstrated by statistics and the inexorable logic of figures that this nostrum is utterly valueless. Many of our lines are encumbered with their traffic, and the anticipated increase necessary to make a lower tariff even equally remunerative with what now obtains could it be realised would be extremely difficult to deal with. It is not possible that a train can always be equally filled with passengers, for many circumstances combine to carry crowds in certain directions at certain hours and seasons when no impelling cause supplies anything like a similar number for the return journey. Traffic managers know very well the statistics of the travelling public, and do their best to provide for all possible contingencies. It may be said that trains are run too frequently, and it may be so, but this does not strike at the root of the matter. Railway companies must be possessed of a rolling stock adequate to the demands of their heaviest traffic, nor would some less costly means of obtaining the necessary powers of construction, though most desirable, tend one whit to improve the position of companies already existing. The question is unalterable—on one side a certain amount of capital and certain working expenses, on the other a certain income. That this latter is lamentably deficient with many of our companies is painfully apparent from the reports of the directors. To improve matters it is recommended that the expenses of management, assumed to be extravagant, be reduced, but I contend that on the whole railway officials are not overpaid, and whatever cheese-paring might be effected in this direction could at most amount to a mere "drop in the bucket." Whatever improvements of a radical nature may be adopted must be made in the mechanical appliances for working the traffic of our iron roads and Mr. Fairlie's arrangements of the bogie truck system applied throughout to carriages, waggons, and locomotives point to the commencement of a new era for railway companies. With our present system Mr. Haughton has shown that a railway passenger weighs in reality two tons the moment he enters the carriage of a train, while Mr. Samuels confirms the estimate of Mr. Fairlie, who puts the figure a little higher, in fact, two and a quarter tons. The latter gentleman, however, does not stop here, but has demonstrated that it is possible to carry 66 persons in a steam carriage, at a weight of eighteen and a half tons, all told, and has exhibited a little train of this description at actual work. In a cabbage garden at Hitcham this steam carriage has been whisked along at good speed round very exceptional curves of 50ft. radius. Mr. Fairlie, now assisted by Mr. Samuel, has also designed another carriage with engine attached which will weigh along with its living freight of 90 passengers only 20 tons. In these cases in place of 132 or 148 tons, we have 18½, and for 180 or 202 only 20 tons. The temporary rails on which the first-mentioned of these trains has been run experimentally are by no means smoothly laid, but even on this rough road the motion of the carriage even when rounding exceptional curves is easier than that of an ordinary train on a well-laid road. Again, with regard to goods traffic Mr. Fairlie has built a locomotive capable of hauling 800 tons. While the weights of this engine are better distributed over the wheels, they are not in the aggregate heavier than those of heavy locomotives of the ordinary type, and nearly double work is performed One of this new construction, fitly named "Progress," has been at work for some months past on the Midland Railway with the most satisfactory results. At a public trial it dragged a train of from 60 to 70 coal waggons, weghing 700 tons, up a rising gradient of 1 in 108, and of more than a mile in length, at a speed of 15 miles an hour. Nor is this the most powerful Mr. Fairlie can construct, and yet it greatly exceeds in power the heaviest in ordinary use. Now here we have the proved success of a new description of rolling stock, capable of performing every species of service required on a railway at an immense reduction of weight. It may be objected that a steam carriage is not adapted to the service of a main line. But the principle is clearly susceptible of much modification and adaptation, and so far as the engine itself is concerned, we have the precedent of the goods locomotive on the Midland Railway, nor do the advantages end with the mere weight to be transported. The wear and tear of engines, carriages, and waggons, and of the permanent way itself, are chiefly owing to the severe concussions which result from every roughness and inequality in the road. Everyone is tolerably conversant with the uncomfortable shocks which frequently occur even in the course of a short journey by train, and most of us have observed how hard the flanges of the wheels of carriages bear on the rails when passing round a curve, when the connection also between carriage and carriage is formed by the coupling and one buffer only. The buffers on the outside of the curved train are some little distance apart, and the ordinary amount of unsteadiness is very much increased when passing over any roughness. This is certainly a matter which could be remedied by a reciprocating arrangement between the buffers at each end of each carriage. These things all of us know very well, but only the locomotive superintendent and the custodian of the permanent way are fully cognisant how destructive these shocks and concussions prove to engines, carriages, and waggons, as well as to the road itself. The oscillation, with which too we are very familiar, and which banishes sleep from many on a night journey, is also owing to our present system. This, too, Mr. Fairlie removes, and with such success that the motion of his locomotives is compared to the ease of a bird's flight by Captain Tyler, the government inspector, who travelled on it at the rate of 50 miles an hour, thus bearing witness to the comfort in store for us. It is easily understood that by hanging our engines and carriages on two or more points in the centre line lengthwise, and establishing a connection by a swivelling joint at each of these points, with a bogie of a very small wheel base, we obtain trains capable of moving round very sharp curves. Experiment has established how safe and steady is the motion, which will at once appear infinitely better adapted for the inequalities of even the best roads than the long rigid wheel base we employ at present. The absence from shocks in the ordinary course of traffic resulting from this arrangement might admit of buffers being dispensed with throughout an entire train, with the exception of the end carriage or brake van and the engine. For this object Mr. Fairlie recommends that the end beams of carriages be formed as arcs of circles struck from the centre of each carriage, to which point he would attach the draw bar; when a train is made up, each carriage would be coupled up closely to its neighbour, and thus under all conditions one point only, but always one point, of each carriage would be in close contact with its fellow, and the whole train would preserve more or less a constant and flexible continuity. So far as goods trains are concerned, dead weight of freight must of course remain a constant, but even here there would be a gain as compared with our present system in the relative lightness of the new style of locomotive and waggons.

That great desideratum, then, smoothness of motion, and consequently the longer life of rails and rolling stock, combined with much greater economy of working, are certain results which will follow the adoption of Mr. Fairlie's arrangements. The development of the bogie truck system points clearly in the direction of a more remunerative return on the immense capital invested in railways, and even at the possibility of lower fares. The dividends of the last year are on an average nearly the same as those of the preceding, and the number of companies whose unfortunate ordinary shareholders receive nothing at all bears a painfully large proportion to those paying from 5 per cent. upwards. It is of the utmost importance that some better method of working our railway traffic be adopted, and any scheme devised for this end is worthy of all encouragement, and Mr. Fairlie has proved by actual practical demonstration that his system of arrangement is perfectly safe, and that it contains the elements of a wide success. This year has been rendered famous in engineering annals by the completion of three great works, two of which are of international or rather universal interest. The great continent of North America is crossed from ocean to ocean by the Pacific Railway, an undertaking of the first magnitude. A third link, in the shape of the Anglo-French Telegraph Cable, forms with its two elder brothers a triple bond between the old world and the new, symbolical, we all trust, of a clearer recognition of how closely our interests and those of our transatlantic cousins are united. It will indeed be an evil day should our good relations be disturbed, equally disastrous on one side as on the other. The Suez Canal forms the last, not in magnitude but in point of time, and it is confidently anticipated that this great water highway will be magnificently inaugurated, and Africa reduced from its ancient dignity of a continent by being formally declared an island. Invitations for the grand ceremonial have been issued with no sparing hand, and I have the pleasure of informing you that our society has not been overlooked. But the gathering to witness the successful results of M. de Lesseps' many years of labour, put at the disposal of all who may choose to make use of his canal, will be, indeed, a wonderful spectacle. All civilised nations will send their contingents to applaud the great enterprise of the Frenchman, who has made the desert to blossom, and has added another to the number of the great works of a world fame which have so eloquent a blazon in the aphorism "Peace hath her victories as well as war." To the effects of every one to these bloodless conquests may well be applied the motto once appended to the admission cards of an art exhibition, for these victories are triumphs of art of the highest order, with its attendant handmaids, Labour, Patience, and Skill. Of each of these gigantic undertakings it may well be proclaimed "Dissociata locis, concordi pace ligavit."

THE LEEDS ASSOCIATION OF FOREMEN ENGINEERS.

THE fourth anniversary festival of this institution took place on Saturday, the 27th ult., at the Great Northern Railway Station Hotel, Leeds. Mr. John Manning (Messrs. Manning, Wardle, and Co.) presided, and was supported by Mr. Wigram, Mr. Greig, Mr. Walker, and several more of the employers of engineering labour in the town of Leeds. The assembly room of the hotel was filled with members and friends of the society, and Messrs. J. Newton and R. B. Sanderson represented the London and Manchester associations. The Chairman, in proposing the toast of the evening—that of "Prosperity to the Leeds Association of Foremen Engineers"—made the following judicious remarks:—'Mr. Fowler and Mr. Hawkshaw, when successively elected presidents of the Institution of Civil Engineers, both acknowledged how greatly they were indebted for their professional success in life to the efficient staffs by whom they were surrounded. I have endeavoured to show you that the profession of an engineer is a very honourable and important one, and I am proud to think that Leeds stands high as a mechanical town. The cloth trade and the flax trade were for generations counted the staple manufactures, but I think I am not wrong in saying that the iron, engineering, and machine trades now rank first in importance. If this be so, how great the responsibility and opportunities of the positions we occupy as employers and foremen! We, as employers, have opportunities of meeting each other at our own institution; but this is the foremen's night; we have met to do honour to them, and we can well afford to admit the importance of their aid and to acknowledge our obligations to them in matters of detail. Let us not distrust these men and their objects; let us tell them to-night that we believe they meet for mutual improvement and instruction alone; that we regard their association as one means of technical education, of which there is so much need; and that we hope and believe that in the course of time the prejudice of which they complain will gradually die away. You, too, as foremen have your share of responsibility; for what is theory without practice, what a good design carelessly carried out, what machine will work well if its details be imperfect? Let us, then, by all means maintain the highest possible standard of excellence in our work. Let us trust in each other. Let the master believe that if he only have the sagacity to select the right foreman, he may and ought to trust him; and let the foreman feel that by studying his employer's interests he is likely to improve his own position—then shall we go strong-handed together, maintaining our own against all comers, and thus shall we support the credit of our town, the honour of our country, and help to uphold the fame of England as the first mechanical country in the world.

Mr. Harrison, chairman of the association, responded, and when, shortly afterwards, Mr. Gozney gave the toast of "Kindred Institutions," Mr. Newton, who acknowledged it on behalf of the London association, spoke to the following effect:—'It is not my intention to accept as applicable to myself alone the compliments which Mr. Gozney has so unstintingly bestowed. I am quite aware that they are intended for distribution amongst the members of the society which I have the honour to represent—the London Association of Foremen Engineers. It will be a real pleasure to me to convey to them the assurance of your continued and hearty friendship, as it is now my mission to assure you of theirs. We feel a deep interest in the welfare of this association, and of that which flourishes in Manchester, because we know that their members are animated by views and aims identical with our own, and that those views and aims are of the most laudable kind. You, like us, have sought, and are seeking, to elevate the class of foremen engineers especially, and to make them at once better men and more valuable and effective agents of their employers. So far as the London association is concerned, I can answer for the fact that its existence has proved of real advantage to every section of representatives of the engineering trade in the metropolis, and, perhaps, not least to the employers of engineering labour. It has been my own policy, as its chairman, and that of each succeeding committee with whom I have acted, to endeavour as far as in us lay to remove those unhappy prejudices which have existed in time past, and which, to some extent, exist at present between the classes to which I have referred. We have sought to demonstrate the fact that we as foremen desire to have the friendship of employers, both in the workshop and out of it, and to co-operate with them everywhere and at all times for the promotion of the moral and material interests of the combined body. That this policy has been appreciated by employers is evidenced by the circumstance that more than forty of the most eminent of them are honorary members of the London association, and that on all occasions similar to the present they delight in honouring with their presence our festive board. My own impression is that if all employers could be brought to see clearly the exact nature of our associations, they would foster and encourage them in every possible way, and one and all unite themselves to them. We do not, never have, and never shall attempt to make our institutions in any way the medium for interference with what are the just rights and privileges of employers. To do so would be simply attempting to accomplish what in the first place would be an injustice, and in the next a suicidal act. I can well understand employers unacquainted with the internal mechanism of such societies as our own may imagine that it is possible for communications to take place at their meetings of a character inimical to employers' interests. The only way which I can propose for the removal of these not unnatural doubts is that employers should join the association. But I can assure them that after being a member of the London Association of Foremen Engineers for fourteen years, and having occupied the post of chairman of it for ten years, I have never known an instance in which an employer's confidence has been there betrayed or a revelation made to his detriment. In conclusion, permit me again to thank you for your hospitality, and for the enthusiastic manner in which you have received the toast for which I have so inadequately responded. Mr. Newton was followed by Mr. Sunderson, who responded for the Manchester association, and the Rev. J. P. Ward, who represented the Leeds Mechanics' Institution. Other toasts of a complimentary nature succeeded, and when Mr. Manning retired, Mr. Newton was unanimously voted into the chair for the remainder of the evening. The National Anthem terminated the proceedings.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, December 2.)

SINCE our report of the 22nd ult., the business transacted has been sufficiently encouraging to sustain prices and keep producers well engaged. The demand for present consumption is perhaps a little easier, consumers, as usual at this time of the year, regulating their orders to provide for small stocks at Christmas. The chief feature of importance is the probable weakening in the prices of nitrate soda. Our advices from Valparaiso state that the shipments of this year, up to September, are 88,000 tons, being already a considerable increase on the total shipments of either 1867 or 1868. In minerals of most descriptions, but more especially in the staple home productions, there has been a fair business done. The advance in iron has produced considerable firmness in the prices of the oolitic and other ores of the Midland district. There has been little change in the value of metals during the week, and the sales have been inconsiderable, with the exception of Scotch and Cleveland pig iron, in both of which a satisfactory business has been done at advanced prices, the market closing very steady. Copper is not in great requirement, but smelters are firm at present rates. Tin and spelter remain quiet. Lead in good inquiry at full rates. Soda: most of the largest consumers have completed their contracts for twelve months supply. Prices of soda ash, caustic soda, soda crystals, and salt cake remain stationary. Bi-carbonate easier at £9 5s. Nitrate of soda: meets with an ordinary sale at 15s. 6d. to 16s. Potash: muriate is not sufficiently plentiful to keep pace with the consumption, and prices rule from £7 7s. to £7 10s. Saltpetre: a shade lower for foreign, 22s. 3d.; refined firm at 27s. Alum: finds a steady demand at £6 5s. for loose lump; £7 for export barrels; and £7 for ground. Ammonia: sulphate firm at late high prices; muriate, being difficult to obtain, commands a proportionately higher value. Copperas: at old prices, 50s. to 52s. Lime: phosphate remains at 52s. 6d. for 65. Bleaching powder at £8. Manganese: steady at 95s. for 70. Iron ores: hematite, 15s. to 18s.; oolitic in great favour at 6s. to 8s. Staffordshire. Guano: is offered at £13 7s. 6d. to £13 10s. 6d.

METALS.—Iron: Scotch pigs firm at from 56s. 2d. to 56s. 3d. Cleveland, 46s. for forge, and 50s. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire bars, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: firmer. English tough, £71 to £73; Chili slab, £67 to £68. Tin: English is officially reduced. English ingots, £120; Straits, £114 to £115. Lead: steady. P.G. best English soft pig lead, £19. Spelter: in moderate demand. English, £20 10s.; Silesian, special brands, £19 10s. to £19 15s.; hard spelter, for export, £16 10s.

Legal Intelligence.

ROLLS' COURT.

NOVEMBER 25.

CANNINGTON v. NUTTALL.

THIS case was to determine the validity of a patent granted to a M. Pocheron for an invention for improvements in the manufacture of glass, consisting mainly in the substitution for the fire-clay pots usually employed to hold the molten materials of tanks or basins, the sides of which are hollow, so that a current of cooling air may be admitted to circulate and prevent the sides from being unduly heated. This patent was dated May 6, 1866, and was assigned to the plaintiffs, who are glass manufacturers at Liverpool. They allege that the defendant, who is a glass manufacturer at St. Helen's, has erected a tank or furnace, which is an infringement of the patent.

Certain issues have been tried before a jury in the Rolls' Court, and to-day the jury found a verdict for the plaintiff in respect of the originality, novelty, and utility of the invention, and of its infringement by the defendant.

Mr. Fooks, Q.C., Mr. Jessel, Q.C., Mr. Webster, Q.C., Mr. Grove, Q.C., Mr. M'Naghten, Mr. Aston, and Mr. Carpmael appeared.

Correspondence.

COMMITTEE OF THE BRITISH ASSOCIATION ON THE TREATMENT AND UTILISATION OF SEWAGE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I beg to enclose herewith a copy of a circular letter which the above committee are about to issue to all the towns in Great Britain and Ireland, and to request that you will kindly insert the same in your columns.—I am, Sir, yours, &c.,

GEORGE F. BARNES,
Honorary Secretary *pro tem.*

22, Whitehall-place, November 27.

"SIR,—I have the honour to inform you that last year at the meeting of the British Association at Norwich, a committee was appointed to report on the treatment and utilisation of sewage. In the first instance, a grant of £10 was placed at the disposal of the committee, with which to defray the cost of printing and postage incidental to the collection of preliminary statistical information. Through the kindness of her Majesty's Government the committee was enabled to obtain reports respecting the methods of dealing with town refuse practised in most civilised countries, and that information has now been collected in a more complete form than hitherto existed in any country.

"This preliminary work being completed, the committee was reappointed at the meeting of the British Association this year at Exeter, and the inquiry was considered to present such important features of social and scientific interest that the sum of £50 was voted towards enabling the committee to enter more fully and practically upon the investigation of this subject. The British Association being a purely scientific body has not at its disposal funds which would be adequate or applicable for the full prosecution of this very large and pressingly important inquiry. The committee nevertheless desires to take advantage of the opportunity created by the British Association to investigate the entire subject in all its bearings—whether chemical, physiological, or engineering, sanitary, municipal, or agricultural—and in a manner worthy of the body they represent.

"It is unnecessary to point out the enormous importance, especially at the present time, of a full and complete investigation of this question by the light of the knowledge and experience now gained in the several departments above alluded to; but properly to carry out such an inquiry with a practical end numerous observations, gaugings, and experiments, aided by simultaneous analyses, are essential; and these cannot be accomplished, especially the analyses, without the continued aid of efficient, and, therefore, highly-paid assistants. Moreover, from time to time it may be necessary for the committee to purchase expensive apparatus, and to subject various inventions and processes to a thorough and complete test; for it is the desire of the committee not only to ascertain, as far as possible, the causes of the sanitary inefficiency of existing works, but also to inquire into every suggestion which affords promise of practical utility, in order that this investigation may be searching, the report practical, and any recommendations that may be made authoritative.

"It is the wish of the several members of the committee to devote, to the utmost of their ability, their personal attention to the work thus sketched out; but the expenses absolutely necessary to enable them to conduct so extended an inquiry cannot but be very heavy, and, unless they are able to secure an adequate fund, they must aban-

don the attempt to investigate the subject in this broad and comprehensive manner. However, since there is no subject of greater practical and social importance to the public generally, and thus to the various municipal authorities and other governing bodies throughout the country, it is believed that many will share the opinion expressed at the recent meeting of the British Association at Exeter, that the existence of this committee affords a specially favourable opportunity for such a wide inquiry, and for that reason its members confidently appeal to those authorities who are officially interested in the subject to supply the funds necessary for the investigation.

"I am, therefore, desired to request that you will kindly submit this letter to the body you represent, and I venture to hope you will give the committee the benefit of your good offices in procuring a subscription proportionate to the population of your town or district.

"It is suggested that the subscriptions of towns of different populations might be graduated somewhat in the following proportions:—

	£	s.	d.
Where the population does not exceed 10,000	5	5	0
Between 10,000 and 25,000	10	10	0
Between 25,000 and 50,000	21	0	0
Between 50,000 and 75,000	30	0	0
Between 75,000 and 100,000	50	0	0
Above 100,000	100	0	0

"I beg to call your attention to the accompanying list of members of the committee, and to inform you that all public bodies subscribing not less than £5 5s. will have the benefit of the information from time to time, as the results of the inquiry partake of a conclusive character, and will receive a copy of the report of the committee when published.

"I have the honour to be, Sir,
"Your obedient servant,
"GEORGE F. BARNES,
"Honorary Secretary *pro tem.*"

The following are the names of the committee:—Messrs. Richard B. Grantham, M. Inst. C.E., F.G.S., chairman; J. Bailey Denton, M. Inst. C.E., F.G.S.; J. Thornhill Harrison, M. Inst. C.E.; Benjamin H. Paul, Ph. D., F.C.S.; Professor Wanklyn, F.C.S.; Mr. William Hope, V.C.; Professor Williamson, Ph. D., F.R.S.; Professor Marshall, F.R.S., F.R.C.S.; Professor Corfield, M.A., M.D.; Mr. M. C. Cooke, and Sir John Lubbock, Bart., F.R.S., treasurer.

Subscriptions should be paid to the credit of Sir John Lubbock, on behalf of the committee, at Messrs. Robarts, Lubbock, and Co., 15, Lombard-street, London, E.C.

THE CANADIAN PATENT LAW.

Mr. A. V. Newton presents his compliments to the Editor of the MECHANICS' MAGAZINE, and will feel obliged if he will give publicity to the following correspondence, which may be of interest to many of the readers of the magazine.

To the Right Hon. Earl Granville.
Secretary of State for the Colonies.

MY LORD,—I venture, before the new patent law of Canada is confirmed by the Crown, to recall your attention to one of its provisions, which can, I think, scarcely meet the approval of her Majesty's Government. You will remember that during last session this question was asked in the House of Commons, viz., "whether the Colonial Office was prepared to recommend the Government to advise her Majesty to withhold or postpone her assent to the Bill, with a view to give an opportunity to the Canadian Legislature to reconsider its provisions." The reply of Mr. Monsell was variously and evidently very imperfectly rendered by the daily papers, but those points which a concurrence of testimony supported may, I presume, be taken as correctly printed. He is reported by the "Times" to have said that "the subject of patents was essentially one with which the dominion of Canada might deal, and this was evidenced by the terms of the 18th sec. of the Imperial Act 15 and 16 Victoria, cap. 83," and then the clause was quoted. The inference drawn from this quotation was, according to the "Morning Post," that "we really had no more to do with the passing of the patent laws in Canada than we had to do with those of France." The concurrent testimony on this point is thus given by the "Morning Advertiser":—"As to refusing the Royal assent, they were precluded by the terms of a former Act of Parliament from having recourse to such a proceeding." I may here state that the Act of the Imperial Legislature will bear no such construction, for the clause is simply a saving clause, to the effect that if British patents are granted with an extension of the same to the colonies (a practice which formerly obtained) that then, if a local Act comes into collision therewith, the home grant shall have no effect as opposed to the colonial law. By order of the Colonial Office no extension to the colonies has ever been made under the Act of 1852, and, therefore, the clause cited is virtually a dead letter. Referring now to the Act of the dominion of Canada (1869), it will be found, when read by the side of the Acts which it has repeated, to have deprived certain of her Majesty's subjects of rights which they heretofore enjoyed, and on this ground, if upon no other, I submit that it should be disallowed by the Crown. Before the passing of this Act any subject of Great Britain residing in Canada might obtain a patent for his invention. Now, however, a prohibition is created by altering the provision to "a resident of Canada for at least one year next before his application." To say nothing of the policy which a "residence" in Canada points to, I think a great principle is here set at nought, viz., that subjects of the Crown may claim equal rights throughout the empire. I could point to the unjust and oppressive action of this new law, but I refrain, trusting that your Lordship will appreciate the importance of the principle I have enunciated, and will not suffer the maimed rights hitherto possessed by British inventors under the Canadian patent laws to be destroyed.

I am, my Lord,
Your Lordship's obedient servant,
A. V. NEWTON.

November 9.

Downing-street, November 29, 1869.

SIR,—I am directed by Earl Granville to acknowledge the receipt of your letter of the 9th inst., remonstrating against the provisions of the recent Patent Act passed by the Canadian Legislature.

Lord Granville desires me to inform you that your representation will be considered before any advice is tendered to her Majesty on the subject of this Act.

I am, Sir,
Your obedient servant,
FREDERICK ROGERS.

A. V.Newton, Esq.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

MR. JOHN GRAY (Toronto).—We have forwarded your letter as requested, and the firm have acknowledged its receipt.

RECEIVED.—G. W. H.—W. F.—H. J.—R. B.—N. and Co.—L. and P.—H. E. H.—T. C.—E. F. B.—J. G.—H. F. W.—E. M.—J. J.—B. R. and F. T.—J. R.—T. C.—R. W.—S. M.—W. L. W.—D. S. N.—R. S.—T. B. E.—H. W. F.—T. W. and Co.—G. H.—C. D.—S. E.—H. H. L.—G. B.—J. P.—B. F. B. G.—S. S.—J. W.—E. N.—J. F.—J. M.—W. B.—J. and F. H.—E. K.

Meetings for the Week.

MON.—Royal Institution.—General Monthly Meeting, at 2 p.m.

TUES.—Institution of Civil Engineers.—Discussion on "The Public Works in the Province of Canterbury, New Zealand," by Mr. Edward Dobson, A.I.C.E.; a paper on "Ocean Steam Navigation, with a view to its further development," by Mr. John Grantham, M. Inst. C.E at 8 p.m.

Naval, Military, and Gunnery Items.

THE standard for recruits for the Royal Marines has been raised half an inch.

THE Secretary of State for War has invited tenders for the purchase of 8,000 Whitworth rifles, now lying at the Tower. The arms are identical with those used in the Second Stage of the Queen's Prize at Wimbledon, and are described as "new and slightly used."

MESSRS. A. and J. INGLIS have launched a screw of 1,500 tons, built for the Shanghai Steam Navigation Company. The vessel, which has been named the "Shan Tung," will be fitted with a pair of direct-acting surface-condensing engines of 160-horse power nominal.

THE Thames Conservators have given notice of their intention of applying to Parliament next session for powers to widen, deepen, and improve the River Thames and its tributaries, to remove bridges, regulate the discharge of sewage, and to levy taxes to carry out these works.

WE understand that it is in contemplation to cut down the staff leave of the army. The fact that staff clerks get 61 days' furlough in the year has attracted attention, and it is under serious consideration to diminish this, and the leave of the department officers as well generally.

SOME experiments which are considered to have been very successful have been made in the Medway, at Gillingham Reach, near Chatham, with a newly-invented torpedo, under the superintendence of the chief officers of the School of Military Engineering at Brompton.

IT is stated that Messrs. Shaw and Thomson, of Leadenhall-street, iron merchants, have undertaken to act as advisers and agents of the Admiralty in the disposal of the large stock of surplus iron stores at the dockyards, in which are embraced the quantities that have obtained notoriety as "Seely's pigs."

THE Viceroy of Egypt has given an order to the Societe des Forges et Chantiers de la Mediterranee for a large floating iron dock. The total length of the dock will be 470ft. 10in., and its internal breadth will be 80ft. The breadth of the sides will be 10ft., so that the total external width of the dock will be 100ft. The height will be 36ft. 8in., and the weight 4,600 tons.

TWO very handsome and capacious steam lifeboat pinnaces, Nos. 18 and 19, built for her Majesty's navy, by Mr. John Samuel White, of East Cowes, Isle of Wight, were recently tried at Portsmouth, under the supervision of the Steam Reserve and factory establishment, with very satisfactory results, both boats attaining a mean speed of upwards of eight knots per hour.

WE, "United Service Gazette," are in a position to state positively that no attempt will be made to disband the military train upon the formation of the new transport corps. The military train will co-exist with the new corps until all the officers and men are provided for. The mess-traps, &c., of the officers will all be duly taken up by the War Office at their estimated value before the final abolition takes place.

THE "King George," Greek ironclad turret ship, which left Plymouth on Tuesday week for the Piræus of Athens, in charge of Commander Pym, R.N., has been compelled to put back to Plymouth Sound, in consequence of her rolling so heavily, even in fair weather, as to be considered unsafe to proceed on the voyage. She is evidently over top-weighted—a defect which will have to be counteracted before going to sea again.

THE "Eddystone," screw, built and engined by Messrs. Blackwood and Gordon, of Port Glasgow, for the Clyde Shipping Company's Glasgow, Cork, and Waterford route, has made a favourable trial trip. The "Eddystone" is a vessel of 700 tons burden; her length is 190ft., her breadth 27ft., and her depth of hold 14ft. 6in. The engines, which are of 100-horse power, are on the compound principle; the high-pressure cylinder is 2ft. 6in. in diameter, and the low-pressure 46in. in diameter.

COLONEL BOXER, R.A., has resigned his appointment of superintendent of the Royal Laboratory, and his resignation has been accepted. Colonel Boxer's successful exertions in connection with the improvement of our war *materiel* are known mainly through the fuses, shrapnel, shell, life-saving rockets, and breech-loading cartridges with which his name is associated; but these are only the more conspicuous examples of an inventive faculty which for fifteen years has been in constant operation for the public benefit.

WITHIN the brief compass of a week, the oldest of famous American sailors and the oldest of famous American soldiers passed away. Rear-Admiral Stewart in his 92nd year, Major-General Wool in his 86th, lay in state together on the 10th ult. The press and public men of the country pronounced upon them simultaneous eulogies. Over their bodies their younger comrades and their countrymen bent at the same moment, while the flag under which they had fought for half a century together, on land and sea, and to which they had given by their skill and valour so lustrous a prestige, ran down to half mast in a common token of national sorrow for a double calamity.

Miscellanea.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending November 27, was 1,103. Total number since the opening of the Museum, free daily (May 12, 1858), 1,683,171.

THE imports of rough iron into the Zollverein in the first half of this year amounted to 74,121 tons, or 22,084 tons, or 42 per cent. more than in the corresponding period of 1868.

THE Liverpool magistrates have decided that a bicycle is a carriage within the meaning of the Act, and have fined a youth for driving one upon a footpath.

VELOCIPEDES are gaining ground in Sydney. They are not so commonly met with as at Melbourne, but races are got up at the Albert Cricket-ground.

AT some granite quarries in the neighbourhood of Camborne, Cornwall, on Saturday, a 9ft. deep hole, charged with 56lb. of powder, was fired, the explosion removing from 700 to 800 tons of granite.

THE death of Mr. John Hodgson Hinde, M.P. for Newcastle from 1830 to 1847, is announced at the age of 64. The deceased was an eminent archæologist and antiquarian, and the author of several standard works.

AT the ordinary meeting of the Manchester Literary and Philosophical Society, held November 16, 1869, Mr. J. P. Joule, LL.D., F.R.S., &c., President, in the chair, Professor Osborne Reynolds, B.A., of Owen's College, was elected an ordinary member of the society.

AT the latter end of last week Italy was visited by very heavy snow-storms. The railway communication across Mount Cenis was completely stopped, and even as late as Friday the snow on the mountain was four feet deep. The obstruction, however, has been removed, and traffic is now carried on as usual.

THE Prussian iron trade displays considerable firmness; some contracts for rails and other materials have recently been let; thus the Nassau and Wiesbaden and the Hanoverian Railway Companies have ordered between them 1,656 tons of cast steel rails, besides a considerable quantity of ordinary iron rails and iron sleepers.

CONTINUED activity still characterises the French iron trade, at any rate, so far as the departments of the Haute-Marne, the east, the north, and the Ardennes are concerned. In the Haute-Marne the water supply has been completely re-established, and rolling mills, forges, wire works, &c., are all well employed.

THE "Moscow Gazette" says that, according to official returns, there have been more fires in the Russian empire this year than were ever known to have occurred before. The total number, so far as is known, exceeds 15,000. The value of the property consumed can only be roughly estimated for about four-fifths of them, but this gives it as exceeding 25 millions of roubles.

THE new session has just commenced at the Ecole des Beaux Arts, Paris, and the following is the list of students in the various sections:—School of painting, seventy pupils, and ten supplementary, or candidates for admission; sculpture and medal engraving, twenty-seven pupils and ten supplementary; architecture, thirty-nine pupils. Total, 156 titulary and supplementary students.

THE Agricultural Society of New South Wales is progressing. Negotiations are being made between the Corporation of Sydney and the society with reference to the erection of a large building in the Alfred Park, to cost £14,000, and in view of the guarantee that will be required for its occupation for a term of years the society is now going into incorporation.

THE number of visitors to the South Kensington Museum during the week ending November 27, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 6,851; Meyrick and other galleries, 849; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,714; Meyrick and other galleries, 73; total 9,487. Average of corresponding week in former years, 8,800. Total from opening of Museum, 8,968,858.

A MELBOURNE paper says that the satisfactory intelligence received by the last few mails, respecting the disappearance of the prejudice once existing against Australian preserved meat as an article of food, has not only led to the formation of several new companies, but has encouraged manufacturers at present in the field to extend their operations. A company re-commenced operations in June last, since when they have shipped 300 tons of meat in tins, and the whole has met with a ready sale.

ADVICES from Buenos Ayres mention that the samples forwarded for competition for the premium of £800 offered by the Argentine Government for the best method of preserving meat in a fresh condition were opened on the 1st of October in presence of the jury. "The smell," it is stated, "was in most cases very offensive, but of the 35 samples there were half a dozen good, and one in particular sent from Glasgow is likely to take the prize." The jury, however, had not yet decided.

THE extent of the railways in operation in France at the close of September, 1869, was 10,302 miles, as compared with 9,929 miles at the close of September, 1868. It follows that the length of new railway brought into operation in France in the 12 months ending September 30 this year was 373 miles. The work of railway construction is probably now proceeding faster in France than in Great Britain, France being still by no means over-supplied with railway communication.

"NATURE" announces that the three annual medals of the Royal Society have been awarded thus:—The Copley medal goes to M. Regnault, one of the first among the many living French physicists and chemists; one of the Royal medals has been conferred on Dr. Matthiessen, distinguished for his chemical and physical researches; while Sir Thomas Macleat, the Cape astronomer, with whose valuable contributions to science all are doubtless familiar, carries off the other. The medals were presented on the 30th ult., at the annual meeting of the society.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1413, 1435, 1456

BUILDINGS AND BUILDING MATERIALS—1404, 1432, 1445, 1455, 1466

CHEMISTRY AND PHOTOGRAPHY—None

CULTIVATION OF THE SOIL, including agricultural implements and machines—1406, 1417, 1422

ELECTRICAL APPARATUS—1441, 1467

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1367, 1410, 1421, 1437, 1462, 1470, 1478

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1414, 1419, 1449, 1450, 1457, 1468

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1407, 1408, 1416, 1423, 1428, 1453, 1474, 1480

GENERAL MACHINERY—1405, 1459, 1465, 1475

LIGHTING, HEATING, AND VENTILATING—None

METALS, including apparatus for their manufacture—1409, 1418, 1426, 1431, 1433, 1434, 1443, 1446, 1452, 1458

MISCELLANEOUS—1401, 1402, 1403, 1420, 1424, 1425, 1429, 1440, 1442, 1457, 1461, 1469, 1471, 1472, 1473, 1476, 1477

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1411, 1415, 1438, 1439, 1447, 1454, 1463

SHIPS AND BOATS, including their fittings—1460, 1464

STEAM ENGINES—1423, 1444

WARFARE—1427, 1430, 1436, 1448, 1479

1367 J. BULLOUGH, Accrington. *Warping machines.* Dated May 4, 1869.

The inventor employs a novel construction of drop pin, in the body of which an enlarged pear-shaped eye with a stem above and a stem below is formed. The lower stem of the improved pin is of the same strength as that now in general use, but the upper stem is considerably lighter and is also bent or cranked near its extremity. The pin from the foot of the upper stem has an open or pear-shaped eye formed in it, which is provided with a side opening or slot, through which the continuous thread is passed into the eye.—Patent completed.

1401 E. SEYD, Princes-street. *Fluid meters.* (A communication.) Dated May 7, 1869.

This consists of a rotary fluid meter with a stationary outer casing and a movable inner casing in combination with one or more pistons, rolling upon the casings or their equivalents with the necessary ports, channels, and appendages.—Patent completed.

1402 R. FENNELLY, Wellington Chambers, E.C. *Washing out casks.* (A communication.) Dated May 7, 1869.

This consists in so constructing the apparatus that the casks to be washed may be carried upon a horizontal revolving table in such manner that they may be caused not only to revolve upon an axis standing up from the table, but also that the cask may at the same time be caused to revolve on its own longitudinal axis. By this means, when the table carrying the casks is caused to revolve, the water previously placed in the casks is thrown away from the central axis of the table, whilst the cask, being at the same time caused to revolve simultaneously on two axes, which are at right angles to one another, every point of the interior of the cask must necessarily be subjected to the action of the water.—Patent completed.

1403 D. and A. POSENER, Mansell-street, Goodmans Fields. *Tobacco pipes.* Dated May 7, 1869.

The inventors place at the bottom of the bowl a plug of peculiar construction, so that the oil or moisture from the burning tobacco may be absorbed or taken up by the porous part of the plug, and thus be prevented from entering the pipe, stem, or tube.—Patent completed.

1404 G. N. MANSFIELD, Great Portland-street. *Parquet flooring.* Dated May 7, 1869.

The inventor uses veneers of hard or ornamented woods (by preference from one-eighth to one-sixth of an inch in thickness) for the wearing surface of the covering, as has heretofore been proposed. These he backs with strips or sheets of the substance known in the market as kamptulicon, rolled to a thickness (say) of about one twelfth of an inch. The veneer he attaches to its backing by means of a solution of glue.—Patent completed.

1405 J. RAMSBOTTOM, Leeds, and T. M. PEARCE, Bradford. *Steam and hydraulic apparatus.* Dated May 7, 1869.

On the cylinder end of a steam or water pressure pumping engine and forming a part of its end cover, the inventors cast a small valve cylinder at right angles to the cylinder proper, and in this valve cylinder they place a piston valve intended to be moved longitudinally in either direction by the steam or water with which the engine is worked.—Patent completed.

1406 A. J. MURRAY, Albany-road, Camberwell. *Reaping and mowing machines.* Dated May 7, 1869.

The inventor takes a tube of the required length and of any convenient diameter, and divides the same longitudinally through its centre or through any desirable part thereof, so as to form an upper and lower part. The lower part is to be fixed to the frame of the machine, and the upper part is to be made movable upon centres or hinges at the back of the tube, or jointed in any other suitable manner. The fingers are divided into two parts; the upper part is to be riveted or otherwise fastened to the upper part of the tubular bar, and the lower part of the fingers is to be riveted or otherwise fastened to the lower part of the finger bar.—Patent completed.

1407 F. LEONARDT and H. HEWITT, Birmingham. *Pens.* Dated May 7, 1869.

This consists in making in the points or nibs of pens a series of transverse corrugations or depressions, or curved or angular corrugations or depressions, for the purpose of forming a reservoir for the ink, and to give the pen an easy action in use. The corrugated nibs or points may either be perforated or unperforated.—Patent completed.

1408 J. G. TONGUE, Southampton-buildings. *Manufacture of envelopes.* (A communication.) Dated May 7, 1869.

A series of swinging shears are so applied as to cut out the envelope blanks one at a time by a series of shearing cuts from one thickness, sheet, or long strip of paper, so that there is little or no waste except at the necessary gores removed at the angles of the envelope to allow the flaps to lap in. Folding shears arranged in this manner cut out one blank envelope at a time, and the cutting edges remain in working order for a considerable time. When dull they can very readily be ground.—Patent completed.

1409 Sir F. C. KNOWLES, Lovell-hill, Berks. *Purifying cast iron.* Dated May 8, 1869.

The main feature is the retention of chemical substances below a bath of molten metal in order to purify and convert the latter. Shotted metal is principally used. Caustic soda mixed with pulverised ore is employed to form a base to take up the acid. The gas to be employed is produced from chalk or limestone mixed with charcoal. A very great heat is caused from this gas, which is passed through the body of the metal. The furnaces are made in a peculiar manner to suit the above processes.—Patent completed.

1410 W. HENDERSON, Glasgow. *Finishing woven fabrics.* Dated May 8, 1869.

The two endless chains ordinarily employed in these machines for holding the selvages of the fabric by means of stenter pins or clips are as usual passed round pitch wheels at each end of the machine and along grooved guides. These guides are formed or fitted along the top and bottom edges of vertical side plates extending horizontally from end to end of the machine and made about as broad vertically as the diameter of the pitch wheels. The fabric is entered at one end of the machine, passes along the top to the other end, and returns along the bottom to within a short distance of the entering end, being thence led away in a downward direction; an enclosed space is thus formed having the fabric for its top and bottom, whilst vertical plates form its sides. Heated air, by means of a pipe, is blown into this space for the purpose of drying the fabric.—Patent completed.

1411 B. HUNT, Serle-street, W.C. *Horse collars.* (A communication.) Dated May 8, 1869.

This consists in dividing the collar into two parts, so arranged as to be extended or contracted at will, in length or breadth, according to the size or conformation of the neck and shoulders of the horse.—Patent abandoned.

1412 H. MYERS, Miles Platting, near Manchester. *Furnaces of locomotives.* Dated May 8, 1869.

This consists in making the doors of locomotives and other furnaces to slide in a vertical direction in place of opening on hinges, or being made in two halves and sliding in a horizontal direction.—Patent abandoned.

1413 E. MAYBURY, G. MATTHEWS, and E. MARSTON, Pendleton. *Puddling furnaces.* Dated May 8, 1869.

The hearth is surrounded or partially surrounded by a hollow metal box or chamber, through which water is caused to circulate in order to keep the box and the fettling in immediate contact therewith comparatively cool.—Patent abandoned.

1414 R. and G. CADBURY, Birmingham and J. M. BENDALL, Torquay. *Cacao biscuit.* Dated May 8, 1869.

The cacao bean is ground in the customary manner, and when ground, there is associated with it farinaceous matter, sugar, and butter. The whole is then mixed and prepared in the usual manner to form the biscuit.—Patent completed.

1415 E. S. COPEMAN, Norwich. *Communicating in trains.* Dated May 8, 1869.

In the roof of each of the compartments of the carriages to which it is desired to apply the apparatus, two

holes or apertures are made. The apparatus consists of a box, the base or bottom of which fits on or covers the before-mentioned holes or apertures, any suitable contrivances being employed for keeping it in a firm position. Each side of the box is constructed with vertical slots, through which the arms used for signalling are capable of passing. One of such arms is placed at each side of the box.—Patent completed.

1416 A. B. HAWES, India Office, Whitehall. *Bottles and flasks.* Dated May 8, 1869.
The cap or stopper has two or more grooves, more or less deviating from a horizontal line formed circumferentially near the neck. Each of the grooves is at its lowest point cut right through to the edge of the cap, forming a notch in the same. In each of the grooves fits a corresponding stud or projection fastened to or in one with the neck of the bottle, each stud and groove together forming a joint somewhat similar to a so-called bayonet joint.—Patent abandoned.

1417 W. N. NICHOLSON, Newark. *Haymaking machines.* Dated May 10, 1869.
This consists in the introduction of carrier pinions, in consequence of which the speed at which the forks revolve may be varied, a circumstance of great practical advantage in haymaking. When it is not required to vary the speed, the carrier pinion may be withdrawn.—Patent completed.

1418 H. R. LUMLEY, Marlborough-place, St. John's-wood. *Purifying molten iron.* Dated May 10, 1869.
Instead of forcing air through the mass of molten iron, the inventor allows it to fall from a sufficient height in the smallest particles, or in a thin shower through an upward rushing blast of heated air.—Patent abandoned.

1419 H. DUFRENE, Paris. *Desiccating and preserving food.* (A communicaton.) Dated May 10, 1869.
The inventor places the substances to be treated in a receiver kept in a hot water bath at a suitable temperature. He forms a vacuum in the receiver. The vapours disengaged from the substance to be desiccated are dissolved by an absorbing agent placed in the apparatus, or are liquefied in a condenser suitably placed. The desiccation is then effected.—Patent abandoned.

1420 E. FIELD, Chandos Chambers, Adelphi. *Steam fire engines.* Dated May 10, 1869.
This consists in actuating the valves which regulate the admission and emission of steam to and from the main steam cylinders of steam pumping engines by means of tongues or levers actuated by curved or inclined surfaces in or in connection with the main pistons.—Patent abandoned.

1421 C. LAUTH, Paris. *Dyeing and printing.* Dated May 10, 1869.
This consists of improved means whereby both animal and vegetable substances can be died or printed with aniline black. The inventor commences by fining thereupon bioxide of manganese, preferably by means of a permanganate dye, but any process that will thoroughly fix the superior oxides of manganese is applicable to this invention. The fibres thus covered with bioxide of manganese, and generally known as plain goods, are caused to undergo a process of washing for the purpose of separating those parts that do not combine with the fibre, and that would eventually fall away in the dyeing bath, and thus cause considerable loss in alkaloids. The inventor then proceeds with the dyeing process.—Patent completed.

1422 R. BLEZARD, Liverpool. *Dressing millstones.* Dated May 10, 1869.
This consists in giving to the radial arm or arms whereon the tool carrier or tool carriers are made to slide to and fro, either by itself or themselves or with the supporting frame, an intermittent motion over the surface of the millstone, around the centre thereof, or around an eccentric point or points thereon.—Patent completed.

1423 W. CURRIE, Edinburgh. *Cushions.* Dated May 10, 1869.
This consists in substituting for the materials or springs hitherto employed for the purpose hollow airtight pads or balls, which are laid together and enclosed in a covering of cloth, velvet, leather, or other suitable fabric or material.—Patent abandoned.

1424 M. S. WOLFGANG, Stratford-le-Bow. *Cricket balls.* Dated May 10, 1869.
The inventor employs as usual a core of compressed cork, which he binds by means of canvas, cotton, twine, or other suitable material, as heretofore. He then covers the core with indiarubber to obtain the required size and shape, and submits it to the action of heat, until the necessary degree of hardness is obtained, but as the application of heat to the materials composing the ball as before described would tend to injure the core and the binding material, he places between the binding and the core and between the binding and the indiarubber a coating of asbestos.—Patent completed.

1425 R. F. HOPPE, Cheapside. *Musical boxes, albums, &c.* (A communication.) Dated May 10, 1869.
This consists in so adapting musical boxes, albums, and other articles of a similar description, that, in addition to the ordinary mechanism for playing tunes, an arrangement is effected for the display of photographic portraits, views, and other pictures, which are made to revolve underneath the lid or cover of the musical box or album, and be seen through an opening in the same, and so continue to revolve as long as the music is playing.—Patent completed.

1426 W. E. NEWTON, Chancery-lane. *Hardening iron.* (A communication.) Dated May 10, 1869.
In the process of converting iron castings into steel, the inventor uses black oxide of manganese, peroxide of iron, and common resin, or their chemical equivalents, in about the following proportions, viz., 25 parts of manganese, 15 parts of peroxide of iron, and 60 parts (by weight) of common resin.—Patent completed.

1427 W. E. NEWTON, Chancery-lane. *Gun locks.* (A communication.) Dated May 10, 1869.
The inventor provides a movable nipple guard, which will prevent the hammer from falling upon the cap in case of accidentally becoming disengaged from its holder, by any means other than the regular action of the trigger in discharging it. This nipple guard will also by the action of the trigger be moved out of the way of the hammer when regularly discharged.—Patent completed.

1428 W. B. SMITH, Coventry. *Watches and chronometers.* Dated May 10, 1869.
The positions of the pillars which are at a proper distance from the edge of the plates are as follows:—One is on the escapement side of the barrel, having both the top plate and barrel bar screwed to it; one is between the escape wheel and fourth wheel; one is inside the detent spring just at the back of the detent; and one instead of two between the fusee and barrel behind the third minute division. This last pillar in the half-plate movement being higher than the others by the thickness of the top plate, and having the extended barrel bar only screwed to it.—Patent completed.

1429 J. WITHERS, Handsworth. *Water meters.* Dated May 10, 1869.
The inventor fixes to the outer ends of the measuring cylinders a cylindrical valve case, having two lateral openings communicating through the end of the measuring cylinder with the interior thereof. In each of these valve cases work two piston valves so disposed that when one of the openings, say the inlet, is open to the cylinder, the other outlet shall be closed or *vice versa*.—Patent completed.

1430 W. R. LAKE, Southampton-buildings. *Bronze ordnance.* (A communication.) Dated May 10, 1869.
The inventor hardens, condenses, and smooths the metal surrounding the bore, rendering the bore of uniform size, and lessening its inner depressions and porosity. He effects this condensation substantially in the following manner:—If a bronze gun is to be treated, the inventor bores the rough casting carefully to secure the best bore possible to a diameter about ½in. less than it is to be when finished. The rough gun casting is then to be enclosed in such hoops or flask as will constitute a strong casing, but as the exterior of the casting is rough and irregular, as is also the exterior of the casing, the inventor leaves between the gun casting and casing an annular space to be filled with cement or other suitable cheap material, which will make a hard unyielding filling. The encased gun is then to be placed in a frame or upon a bed somewhat like a boring mill for guns, but instead of using a bar provided with cutters, the inventor fixes in the end of the bar a smooth cylindrical plug of hardened steel about 5-100in. larger than the diameter of the reamed hole in the gun. The plug should be made of two frustrums of cones, with their bases connected by a short cylinder.—Patent completed.

1431 H. BESSEMER, Cannon-street. *Manufacture of iron.* Dated May 10, 1869.
This consists, first, in certain modified forms of the reverberatory furnace, and in each and every of such modifications the inventor employs an outer shell or casing constructed of plates of iron or steel, securely riveted together, or of cast iron secured by hoops, bolts, or ties of malleable iron or steel, the shell in either case being well caulked and rendered airtight at all laps and joints, and of sufficient strength to resist safely an internal pressure of one or more atmospheres in excess of the external atmospheric pressure.—Patent completed.

1432 H. BESSEMER, Cannon-street. *Furnaces.* Dated May 10, 1869.
This principally consists in fusing malleable or wrought iron or steel, and also pig or other carburets of iron in furnaces, where the gaseous products of combustion within the furnaces are retained under a pressure much greater than that of the external atmosphere, but which gaseous products are not in excess, but somewhat less than the pressure of the atmosphere, which immediately surrounds the exterior of the furnace or some parts thereof, the difference being only such as will cause a powerful draught or current of air to pass through the fuel in such furnaces.—Patent completed.

1433 H. BESSEMER, Cannon-street. *Converting crude into homogeneous iron.* Dated May 10, 1869.
The inventor makes the converting vessel of great strength, securely riveting and caulking all the laps and joints, so as to render it as nearly airtight as possible. He by preference forms the mouth of the vessel circular instead of oval, and of a smaller size than usual, lining the mouth with a single ring of well-burnt fireclay or composition of clay and plumbago, and he forms the metal part of the mouth of the converter with a movable dovetailed flanged ring, so that the fireclay mouth of the vessel may be readily taken out and renewed by unbolting or uncottering the iron ring which retains it in place.—Patent completed.

1434 H. BESSEMER, Cannon-street. *Treating pig iron.* Dated May 10, 1869.
This consists of a method or methods of carburising or further carburising molten pig iron after it leaves the blast furnace, and prior to its solidification, and also the further carburation of molten scrap or other wrought or malleable or puddled iron or steel that has been fused in high-pressure furnaces, as described in the specification of a patent granted to the same inventor dated November 10, 1868 (No. 3,419), or by other means, and which treatment may also be made to in part purify the iron of sulphur or other deleterious matters simultaneously with the carburising process.—Patent completed.

1435 H. BESSEMER, Cannon-street. *Blast furnaces.* Dated May 10, 1869.
The outer shell or case of the furnace is made of very strong plate iron or steel, which extends from below the bottom of the hearth up to the crown or top of the furnace, there uniting with the metal ring which forms the mouth of the furnace and thus encasing the whole of the firebrick or stonework which constitutes the furnace, suitable openings being left in the shell. The inventor prefers to make the shell in separate rings or sections united by stout flanges, by means of which the several portions are firmly united, the whole being, as far as needful, strengthened by hoops, angle ribs, or T-irons, securely riveted to the plating, the general structure being further supported on cast iron or riveted plate iron columns surrounding the lower part, all the joints of the sheet being well caulked, and capable of resisting an internal pressure of 20 or more pounds per square inch on the whole internal surface of the furnace.—Patent completed.

1436 J. HALL, Birmingham. *Firearms.* Dated May 11 1869.
This consists in making the plunger of metal with a conical or rising shoulder, on the under side of which a metal rod or pin is made to impinge by the action of the main spring of the lock (when are bounding lock is used), the plunger being made to act through a hollow nipple or other space formed for the purpose, and the breech butt being bored through so as to allow of the free passage and the up and down movement of the pin actuated by the main spring.—Patent completed.

1437 E. BRENNAN, Manchester. *Polishing threads.* Dated May 11, 1869.
This consists in employing improved rollers in connection with an improved arrangement for raising the top roller for stretching the material. The inventor forms each of the improved rollers with a number of ribs or corrugations, and places the rollers in front of the revolving brushes, the corrugations being for the purpose of allowing the bristles of the brushes to pass between the threads and open and spread them very effectually.—Patent abandoned.

1438 C. CROSS and A. HEYWOOD, jun., Manchester, and G. D. and T. B. WILSON, Cressbrook, Derbyshire. *Velocipedes.* Dated May 11, 1869.
This consists, first, in the application to the velocipede of toothed gearing for multiplying the revolutions of the driving wheel, and, second, in an improved arrangement of velocipede with three or more wheels.—Patent completed.

1439 T. DUNN, Pendleton, Manchester. *Velocipedes.* Dated May 11, 1869.
The inventor applies a ratchet wheel or other equivalent to the hind wheel of the velocipede. This ratchet wheel is worked by a catch jointed to a lever which is moved up and down by the foot of the operator. By this means the operator can get on the velocipede when it is stationary, and by working the catch lever he can then cause the velocipede to advance slowly for a certain distance, or until it has acquired the desired speed for working by the ordinary treadles.—Patent abandoned.

1440 W. R. LAKE, Southampton-buildings, Chancery-lane. *Detergent compound.* (A communication.) Dated May 11, 1869.
The gas, on being generated in the retorts, is mixed with a large quantity of impurities, chiefly ammoniacal gases, tarry vapours, sulphites, sulphides, phosphides, and others. In order to separate from the gas the ammoniacal and tarry vapours, it is passed first through a cylindrical vessel partially filled with water, and called the "receiver," and then it is passed through the "condenser." The water contained in the receiver and condenser absorbs the largest portion of the ammoniacal and some parts of the other vapours mixed with the gas, while the tarry vapours are condensed and precipitated in the form of tar.—Patent completed.

1441 C. D. ABEL, Southampton-buildings, Chancery-lane. *Galvanic batteries.* (A communication.) Dated May 11, 1869.
This consists in an improved construction of economic galvanic battery combining with a minimum of volume a maximum of intensity or of durability, and in which no evolution of nitrous or other gases takes place. The battery is, furthermore, of a more regular action than the best batteries now used, and is not subject to wear when the circuit is broken, thus effecting a saving of zinc.—Patent completed.

1442 B. LATHAM, Westminster Chambers. *Sewer ventilators.* Dated May 11, 1869.
This consists in so arranging spirally or otherwise arranged channels or passages inside the ventilating chamber containing charcoal or other deodorising material, that while any water that enters the ventilator can pass freely through such channels or passages down into the sewer without coming in contact with the deodorising material, yet any noxious gases passing up through such channels will be brought into contact with the deodorising material before issuing from the ventilator.—Patent completed.

1443 B. J. B. MILLS, Southampton-buildings. *Casting under pressure.* (A communication.) Dated May 11, 1869.
This consists in the use of a rotary wheel or cylinder, on the periphery of which are arranged a series of moulds, each formed of a pair of hinged metallic plates, which, while the casting is being performed, are held firmly together between stationary housings, suitable rollers being interposed between the rotary mould plate and the stationary housings to reduce the friction. Each of the mould plates is provided with one or more springs, which, as the rotation brings the moulds successively opposite recesses in the housings, cause the mould plates to separate with a sudden movement, causing a jar, which effectually detaches and discharges the casting.—Patent completed.

1444 J. A. MARDEN, Boston, U.S. *Steam engines.* Dated May 11, 1869.
This consists in the adoption of one or more shallow vanes or blades affixed to arms swivelled to a revolving disc mounted upon a tubular shaft supported in suitable bearings, and carrying a sliding spindle connected with the engine valve by an intermediate lever and weighted connected rod and engine valve, the whole being so arranged that friction upon the blades, induced by contact with the atmosphere, against which they are driven by the revolution of their supporting disc they shall govern and control in combination with the weighted lever the longitudinal movements of the spindle and of the weighted rod and engine valve.—Patent completed.

1445 J. B. PAYNE, Chard. *Roller blind fittings.* Dated May 11, 1869.
The fittings for roller blinds, which form the subject of the present invention, comprise a novel mode of coupling, joining, or connecting together the ends of the cord which passes round the pulley on the end of the blind roller, and also the pulley attached to the rack or tension slide below the object. As regards roller blind cords the chief object of the invention, as adapted to roller blinds, is to dispense with sewing or connecting the ends of the cord by means of thread, as is now the case.—Patent completed.

1446 L. WRAY, Ramsgate. *Quartz crushing.* Dated May 11, 1869.
The crushing instruments consist of a heavy metal block, which is mounted on a horizontal rocking shaft supported in adjustable bearings. This grinding and crushing block oscillates between two fixed jaws, the working or crushing surfaces or cheeks of which (as also those of the fixed jaws) are made, by preference, of steel or other very hard metal or substance, and are secured to the block and fixed jaws.—Patent completed.

1447 A. VICKERS, Old Broad-street. *Connecting railway rails.* (A communication.) Dated May 11, 1869.
This relates, first, to an improved mode of connecting together the rails of railways, by the adoption of which

no holes are required to be punched through the neck or web of the rail. Second, to the construction of a continuous permanent base or support for the rails of railways.—Patent abandoned.

1448 A. HENRY, Edinburgh. *Breechloaders.* Dated May 11, 1869.

This consists in employing a hollow breech cavity, similar to those specified under letters patent previously granted to the same inventor, but in place of the breech-piece being arranged as therein set forth an opening is made in one side of the breech cavity, through which the breech-piece, which is hinged or jointed to the bottom of the breech cavity, protrudes the protruding part, constituting a thumb or finger-piece, by which the breech is opened or closed.—Patent completed.

1449 C. H. MERRITT, Brunswick-square. *Basting apparatus.* Dated May 12, 1869.

The butter, fat, dripping, or other material to be used for basting is placed in a vessel, by preference of an inverted cone shape, the top or base of the cone being provided with apertures having hinged covers, through which the basting material is introduced. Near the apex of the cone and inside of it there is a grating, on which the basting material rests, from whence it flows, and is led through pipes to the article or articles to be basted, the flow being regulated by a valve or valves placed in the pipe or pipes leading therefrom. Through the centre of the vessel a tube is passed, which is intended to receive the cord or chain supporting the ordinary bottle jack or article being roasted, the basting vessel itself being suspended by a chain hooked to the lid, and, by preference, placed over the neck of the bottle-jack, when such is used. —Patent completed.

1450 J. ROBEY, Newcastle-under-Lyme. *Sugar refining.* Dated May 12, 1869.

This consists in the use and application of a decoction of tannin or Gallo-tannic acid, prepared in any suitable way from oak bark, valoinas, or other vegetable products, (which may be prepared in the same manner as the tannin used by tanners), and which is mixed in suitable proportions with the unsound syrups, sweet waters, or raw sugar in the melting pan or blow-up, and melted in the usual way.—Patent abandoned.

1451 E. T. HUGHES, Chancery-lane. *Tea and coffee urns.* (A communication.) Dated May 12, 1869.

The urn is formed with a chamber at its top entirely around its edge, space being left in the centre for the insertion of a cylinder with a perforated bottom, and of another and shorter cylinder with a perforated bottom, which serves as a sprinkler.—Patent abandoned.

1452 P. W. and W. FLOWER, Great Winchester-street-buildings, E.C. *Producing impressions on tin, &c.* (A communication.) Dated May 12, 1869.

This relates to the printing or producing impressions upon tin and terne plates and sheets of iron or other metal, covered with a coating of paint or varnish, or other coating material that will resist heat, or without such coating. And also to the use of a stove or drying oven of a new construction, specially adapted for practically carrying out the method above referred to.—Patent completed.

1453 H. ING, St. John-street-road. *Book clasps, &c.* Dated May 12, 1869.

This consists in making such fastenings or clasps expanding, flexible, and elastic by constructing them of a series of semi-cubular or trough-shaped pieces of metal interlocked and in combination with spiral or other springs, either inside or outside.—Patent abandoned.

1454 J. B. HANDYSIDE, Glasgow. *Wheels.* Dated May 12, 1869.

The wire or rim of the wheel is connected to the central boss or hub by two discs or annular plates of malleable iron or steel, these discs being put together so as to clasp between them, and in concavities formed in them for the purpose certain duplex annular projections formed on the rim or tyre and on the boss or hub respectively.—Patent completed.

1455 T. BULLIVANT, Ledbury-road, W. *Window sashes.* Dated May 12, 1869.

This consists in the employment of plain guides in which the projections at each end of such guides are dispensed with, thereby obviating the necessity of a groove deeper than the width of the guide in which to receive it when it is disconnected from the sash.—Patent completed.

1456 H. ROBINSON, Skipton, Yorkshire. *Kilns for limestone.* Dated May 12, 1869.

The kiln is composed of a top central cone together with two lower cones communicating with the top central cone on its lower side. The fuel is supplied by a separate passage or passages proceeding from the top or upper surface of the kiln and opening into the lower cones.—Patent abandoned.

1457 J. L. GREATOREX, East Grinstead. *Urinals.* Dated May 12, 1869.

This consists in so constructing the slab and overflow that they form their own trap and stand permanently half filled with water. They are thus enabled to effect the irrigation of the whole of the interior parts of the basin and back by means of perforations or openings in the hollow moulding and rim of the basin. At the soffit of the top moulding the inventor provides a guide to prevent any spray of water from the perforation at the soffit. —Patent completed.

1458 P. W. FLOWER, Neath, H. NASH, Liverpool, and R. HEATHFIELD, Birmingham. *Coating metal.* Dated May 12, 1869.

This consists in combining sheets of iron or of other metal together at their edges by any of the ordinary means before they have been coated, or such connecting of the sheets together may be only temporary where it is desired simply to obtain the advantages of a more continuous process of dipping a series of plates or sheets into a coating fluid. The joined or connected series of plates or sheets are then immersed in succession into the bath of melted metal or other substance with which they are to be coated.—Patent completed.

1459 J. H. JOHNSON, Lincoln's Inn-fields. *Saw teeth.* (A communication.) Dated May 12, 1869.

In place of treating each tooth separately by a hammer and file a dressing machine, extending over a considerable number of teeth, or, indeed, over the entire number if required at one and the same time, is employed, and the same treatment is extended to each tooth simultaneously, thereby avoiding any difference and creating complete uniformity.—Patent completed.

1460 F. R. A. GLOVER, Brading, Isle of Wight. *Anchors and gear.* Dated May 12, 1869.

The inventor attaches to the shank of the anchor, at some point near the centre of gravity, a chain or painter, whereby the anchor may be lifted and turned on this centre, on which it may be suspended in equilibrium.—Patent abandoned.

1461 A. V. NEWTON, Chancery-lane. *Expressing juices.* (A communication.) Dated May 12, 1869.

A rolling action of the pressing surfaces is adopted, derived from two cylinders set eccentrically one within the other. These cylinders are carried by antifriction rollers, which turn in rings that form loose bearings for them.—Patent abandoned.

1462 W. F. DE LA RUE, Bunhill-row. *Paper water mark.* Dated May 12, 1869.

The inventor makes a dandy roll with a sunk-in place of a raised pattern upon it and finds that the soft pulp enters the depressions of this roller so as to make a thicker paper at the parts corresponding with these depressions, whilst the paper is left elsewhere of a uniform and even thickness.—Patent completed.

1463 V. DE STAINS, Shepperton Villas, N. *Bicycle wheels, treadles, and brakes.* Dated May 13, 1869.

This relates, first, to a wheel composed of three distinct parts, viz., an outer circle, a nave, and a number of spokes connecting the two, and so disposed as to bear each singly in its turn the whole weight carried by the wheel.—Patent completed.

1464 E. V. NEWTON, Oxford-street, and P. M. CRANE, Manchester. *Coating ships.* Dated May 13, 1869.

This consists in the employment of paraffin as the basis of a composition or compound to be used for coating ships, boats, and other surfaces, to protect them and to prevent their fouling.—Patent completed.

1465 J. TIMMINS and J. GAYTON, Birmingham. *Lever fastening.* Dated May 13, 1869.

This consists, substantially, of a bent lever fitted with a cross pin in about its middle part, and which forms the axis upon which it works. The upper end of the lever is grooved or spread open so as to form a kind of prong or fork, and is for the reception of the cord or cable employed, the other end of the lever pressing the card against the frame provided when the lever is in use, and so holding it securely in a state of tension.—Patent completed.

1466 H. LUKE, Manchester. *Window sashes.* Dated May 13, 1869.

This consists in dispensing with the cords, pulleys, and weights usually employed to counterbalance window sashes, and in employing in lieu thereof a spring shot bolt or other equivalent, with an antifriction bowl at its end acting in an inclined groove in the window frame when the shot bolt is attached to the sash, or in the window sash when the shot bolt is attached to the window frame.—Patent completed.

1467 W. A. LYTTLE, Hammersmith. *Electro-telegraphic apparatus.* Dated May 13, 1869.

The inventor employs in the instrument known as the Morse printer or embosser two separate levers with an inking roller, inking point, pen, or embosser to each, one of the levers being terminated with a soft iron armature, and the other with an armature of magnetised steel or iron kept constantly polarised by the proximity or contact of a permanent magnet, and each lever having its armature end adjusted suitably for attraction by one or more electro-magnets placed underneath.

1461 T. G. F. DOLBY, Forest Gate. *Feeding bottle valve.* Dated May 13, 1869.

This consists of a tapered or conical piece in metal or other suitable material, and of a piece of sheet or moulded india-rubber or other elastic material fitted upon the tapered or conical piece, so that when the piece of india-rubber is at the thicker end of the tapered piece the valve is closed, and when the piece of india-rubber is at the thinner end the valve is opened.—Patent completed.

1462 J. TOWNSEND and P. FORBES, Glasgow. *Refining oils.* Dated May 13, 1869.

This consists in redistilling the oil or fat by means of saturated steam of high pressure, that is (to say, of a pressure of 60lb. or upwards per square inch, such steam being partly blown into the oil or fat, and partly applying its heat thereto by closed pipes, jackets, or the like, whilst direct fire heat is entirely avoided.—Patent completed.

1470 I. and G. BATTINSON and T. WHITEHEAD, Halifax. *Combing wool.* Dated May 13, 1869.

This consists in placing, when constructing new machines, the small circles nearer the large circular comb, and the dabbing brush is so arranged that a portion of the wool (being combed or operated upon) is forced upon the small circles or combs, such wool or fibre being part of or intermingled with that on the larger comb. The tensional strain exerted on the wool or fibre by the rotation of the large circle or comb draws on the small circles or combs, and imparts the necessary rotary motion on their bearings without the wheels and shafts or spindles and stud, as heretofore employed for the purpose.—Patent completed.

1471 J. FAWCETT, Huddersfield. *Measuring oil.* Dated May 13, 1869.

This consists in the employment of a supply cistern, which, by preference, the inventor furnishes with an ordinary ball tap or self-acting tap for regulating the inlet thereto of the oil or other liquid. Also in a series of enclosed measures or vessels of any required capacity, so arranged either underneath the cistern, or by its side, in such manner that the oil or liquid will gravitate or flow from the cistern into the measures when at liberty to do so. A tap or cock suitably constructed is applied to each measure, with pipes to connect them respectively with the cistern.—Patent completed.

1472 C. FERGUSON, Glasgow. *Washing, brushing, and filling bottles.* Dated May 13, 1869.

Each set of six quart bottles are first ranged or placed in a portable case or box, at equal or fixed distances apart, as in a circle equally divided round it. Each bottle is set in a good deep socket of its own, projecting up from the bottom and having a movable round supporting piece or bottom, by preference covered with a thin sheet of india-rubber. The shoulders of the bottles come up through the holes in the portable light loose lid or cover, the holes being ranged in a circle in the cover, for being brought down over the necks of the bottles, and then temporarily fixed to the box by the swivel bolts or latches, taking into recessed notches or catches on the lid and sides of the box respectively.—Patent completed.

1473 J. BOWNES, Mansfield. *Steaming tobacco.* Dated May 13, 1869.

This consists in the employment for that purpose of a steam jacketted cylinder, mounted upon a suitable supporting surface, and provided internally with a pressing piston, which works from below upwards.—Patent abandoned.

1474 A. FRIEDMANN, Hatton Garden. *New ornament.* Dated May 13, 1869.

The ornament is formed of two separate parts or pieces which are fitted, connected, or fastened together by snap, catch, or other connecting contrivance, so that they are capable of being readily connected with and disconnected from each other.—Patent abandoned.

1475 W. CADOGAN, Birkenhead. *Coupling for driving straps.* Dated May 13, 1869.

In order to connect together the two ends of a driving strap, the inventor attaches to the back of the belt at both of its ends by rivets, screws, and nuts, or otherwise, a plate of metal. The back of each plate has standing out from it a row of studs, each stud carrying a pulley grooved around its circumference; above the pulleys is a bar or narrow plate, to which the tops of the studs are fixed, and this bar or narrow plate is attached at its ends to the two ends of the plate, which is fixed to the end of the strap. Each end of the strap is thus furnished with a row of pulleys at its back.—Patent completed.

1476 W. STEPHENSON, Sculcoats, Yorkshire. *Facilitating consumption of smoke.* Dated May 13, 1869.

This consists in fitting a cylindrical or other shaped reservoir at or near the front of the furnace. In this reservoir the inventor fits a vessel having a valve opening inwards in the bottom of it. The upper part of this vessel is connected by a series of rods and levers to a door or valve set in the brickwork at or near the bridge at the back of the furnace.—Patent abandoned.

1477 I. and J. H. STOREY, Manchester, and H. LEA and T. LANE, Birmingham. *Controlling discharge of water.* Dated May 14, 1869.

On the stand, pipe, or fountain the inventors employ a valve, the inlet orifice of which is closed by a diaphragm, acted upon by the pressure of the water when admitted to the back of the diaphragm. The space at the back of the said diaphragm is in communication with a small valve, which when opened relieves the back of the diaphragm from the said pressure, and thus permits the discharge of water from the main valve.

1478 J. and J. KIPPAX, Bolton-le-Moors. *Weaving counterpanes.* Dated May 14, 1869.

The quilts are woven with the aid of healds and of jacquard apparatus, and with designs or patterns either geometrical or figured. Two warps are employed, the face warp having twice as many ends as the back warp. —Patent abandoned.

1479 C. W. LANCASTER, New Bond-street. *Concentrating shot.* Dated May 14, 1869.

The inventor employs over the shot and under the ordinary terminal wad of the cartridge a hollow cylindrical wad formed of a short piece of cylinder of paper or other material closed at the end by the insertion of an ordinary cloth or other wadding or by a terminal wad. This short cylinder the inventor forms to fit inside the cartridge case, and he inserts it after putting in the shot, so that it forms a cup or thimble over the front portion of the charge of shot. This hollow wadding is then secured in its place by the ordinary terminal wad, over which the cartridge case can be turned.—Patent completed.

1480 J. T. GRIFFIN, Fleet-street. *Knives and forks.* (A communication.) Dated May 14, 1869.

The objects are, first, to manufacture the blades, bolsters, and tangs of table and dessert knives and forks of separate pieces of metal, and, second, to form the handles of one or different materials, in order that when complete they may present a novel and ornamental appearance. The blades are made by casting or otherwise, and a notch or recess is formed in the handle thereof, in order to fit the handle thereto.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated November 23, 1869.

3376 H. A. Bonneville, Sackville-street, Piccadilly. A new and improved steam boiler supply cock.

3377 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in electro-metallurgy.

3378 H. A. Bonneville, Sackville-street, Piccadilly. Improvements in electric batteries.

3379 S. G. Arnold, Southampton-buildings, Chancery-lane. Improvements in saws and saw teeth, and in machinery for manufacturing the same.

3380 J. E. Croce-Spinelli, of Paris, Rue de Rome. Improvements in nautic means and apparatus.

3381 E. Round, Sheffield. An improved indicator.

3382 W. E. Gedge, Wellington-street, Strand. An improved system of hydraulic traction on railways and other roads.

3383 H. F. Shaw, West Roxbury, Norfolk, Massachusetts, U.S.A. Improvements in cutters for moving machines.

3384 A. Nairn, Leith, Midlothian. Improvements in steam carriages for common roads, and in part applicable to railway locomotives.

3385 F. Foster, Lansdowne Cottage, Essex-road, Islington. Improvements in pressure gauges.

3386 J. H. Johnson, Lincoln's Inn-fields. Improvements in machinery or apparatus for grinding saws.

3387 H. C. Lobnitz, Renfrewshire. Improvements in motive-power engines.

Dated November 24, 1869.

3388 A. M'Neill, Liverpool. A safe for ships and other navigable vessels carrying mails, specie, and other valuables.

3389 F. J. Granville, Glencrutcherry, Douglas, Isle of Man, and H. Gardner, Elm Bank, Oakfield, Liverpool. Improvements in advertising sheets or papers, being an improved means of advertising, and in apparatus for the production of such advertising papers.

3390 W. Thomas, Llanelly, Carmarthenshire. Improvements in obtaining power.

3391 J. Fogg, Edgeworth, Lancashire. Improvements in machinery for dressing flags and stone, and other hard materials.

3392 S. Cotton, Belfast, Ireland. Improvements in machinery for preparing flax, hemp, worsted, silk, and other fibrous substances.

3393 J. Norris, Manchester, and E. Longworth, Winewall, near Colne, Lancashire. Improved self-acting apparatus for placing fog signals upon railways.

3394 J. Dunkerley, Audenshaw, Lancashire, and B. Dunkerley, Stockport, Cheshire. Improvements in machinery or apparatus employed for felting or planking the bodies of hats, bonnets, or other coverings for the head, which machinery is also applicable for felting woollen cloths.

3395 J. B. Paddon, Hove, Sussex. Improvements in apparatus used in the manufacture of gas.

3396 D. Miles, Boston, Massachusetts, U.S.A. An improved mode of, and apparatus for, lighting and extinguishing gas by electricity.

3397 J. Turnbull, Edinburgh. Improvements in connecting and disconnecting carriages and waggons on railways, and in the apparatus connected therewith.

3398 S. Chatwood, Bolton, Lancashire, and T. Sturgeon, Manchester. Improvements in apparatus for forcing and drawing fluids and liquids.

3399 M. Henry, Fleet-street, City. Improvements in apparatus for moving or transporting railway carriages and other heavy bodies from place to place.

3400 J. Downs, Kingston-upon-Hull, Yorkshire. Improved hydraulic presses used for seed-crushing, oil expressing, and other similar purposes.

3401 W. C. Mann, Leeds. Improvements in the manufacture of hats and in the machinery used therein.

Dated November 25, 1868.

3402 P. C. Evans, Brimscomb Mills, Gloucestershire, and H. J. H. King, Glasgow. Improvements in apparatus for feeding wool, cotton, or other fibrous materials to carding or other machines.

3403 F. W. Webb, Bolton, Lancashire. Improvements in locomotive and other steam engines and boilers, parts of which are applicable to riveted work and railway rollin stock in general.

3404 T. Richardson, Manchester Improvements in the construction of compound forms and desks or tables for schools and other similar purposes.

3405 J. Nichols, Pendleton, Salford. Improvements in machinery for polishing yarns and threads.

3406 B. Goddard and W. Finley, Stockport, Cheshire. Improved machinery for pill mass mixing and pill making, mixing plastic substances, making plaster rolls, and for other similar or analogous purposes.

3407 E. F. Goodall, Birmingham. Improvements in excise inkbottles, and other ink bottles and inkstands.

3408 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for propelling ships.

3409 B. Johnson and E. B. Ellington, Chester. Improvements in hydraulic cranes or apparatus for moving weights.

3410 A. M'Dougall, Manchester. Improvements in the manufacture of blacking.

3411 T. Brown, Newgate-street, City. Improvements in the construction and arrangement of machinery or apparatus for drilling or boring rocks or other analogous substances.

3412 L. Mount, Bromley-by-Bow. Improvements in machinery or apparatus for filling match splints or other splints, whether made of wood, wax, glass, or of any other material.

3413 J. Keats, Leek, Staffordshire. An improved manufacture of buckle.

3414 G. M. Felton, Well-street, City. Improvements in collars, cuffs, and other similar articles.

3415 W. E. Gedge, Wellington-street, Strand. The composition and application of a novel powder for destroying the oidium in vines and other plants, and the application of a mixture of some of its ingredients in a liquid state to destroy parasites between the bark and wood of trees.

3416 W. Pollitt, Charlotte-street, Blackburn, and W. J. Knowles, Alton-street, Blackburn, Lancashire. Improvements in machinery for washing, wringing, mangling, churning, and mixing fluids.

Dated November 26, 1869.

3417 D. Barker, Northfleet, Kent. Improvements in the manufacture of varnish and varnish paints.

3418 J. Denis, Great Dover-street, Surrey. Improvements in the means of, and machinery for, producing pulp from wood and other fibrous substances for the manufacture of paper.

3419 J., J., and W. Fletcher, Eagle Foundry, Salford, Lancashire. Improvements in, and applicable to, mortar mills, and other machines of the like nature for grinding or pulverising.

3420 S. Tatton, Stockwell-street, Leek, Staffordshire. An improved manufacture of reels, bobbins, and other similar articles.

3421 S. Tatton, Stockwell-street, Leek, Staffordshire. An improved card for facilitating the withdrawal of single threads for sewing purposes.

3422 E. H. Burke, King's Bench Walk, Temple. Improvements in metallic barrels.

3423 B. Wood, Wordsley Foundry, Stourbridge, Worcestershire. Improvements in the manufacture of lids for railway axle boxes.

3424 W. Perkins, Herne Hill, Surrey. Improvements in fusees, matches, or other analogous articles, and in the holders for the same.

3425 J. Combe, Belfast. Improvements in machinery for hackling flax and other fibrous substances.

3426 A. C. Engert, Tabernacle-row. Improvements in the manufacture of ornamental placards, show cards, labels, maps, and such like articles.

3427 J. Brunton, Kensington. Improvements in working and locking railway points and signals.

3428 S. Wyatt, Old Town-street, Plymouth, Devonshire. Improvements in the preservation of meat and in the apparatus employed therein.

Dated November 27, 1869.

3429 H. S. Freeman, Fenchurch-street, City. Improvements in the method of effecting the more perfect adjustment of men's wearing apparel.

3430 F. Preston, Manchester. Improvements in machinery or apparatus for preparing, spinning, twisting, and doubling wool, cotton, and other fibrous substances.

3431 W. C. S. Percy, Manchester. Improvements in machinery or apparatus for cutting animal and vegetable substances, and for making pies and sausages.

3432 A. Barclay, Kilmarnock, Ayrshire. Improvements in condensers, and in ejecting or withdrawing liquids and fluids therefrom, and in apparatus connected therewith.

3433 G. Bertram, Edinburgh, and M. Patterson, Ivy Bridge, Devonshire. Certain improvements in apparatus for straining paper pulp.

3434 J., J., E., and W. Pitt, Cleckheaton, Yorkshire. Improvements in machinery, or apparatus for drilling, turning, or cutting and shaping metals or other materials.

3435 L. Pochet, Vendome (Loire et Cher), France. An improved apparatus for cutting or dressing stone.

3436 W. Johnson, Gough-square, City. An improvement in lock fastenings for expanding cases and boxes.

3437 J. Howard and E. T. Bousfield, Bedford. Improvements in apparatus for cutting standing crops and collecting the same when cut.

3438 A. E. Loram, Birmingham. Improvements in buckles and clasps.

3439 W. Cross, Glasgow. An improved manufacture of shawls.

3440 G. Lockett, Red Lion-square, Holborn. A revolving graphoscope.

3441 W. Brookes, Chancery-lane. Improvements in sewing machines.

3442 B. Oldfield, Coventry, Warwickshire. Improvements in looms, and in devices to be employed therewith for weaving.

3443 S., J. J., and L. H. Perry, Red Lion-square. Improvements in boxes for holding various articles.

3444 S. Fox and J. Reffitt, Silver Cross Works, Leeds. Improvements in machinery or apparatus for boring, turning, and polishing treenails, bobbins, or other similar articles of wood or other materials.

Dated November 29, 1869.

3445 J. Moseley, Manchester. Improvements in the manufacture of calico-printers' blankets.

3446 G. B. M'Farland, New York, U.S.A. A convertible double-centre rotary engine, so called M'Farland's rotary engine.

3447 E. Lethbridge, Benson, Oxfordshire. Improvements in the means of, and apparatus for, balancing millstones.

3448 J. Williams, jun., King's-road, Chelsea. A new or improved apparatus for toasting, roasting, and cooking.

3449 J. Tester, Hurst Green, Sussex. Improvements in machinery for cutting chaff and other similar vegetable substances.

3450 E. Oades, Egham, Surrey. Improvements in vent plugs.

3451 T. Reissig, Manchester. Improvements in making a new derivative of phenol, and in producing certain colours therewith upon textile fabrics and yarns.

3452 J. C. Mewburn, Fleet-street, City. Improvements in obtaining motive power, and in apparatus employed therein.

3453 H. Draper, Bebington, Cheshire. Improvements in apparatus to be used when tanning hides and skins.

3454 G. and A. B. Marquis, Glasgow. Improvements in machinery for cutting or dividing metal or other sheets.

3455 J. Edwards, Bridge Cottage, Farrington, near Preston, and J. Quin, Golden Hill, Leyland, near Preston, Lancashire. Preventing roller laps on roller ends of machines for carding cotton, woollen, flax, or any other fibrous material.

3456 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in journal bearings for railway carriages, and in the means for lubricating the same.

3457 W. Parham, Northgate-street, Bath, Somersetshire. Improvements in the construction of horticultural and other buildings and structures.

3458 J. Speight, Bradford, Yorkshire. Improvements in machinery or apparatus for spinning, twisting, and roving worsted or other fibrous substances.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," November 30, 1869

1831 R. S. Bakewell
2147 W. R. Lake
2154 B. Russ
2159 H. E. Newton
2164 A. Ancion
2169 W. Furness
2186 T. Holt
2197 H. Higgins and T. S. Whitworth
2206 G. Follett
2207 G. H. Ellis
2209 G. Allibon and A. Manbre
2221 W. H. Gosling
2222 J. Rowley
2223 W. H. Stone
2233 T. Barnes
2240 J. H. Johnson
2245 W. Mort
2247 H. Greaves
2250 J. Dewe
2257 D. H. Brandon
2260 J. Holding and J. Eccles
2269 J. H. Johnson
2270 R. Shaw and R. Lakin
2272 C. Henderson
2275 I. Barker
2278 J. Windle
2283 H. Gillan and G. Crawford
2294 T. F. Taylor
2299 A. Patene, F. Bardoux, and G. Jurie
2300 J. B. B. Pinchon
2305 C. N. Eyland
2322 E. Beanes
2362 H. Brandreth
2389 S. Hutchinson
2395 S. J. Woodhouse
2465 E. T. Hughes
2466 A. Brown
2468 E. T. Hughes
2522 R. Maynard
2525 O. and F. H. Varley
2540 J. M. Stanley
2706 C. Eskrett and H. Searle
2707 G. A. C. Bremme
2745 W. R. Lake
2825 W. R. Lake
2826 W. R. Lake
2854 G. A. Huddart
2873 J. Critchley
2952 J. and J. A. Huggett
2956 W. R. Lake
2958 A. B. Childs
3083 J. and J. Cash
3088 A. B. Ibbotson and T. S. Sarney
3092 W. R. Lake
3116 T. Clark
3132 S. C. Salisbury
3157 T. Moore and C. A. Head
3172 B. Tower
3173 C. G. Gumpel
3195 J. Booth
3208 W. R. Lake
3222 R. Aders
3229 A. M. Clark
3236 F. Jenkin
3240 F. B. Dœring
3243 A. Mosley
3244 H. Robinson
3259 G. A. Buchholz
3264 S. Chatwood and R. Kenyon
3266 G. D. Edmeston
3277 R. and G. Hardman
3295 W. Gossage
3318 W. H. Perkin
3342 I. Hayford and J. F. Paul

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed November 26, 1869.

1644 J. Ingham and I. Butterfield
1652 A. T. Fairgrieve
1656 A. Hemingway
1664 J. Smith
1665 J. F. Nicholls
1676 R. Mathers
1687 A. Rushworth
1688 C. H. Gardner
1693 C. F. Waldo
1696 R. B. Cooley
1698 J. Urbain
1733 R. B. Plum and R. George
1736 J. Blomfield
1753 G. A. Frebault
1788 R. Harrison
1796 W. Cook
1841 T. Knowles
1916 J. H. Johnson
1958 G. C. Haswell
2569 W. E. Newton
2917 W. P. Gregg

Sealed November 30, 1869.

1689 O. Barrett and G. P. Wheeler
1690 J. Warhurst
1699 A. Watt and T. Knowles
1700 G. V. Turnbull, C. Salvesen, and R. Irvine
1705 F. R. A. Glover
1716 J. Stewart and T. Charlton
1718 J. and R. Tatham
1719 W. V. Morgan
1726 E. T. Hughes
1740 E. G. Brewer
1744 F. H. Holmes
1752 W. R. Lake
1828 M. Benson
1779 W. Madders and J. Wood
1829 M. Benson
1830 M. Benson
1876 G. Molland
1893 M. Olsson
1898 P. G. B. Westmacott
2011 A. Angell
2133 B. J. B. Mills
2458 J. H. Johnson
2483 W. Jones
2705 J. H. Johnson
2888 H. Howard-Keeling
2902 H. and A. Holmes
2903 W. H. Horsley
2914 J. C. Ramsden
2924 T. Rice

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3076 M. Marks
3084 J. Coulson
3095 W. Bass
3099 C. H. Southall, R. Heap, and J. Tasker
3132 A. V. Newton
3136 L. A. Fargon
3137 J. Wadsworth
3143 J. Field
3157 W. Crichton
3186 G. Haseltine

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3174 J. R. Danks and B. P. and R. P. Walker
3165 A. V. Newton

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2753	3210	3233	3259	3272	3286	3299	3313
3091	3211	3235	3261	3276	3288	3300	3315
3151	3213	3237	3262	3277	3289	3303	3316
3167	3215	3239	3263	3278	3290	3305	3317
3195	3217	3241	3264	3279	3292	3306	3318
3199	3221	3243	3265	3280	3293	3308	3322
3201	3222	3245	3266	3281	3294	3309	3324
3203	3223	3249	3267	3282	3295	3310	3326
3205	3225	3253	3268	3283	3297	3311	3328
3207	3227	3255	3269	3284	3298	3312	3330
3209	3229	3257	3271				

LIST OF SPECIFICATIONS PUBLISHED

For the week ending November 27, 1869.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
921	0 6	1099	1 4	1160	1 0	1210	0 8	1236	0 4	1266	0 4
954	2 4	1101	0 6	1163	0 8	1213	0 8	1237	0 4	1267	0 4
982	1 0	1105	0 8	1184	1 2	1214	0 8	1240	0 4	1269	0 4
1008	0 6	1107	0 10	1188	0 10	1217	0 4	1241	0 4	1271	0 4
1022	1 2	1108	0 8	1189	0 4	1218	0 4	1243	0 4	1272	0 8
1026	1 6	1111	0 8	1191	0 4	1219	0 4	1244	0 4	1276	0 4
1040	0 8	1113	3 2	1192	0 4	1220	0 8	1246	0 8	1277	0 4
1042	0 8	1114	0 6	1195	0 4	1221	0 4	1247	0 8	1278	0 4
1051	0 10	1119	0 8	1196	0 4	1222	0 6	1249	0 6	1284	0 8
1055	1 6	1131	1 0	1198	0 10	1223	0 4	1250	0 4	1291	0 4
1061	1 4	1133	0 10	1199	0 6	1224	0 4	1251	0 4	1305	1 0
1068	0 8	1134	0 6	1200	1 0	1225	0 4	1255	0 4	1315	1 6
1071	0 8	1135	0 8	1201	0 4	1226	0 4	1256	0 4	1316	0 10
1080	2 6	1137	0 10	1203	0 4	1227	0 4	1257	0 4	1339	0 6
1085	0 10	1140	0 8	1204	0 4	1229	0 4	1258	0 10	1353	0 4
1086	0 10	1141	0 8	1206	0 4	1232	1 0	1259	0 4	1388	0 4
1088	0 8	1150	0 10	1207	0 4	1233	0 4	1263	0 8	1646	0 8
1093	1 2	1153	0 10	1208	1 2	1235	0 4	1264	0 4	1906	0 10
1098	1 0										

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department, 166, Fleet-street, London, E.C. to whom all communications upon the subject should be addressed.

THE

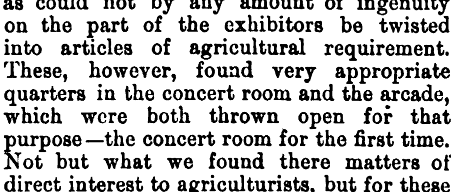
MECHANICS' MAGAZINE.

LONDON: FRIDAY, DECEMBER 10, 1869.

THE SMITHFIELD CLUB SHOW.

FOLLOWING so closely upon a show of such unparalleled magnitude as that of the Royal Agricultural Society at Manchester in July last, at which the various makers had full opportunity of putting forth all their resources, the present Smithfield Club Show becomes rather dwarfed in its dimensions. But we must not compare it with such a display as Manchester witnessed, but rather with its own predecessors in the Agricultural Hall at Islington. And here the comparison is more favourable, inasmuch as the exhibition of machinery and implements this year is over the average of what we usually find. At first sight we were inclined to think there was a falling off in the number of exhibits, but after a careful investigation of every stand in the building, we arrived at the conclusion that agriculture was mechanically represented rather better than usual. One thing, however, is worthy of note, and that is that the committee of the Smithfield Club have exercised a very wise discretion in excluding from the ball proper such matters as could not by any amount of ingenuity on the part of the exhibitors be twisted into articles of agricultural requirement. These, however, found very appropriate quarters in the concert room and the arcade, which were both thrown open for that purpose—the concert room for the first time. Not but what we found there matters of direct interest to agriculturists, but for these we suppose no room could be found in the main building. As, however, these two departments are constantly thronged, the exhibitors will not suffer from any absence of notice from the public. Taking the show as a whole it is devoid of any striking novelty—as far as engines and implements are concerned—although most makers, keeping pace with the times, have improved in detail here a little and there a little, so that we shall not travel from Dan to Beersheba and cry "all is barren."

Turning, then, to our mechanical friends, we first note, in proof of the position we have just advanced, one or two special features which we met at the stand of Messrs. Robey and Co., of the Perseverance Works, Lincoln. This firm exhibited several excellent engines, their special feature being their 8-horse power portable engine, in which the novelty is the method of producing variable expansion of the steam. This is done in a very simple and efficient manner by the governor, of



which we annex a cut. The governor is placed on the crank shaft, and revolving with it is of course affected by the slightest difference in the speed. The valve eccentric has a rectangular slot cut parallel to a line connecting its two centres of forward and backward motion. This fits upon a square on the crank shaft, upon which it slides at right angles to the crank, being held in position by two wedges which are fastened to the governor slide, as seen in the sectional part of our cut. Upon the governor balls expanding the wedges are drawn out, the travel of the valve is reduced, the cut-off is made earlier, while the lead remains constant. The range is from $\frac{3}{4}$in. to $\frac{1}{8}$in.; the 8-horse engine, with 60lb. steam, developes 19-horse power indicated when cutting off at $\frac{1}{3}$in., with a consumption of coal of 60lb. per hour, being equivalent to a trifle over 3lb. per horse power per hour. The cylinder of this engine is steam jacketed, and part of the exhaust is taken to heat the feed water. Messrs. Robey's vertical engine is of 4-horse power, and is strongly fixed on to the boiler, and the whole firmly fixed on a cast-iron foundation plate, which also serves as ashpan and water heater. Besides these engines, we have to notice a thrashing machine and a straw elevator by the same firm. A novel and valuable feature has been introduced in the thrashing machine The frame is made of angle iron riveted up, instead of wood as is the general practice. The advantage of this is obvious in hot climates on account of shrinkage and twisting, whilst generally it is better, being more rigid and durable without being heavier. The straw elevator is noticeable for the ease with which it can be set to work at any angle to the thrashing machine and the very simple method adopted for driving.

At the stand of Messrs. J. and F. Howard, of the Britannia Ironworks, Bedford, we found a new patent self-acting horse rake and a new double-furrowed plough which they have just brought out, and which were exhibited for the first time. The new horse rake —of which an elegant working model was shown beside the full-sized implement—is evidently the result of much thought and careful trial. In preference to any other more costly and complicated device, a simple brake is adopted, which, when put in action by the driver's foot, instantly raises the teeth. This plan has the signal advantage over other self-acting plans, that the teeth can be dropped into work momentarily, or held out of work at the will of the driver. In other words, the action is not dependent upon the revolution of any rochets or complicated lifting machinery, but is under the control of the man. By this arrangement, the foot of the man has not to travel with the lever movement; the driver has simply to touch the lever to put it into action, and the removal of the foot instantly throws it out. The leverage is so arranged that it can be worked by the driver walking behind the implement as well as when riding on the seat. In the new double-furrow plough the beams —as in the steam ploughs of this firm—are of double-ribbed steel, firmly braced and riveted together. The frames are of malleable iron, which has the advantage of being as tough as wrought iron, and as stiff as cast iron. The bodies, which are attached with two bolts only, can be fixed to each side of the beams, so that the width of the furrows can be varied, and this without the firmness and stiffness of the plough being sacrificed. The difficulty in turning double ploughs at the land's end is obviated by attaching the fore wheels to a simple swing carriage of novel construction. By this arrangement, the strength of a boy only is needed to turn the implement. The plough is so arranged that the friction wheel in the rear can be removed when ploughing land which clogs. The shares are fixed on wrought lever necks upon the well-known principle patented by this firm, so that the relative depths of the furrows can be instantly adjusted. We cannot leave this stand without referring to the new patent central-axle haymaker which Messrs. Howard have been engaged in perfecting during the last three or four hay seasons. The main feature of the new machine is that the axle which carries the fork barrels is in a direct line between and not behind the wheels. By this arrangement increased strength is obtained, through the framework being outside instead of inside the wheels, and the whole being held firmly together by a central main axle. The machine will cross ridge and furrow, owing to the wheels and forks falling into the furrows or rising over the ridges at the same moment. The most fruitful cause of breakage in all former machines is that, the barrels being in the rear, they come into contact, not simply with the grass, but with the ground when working over unlevel land. The liability to load when tedding newly-mown grass—so great a drawback in other machines—is avoided, inasmuch as the frame is outside the wheels, and the axle boxes are not stationary, but like the other parts revolve—in other words, there is no dead surface for the grass to lodge upon. Messrs. Howards' safety tubular boiler, which has been illustrated and described in our pages, continues to give every satisfaction and is coming largely into use.

Messrs. E. R. and F. Turner, of Ipswich, showed their portable steam engines, which possess the distinctive features of the manufactures of this firm, viz., careful design and attention to the details of construction. They are well adapted to the requirements of the users of such machines, and possess strength and durability. Any exhibit of machines by this firm would be incomplete without their crushing mills, which we found here in full force. The large variety of these mills manufactured by Messrs. Turner enables purchasers, however large or small their requirements, to find a machine suited to their wants. These mills are well adapted to prepare maize for horse food. As this material has much increased in favour for feeding purposes, we imagine the sale of these mills will receive an additional impetus. In fact, the makers inform us that the demand for these machines has this season been unusually brisk. Three varieties of oil cake breakers were also here exhibited. The cake in passing through the machine is acted on by two sets of rollers and reduced to a size suitable for lambs, with a minimum of power. The larger machine was capable of breaking down two tons per hour of the hardest cake. The horse gear which we found at this stand was mounted on a substantial oak frame, so that no further outlay is requisite on the purchaser's part, as it may be readily and securely fixed by a few stakes. The intermediate motion is provided with a clutch to start or stop the driven machine, independently of the horses. The Royal Society's 1867 first prize French burr grinding mill was also exhibited. This, with accompanying crane, was a well got up machine, and deserved attention. A small machine for shelling maize, suitable for the foreign and colonial market, concluded the exhibit on this stand. The silver medal of the exhibition at Altona, held in September last, was awarded this firm.

Messrs. Clayton and Shuttleworth, of the Stamp End Ironworks, Lincoln, made a very handsome display of engines both portable and fixed. The special features of these engines have been placed before our readers in time past, but as the detail improvements are important and cannot be too well known, we will briefly refer to them here. In the outside cylinder portable engine the exhaust pipe is on the outside of the boiler, and is formed with a branch, to which a tube is attached for conveying a portion of the steam to the feed-water, thus effecting a considerable saving in fuel. Each engine is fitted with a second safety valve under lock and key, as a further safeguard against accidents arising from inattention and carelessness. In the inside cylinder portable, the cylinder is placed in the smoke-box, surrounded by a jacket forming an annular space, which being filled with steam, heats the cylinder and at the same time protects it from the injury that would be caused by direct contact with the heated gases. By this arrangement, condensation and radiation are prevented, and economy is obtained. Both ends of the cylinder and steam chest are left exposed, so that the covers can be removed and the piston

and slide valve cleaned or adjusted as expeditiously and readily as in an outside cylinder engine. This arrangement does away with the objection generally made to engines having the cylinder and steam chest placed inside. An important feature in Messrs. Clayton and Co.'s traction engine is the self-acting differential motion, which enables the driving wheels to accommodate themselves to the sharpest curves without strain or loss of power; both wheels at the same time are kept in gear and receive the full power from the engine. The absence of this feature in a traction engine is a defect, detrimental alike to its efficiency and durability. The thrashing machines of this firm, both portable and fixed, are as perfect and efficient as every known modern improvement can make them. The rolled steel beater plates introduced by this firm are a marked success. They are found to wear three times as long as the malleable iron plates hitherto in use, and when the thrashing surface is worn away the material is available for forge purposes. The corn mills of this firm are too well known to require further remark from us than that they are of the usual excellent design and finish.

Messrs. A. and W. Eddington, of Copenhagen Wharf, Limehouse, and the New-street Ironworks, Chelmsford, exhibited a very good specimen of their work in a 7-horse power portable engine. This firm had several other entries, but owing to the space allotted to them being less than that for which they applied they were obliged to omit them from their stand. One special article which we regretted to see absent was their 12-horse traction ploughing and draining engine, which is fitted with three speeds and compensating road gear. The 7-horse engine exhibited was very strongly built, and so arranged as to be easy of access in case of repair. The starting valve is placed at the top of the cylinder, immediately over the throttle valve, and by removing one cover both are easily examined. By this arrangement the steam is admitted in a much drier state than when it is cut off inside the boiler. All the bearings are supplied with oil syphons worked in the solid metal, thereby avoiding all possibility of losing them, as is the case with loose ones. These engines are very strong, and are well adapted for continuous and heavy work. The boiler plates are of Bowling iron, and being well put together give the impression of thorough reliability, an element much needed in engines which are liable to be carelessly tended.

The old firm of Ransomes, Sims, and Head, of the Orwell Works, Ipswich, Suffolk, were well represented in engines, thrashing machines, and ploughs. To comment upon the exhibits of this firm is simply to repeat the oft-told story of their excellence. We, therefore, leave them to speak for themselves, or rather to be spoken for by the splendid trophy of medals which formed the most prominent feature of this stand. These medals were 113 in number, and filled a circular case about 30in. in diameter. They were from all parts of Great Britain and the continent; in fact, from all parts of the world. They consist of thirty-eight gold, seventy silver, and five bronze medals, forming a collection of which Messrs. Ransomes and Co. may well be proud. With regard to the portable engines exhibited by this firm, we may observe in passing that they are constructed on the expansion principle, and are well arranged for economising fuel. They are admirably adapted for countries where coal has to be imported and is, consequently, very expensive, and where wood is scarce. Two steam thrashing machines were exhibited, a double and a single blast, the latter of which obtained a prize at the Manchester Show.

Leaving for awhile the massive machinery in the basement of the Hall, we will proceed to mount to the galleries, to take a look at some old friends there. And the first to welcome us at the top of the staircase by which we made our ascent is Mr. F. B. Vallance, of 101, Cannon-street, London, and the Alicel Works, Greenwich. This gentleman exhibited the only piece of machinery in motion in the Hall, and that was the Hugon gas engine, which he is largely manufacturing, as it has come greatly into favour with the public. This engine admirably takes the place of the steam engine for occasional use; it is set to work or stopped instantly by turning a tap on or off. It is as completely regulated as a steam engine, and when desired is fitted with governors and throttle valve, but has a special regulating apparatus for feeding itself with gas, which permits the utmost variation of speed and power within reasonable limits, and gives the engine a valuable qualification for operations requiring even and regular speeds. The gas engines have been worked at speeds varying from 50 to 150 revolutions per minute; the most economical speed is about 60 revolutions per minute. The many obvious advantages offered by such a convenient and inexpensive source of motive power are enhanced by the circumstance of its safety. Insurance is not affected either in rate or amount by the insured having one of these engines on any floor of a building. Since last year Mr. Vallance has improved this engine in several details, especially in the slide gear. He has also added a very carefully worked out cam arrangement, and has applied metallic packing throughout.

Messrs. Hayward, Tyler, and Co., of Upper Whitecross-street, exhibited one of the greatest novelties in the building, and one which has already been brought before our readers in these columns. The "Universal" steam pump is one of those useful inventions emanating from American brain, of which so many have found their way across the Atlantic. Having already fully described it in the MECHANICS' MAGAZINE, we shall only briefly say that it is one of the most thoroughly mechanical inventions we have seen for a long time. At this stand is also exhibited a good display of the standard manufacture of the firm, such as deep well pumps, horse gear, well frames, a small vertical boiler with engine attached, garden and house fire engines, besides the California pumps. This firm also exhibited one of Jordan's combination boilers, which are constructed in separate segments, each segment consisting of a cylinder 7ft. 6in. long, 9in. diameter, with top and bottom chambers, giving a heating surface exposed to the flame of 16 square feet, in addition to the cast-iron parts which are out of the way of the fire—an ample allowance per horse power. The horse power is reckoned according to the number of tubes, viz., one tube to a horse power.

Passing on to the stand of Messrs. I. and T. Hepburn and Sons, of Long-lane, Southwark, London, one is forced involuntarily to exclaim "there's nothing like leather." This firm exhibited a collection of leather bands, hose pipes, and other leather articles for machine use. It is as well to draw attention to articles chiefly for agricultural use, and we name what Messrs. Hepburn and Sons appear to have made on this occasion their speciality, viz., the endless belt for transmitting the power from the portable engines. From the circumstance of their being exposed to all weathers, these belts have ever been more or less a source of trouble. When wet, they pull out of shape and run off the pulleys or are destroyed by running on the flange. India-rubber and gutta-percha have both been tried, but in neither has been found a perfect substitute. To meet this want, Messrs. Hepburn have introduced a composite double belt, the under or working side being leather, and the upper layer prepared untanned hide. These are strongly sewn together with wire, and combine the greatest tenacity and durability; they run perfectly straight, and are admitted by all who have used them to be the best band for the work. From the known excellence of Messrs. Hepburn and Sons' leather, and the opportunity they have, as tanners, for selecting suitable hides for the various purposes, they stand in no fear of their bands being rivalled.

No small share of attention was monopolised by Messrs. F. and C. Hancock, of Victoria-terrace, Dudley, whose prize medal butter purifying machine formed as great an attraction here as it did at Manchester. This machine is for the purpose of purifying butter from all traces of milk and acid, also for cooling and making it firm in hot weather without touching it with the hand. All these things it does most effectually, as we ourselves have proved. It also deprives over-salt butter of its saltness, rendering it very palatable. These machines were also exhibited close by at the stand of Mr. J. D. Hancock, of Slaney-street, Birmingham, who also had a new haymaking machine and a new horse clipper, which are well worthy the attention of agriculturists.

Messrs. Yarrow and Hedley, engineers, of Poplar, London, and well known for their steam launches, exhibited a 3½-horse power steam engine and boiler, specially useful to colonial farmers requiring to transport produce by river. This is a special class of engine to which this firm have devoted their attention; it is very simple in design, and of as high-class workmanship as can be produced. It is applicable for all purposes where power is required, equally the same as any portable or stationary engine, the main difference consisting in its being adapted for readily fixing in a boat or barge for purposes of propulsion. In districts where the produce of the farm has to be conveyed distances on rivers or canals, this application of steam power cannot fail to be of great utility.

Messrs. Coleman and Morton, of the London-road Ironworks, Chelmsford, had several examples of their prize cultivator and other agricultural implements. Their adjustable rotary corn screen and separator is a very perfect instrument, and possesses many advantages. The screen is composed of diagonally-placed bars of a triangular section, the spaces being set by an adjusting screw. This arrangement appears most satisfactory. We should add that there is an outside padded roller which keeps the meshes of the screen clear. A special feature at this stand was Walkers' patent horse pitchfork or elevator for stacking straw and hay. It is an American labour-saving invention, and by it hay or loose corn can be lifted off carts or waggons and deposited on the stack or in the barn. This implement will be found of great use where ricks have arrived at a height where the hay has to be raised overhead.

Before drawing our present notice to a close we must refer to a very ingenious and perfect self-acting brake which was exhibited by Mr. T. B. Ayshford, of the Britannia Works, Walham-green, Fulham. On quitting the building we found this brake fitted to one of Mr. Ayshford's elegant canoe waggonettes, and which acts with the greatest certainty. It consists of a chain attached to the horse collar, and which, passing round a pulley on the end of the carriage pole, is attached to a rod which runs under the pole. This rod acts on a simple lever arrangement, which puts on the brake directly the horses are pulled up, or when the carriage is going down a hill. If necessary the brake can be released at any moment by the coachman placing his foot on a stud, which brings the lever back and takes the brake off. This is unquestionably the most effective, simple, and useful of modern brakes, as a contrivance applicable to vehicles to which horses supply the dragging power. Whether in stopping or going down hill, it acts just in proportion to the weight and momentum to be overcome,

without the slightest trouble to the driver or inconvenience to the animals.

For the present we are obliged to bring our remarks to a conclusion, but shall resume the subject next week.

A UNIVERSAL TELEGRAPH.

DURING the past few weeks the public in general, and the telegraphic world in particular, have had their curiosity awakened by such announcements in the daily papers as the following:—"The Universal Telegraph," "A Telegraph for Everybody," "The Essence of Simplicity," "No Battery Required," "Highly Entertaining and Indispensably Useful," and no small amount of speculation has been exercised as to their object. On Wednesday last we were favoured with the first view of the remarkable apparatus to which these announcements refer, and which is the invention of Mr. T. W. Tobin, of the Royal Polytechnic Institution, Regent-street. We therefore, without further delay, proceed to enlighten our readers upon the subject. We cannot better enhance the value and appreciation which this invention is bound to command than by describing in detail the seance in which we took part at this our first interview. It would be presumption on our part to give to our readers the preliminary reminder we received as to the points of importance in the ordinary and cheapest form of the electric telegraph. Our object was, of course, to compare, and we were accordingly furnished with certain statements which seemed to bear on the subject in question—first, as to the complication of machinery; second, the cost and trouble of maintenance of battery; and third, the difficulty of acquiring the system of arbitrary signs for the alphabet, &c., indispensable consequent upon the simplest form of instrument in use. We had then introduced to us two neatly finished mahogany cases about 5in. × 3in. × 2in., having a handle or semaphore in front of each, and a disc or index in the rear. On the latter were painted the letters of the alphabet and other arbitrary signs. One of these instruments was attached to the termination of a metallic conductor, and the other to another (in this instance about thirty yards). It was stated at the same time by the inventor that for all practical purposes the length was immaterial, he having already used the same instruments with 1¼ miles of ordinary telegraph aerial wire. Matters thus arranged, and the return current completed by means of earth plates, gas tubing, or secondary conductors, the system was complete and ready for operation.

The semaphores, hitherto in an upright position, were now placed horizontally; immediately corresponding indices moved along the discs of the two instruments, and on arriving at any particular letter or sign were stopped instantly at a slight alteration of the semaphore by the party signalling. As true as the "needle to the pole" did the two indices work with microscopic precision and in perfect unison. When read, by a second movement of the handle both indices return to zero. Here, then, was pointed out a new feature appertaining to alphabetical instruments. Take the beautiful instrument of Wheatstone for example; once out of unison by any of a number of circumstances, so it continues until, by unintelligible signalling, it is agreed by both operators to register zero. Although we must admit there is time sacrificed for the sake of simplicity of arrangement, there is in the present case this decided advantage—almost absolute impossibility of derangement. Where now, we naturally inquired, is the battery or motive power supplying the electricity to the apparatus? Imagine our surprise when we were informed and convinced that, beyond the two instruments previously described, nothing existed to complete the entire system of telegraphy. By what means was the power, then, generated? Where the prime mover? A steam engine without a boiler would have been no less strange. But facts are stubborn things, and here the evidence stares us in the face. Of course, we expressed a desire to see the contents of one of these magic boxes. It was accordingly laid open, and equally astonished were we with the internal arrangement. It simply contained——. But we must not anticipate; being under promise of secrecy we are bound not to disclose at present what we saw. On another occasion we may find reason to revert to the subject. In the meantime the apparatus will be before the public, the instruments will probably be in every household, and will, we anticipate, become "everybody's telegraph." A telegraph complete, consisting of a set of instruments, connecting wire, and all adjuncts, is to be supplied at a price which will bring it within "everybody's" reach. Such, then, is this remarkable invention, as wonderful as it is simple. Whether as a philosophical instrument, as a commercial enterprise, or even from its cheapness as a scientific toy, it is destined to command "universal" patronage.

ON SYNOPTIC WEATHER CHARTS.

THE more we contemplate the progress of meteorology during the present century the more we become impressed with the conviction that the best mode of treating meteorological data with the object of tracing the origin, cause, and destination of the aërial currents which determine the character of the weather of any country is the graphic or symbolical method of exhibiting such data, so as to give a bird's eye view, as it were, of the state of the atmosphere over the largest possible extent of the earth's surface. This is the method upon which the cyclonists have developed the laws of tempests, from the crude data furnished by the ordinary log books of ships, in which neither winds nor weather were recorded with much regard to accuracy, while the barometers and thermometers used were generally defective and differed each from each, few, indeed, agreeing with standard instruments.

In 1857 the Meteorological Office made arrangements for giving the method an extended trial, not without reason expecting fruitful results. Observations were collected for the winter 1856-7 over the area comprised within the parallels of 40deg. and 70deg. N., and the meridians of 10deg. E. and 30deg. W., from the sea as well as from the land. Ships, lighthouses, public and private observatories, both at home and abroad, zealously co-operated and sent in their records. Therefrom it appears a series of charts was compiled exhibiting simultaneous states of the atmosphere over the British Isles and adjacent seas, especially the direction of wind current and its strength at certain times referred to the first meridian, rain also and fog, besides other features. The direction of wind was shown by a line drawn to leeward from the place of observation, in length proportioned to its strength or force. Pressure and temperature duly corrected and reduced were likewise shown, but in what manner we are not informed. Being intended to express consecutive simultaneous states of the atmosphere—as if an eye in space looked down upon the whole extent at one time, and afterwards took similar views at regular intervals of hours or days, so as to obtain sequences of synoptic conditions—Admiral Fitzroy termed them very appropriately synoptic charts. The report of the Meteorological Office for 1858 states: "Among the results already obtained from these charts is the true north and south or meridianal direction of certain atmospheric wave lines (those of the troughs as well as those of the crests), the diminution of the wind's strength or force over land, and evidence of a continuous alternation or opposition of the great polar and equatorial currents of the atmosphere." The next report of the office was presented to Parliament in 1862, and in this the subject is again alluded to as follows:—"In 1857 it was first arranged that simultaneous observations should be made daily at a large number of selected stations in the British Islands, also in and around the Atlantic and at places on the European continental coasts. By combining these observations in synchronous charts and otherwise, it was discovered that, irregular as changes of wind and weather seem to our usual apprehension, there is really so much uniformity and similarity of character in successive variations that, by means of a comparatively small number of observations made daily at a few selected stations sufficiently far apart, and a central station to which meteorological telegrams are sent from the outlying stations, it was seen that distinct intimation of marked changes of weather and warning of dangerous storms might be given at the centre, and thence to all other points of any telegraphic combination." (p 11.)

A few pages previously, in the incongruous way that official reports are usually drawn up and allowed to pass, it states that "By continued and consecutive series of charts, several hundred in number, constructed on the simultaneous or synchronous principle, an insight into the laws of our atmosphere—into meteorological dynamics (distinct from statical results previously obtained at observatories and elsewhere), has been gained, which has enabled us to know what weather will prevail during the next two or three days, and, as a corollary, when a storm may occur. These seem to be satisfactory and rewarding results." (p. 4.)

Admiral Fitzroy reproduced these statements, with more or less alteration, in his work entitled "The Weather Book," published in 1863, but it is important to note (at p. 34) he adds to the discoveries made by means of the charts, "real proof of areas of depression" of barometric pressure. At p. 107 (we are quoting from the first edition) we read: "Soon after a few of the earlier synoptic charts were partly filled, it became apparent that while there are various currents, sweeps, or circuits in any given area of our temperate zone, intermixed and incessantly moving, the whole body of them (as a connected group), the entire mass of the atmosphere in our latitude, has a constant, a perennial movement towards the east, averaging about five miles an hour." It is remarkable that he calls this a "key to the subject" of foretelling common alternations or changes of wind and weather! This law, if it be indeed fact, is referred to again and again in this most discursive book; but we fail to find that any proof of its reality has ever been made apparent, and it seems to us that proof is eminently required as to the lateral motion towards the east of all winds coming from any of the points of the compass having E to them. Is it not to be regretted that no special report has ever been made of this elaborate investigation? The extensive gratuitous co-operation given to the work, and the great expense it must have been to the public, ought to have rendered it an imperative duty of the office to have reported fully what had been done, and what results had been obtained. Admiral Fitzroy appears to have regarded the experiment as made to gain experience for himself individually, and no doubt he turned it to good account when he inaugurated his system of telegraphing daily weather, grafting on it his method of forewarnings for storms, and his attempt at forecasting weather. Doubtless the public even now benefit by it, in the present practice of the office in giving daily reports of weather and intelligence of atmospheric dis turbances. It would be curious to know whether this long series of charts bears out

the law of wind direction and force in relation to barometric differences of pressure. If so it is certainly very unaccountable that he should have stated that "Neither isobarometric curves nor any kind of wave or crest lines seem to show directions of wind"—Report 1864 (p. 23)—and that "the highest barometer and lowest temperature are about midway in the polar current, the lowest or least tension with the warmest air being near the middle of each tropical current." (p 22.) A corroboration this of Cowper's lines—

Reasoning at every step he treads,
Man yet mistakes his way.

These statements are now well known to be incorrect, and the inference is that his charts, somehow or other, failed to interpret the law truly. If this is the case, then there were either some radical defects in the method of charting, or the materials used were bad. In either case, it would be instructive to know the cause of failure. It is as important to eschew doubtful data as it is to avoid defective modes of investigation.

Omission to do what is necessary
Leaves a commission blank to danger.

A similar work has been taken up by M. Le Verrier, Director of the Imperial French Observatory, but how differently has he proceeded. The charts are published periodically as atlases, and show simultaneous weather states over the whole North Atlantic. As specimens of lithography they are really excellent. The plan of execution is simple and readily understood. However, we have heard objection to the manner of dealing with the data in reference to time. It appears that the charts are not strictly synoptic, the data not being reduced to exact instants of time by allowing for differences of longitude. This, in our opinion, must vitiate the value of such charts. We are bound, however, to state that we have only been able to obtain a cursory glance at these atlases, and they require to be examined and compared with great care in order to arrive at any generalisations that they may afford. We trust that some English meteorologist who has access to them will give them a special study, and communicate to the public his inductions from them. The field must be a fruitful one if it only receive better cultivation. We owe much of our information respecting the laws of weather, as at present understood, to the labours of Fitzroy, and it seems apparent that he gained his insight into these laws from the synoptic charts which he constructed in 1858, from which originated his telegraphic weather scheme, commenced practically in 1860.

THE EDMUNDS CASE.

THE proceedings instituted against Mr. Leonard Edmunds by the Crown for certain moneys claimed by it, have been so frequently before the public that it is unnecessary to enter again into their details. We may briefly mention that after the Chancery suit had dragged its weary length through a number of hearings, it was referred to arbitration. The arbitrators set diligently to work to bring the question of Mr. Edmunds' liability to an issue, and after several sittings they took time to consider their award, which they have now made. To the arbitrators was referred not only the Crown's claim against Mr. Edmunds, but, on the other side of the question, they were to make any recommendation to her Majesty's Government on account of any substantive claim of Mr. Edmunds against the Crown, or on account of any claim against the Crown in consequence of the reports of Messrs. Greenwood and Hindmarsh. The arbitrators sat eleven days in public, taking evidence and hearing counsel in the case. In their award, which has just been made, they find that there is still due from Mr. Edmunds to the Crown, £7,142 13s. It may be added that this sum of £7,142 13s. is independent of and in addition to the sum of £7,872 5s. 6d. refunded by Mr. Edmunds in September, 1864, making in the whole £15,014 18s. 6d. We append a verbatim copy of the finding of the arbitrators, which is as follows:—

We award and adjudge that, on the taking and adjusting of the accounts, in the said order referred to, there is due by the said Leonard Edmunds the sum of £8,544 18s., including the sum of £3,033 16s., due from him on account of fees and emoluments received by him in respect to the parchments account.

And we award and adjudge that there are, having regard to all the circumstances, moral grounds for recommending the Government to relieve the said Leonard Edmunds from a part of the moneys due from him on account of the said fees and emoluments received by him in respect of the said parchments account; that is to say, to the extent of £1,402 5s., and we recommend accordingly.

And we award and direct that the said Leonard Edmunds do pay to her Majesty the sum of £7,142 13s., being the amount remaining due from the said Leonard Edmunds upon the taking and adjusting of the said accounts, after deducting the sum of £1,402 5s. And as to the said substantive claims brought before us by the said Leonard Edmunds against the Crown, having regard to all the circumstances of the case, we make no recommendation to the Government in relation to any of such claims.

And as to the said suit in Chancery, we award, adjudge, and decree that neither party has any claim against the other in respect of any matters in question in the said suit not concluded by the said decree or by this award.

And we further award and adjudge that each party do pay his own costs, as well of the said Chancery suit as of the reference; and that the Crown and the said Leonard Edmunds do each pay a moiety of the costs of the award.

In witness whereof we have hereunto set our hands this 27th day of November, in the year of our Lord 1869.

(Signed) George Denman.
Charles E. Pollock.

THE THEORY OF STRAINS.

WERE any proof required that our knowledge on the subject of the strength of materials was dependent upon somewhat antiquated sources of information, it is furnished by the opening paragraph of Mr. Stoney's new volume.* In it he is compelled to refer to experiments conducted exactly fifty years ago in order to commence his remarks on compressive strains. Anyone who is well acquainted with the history of the experiments that have been made with reference to the resistance of various materials to strains of different kinds must be aware of the spasmodic nature of their occurrence. The series of valuable empirical results obtained during the designing and execution of the Menai Bridge was never systematically followed up. No sooner was that magnificent work completed than no further thought was bestowed upon the means which had alone rendered the design successful. We do not mean to assert that no experiments have been made since that time which are not, or rather which might not be, of value to the profession, but they have been conducted generally by private parties for the sole purpose of self-satisfaction. That object once accomplished no pains are taken to render the results of public utility, nor even during the experiments to elicit any information but what may be of interest to the parties themselves concerned. So far, therefore, as the professional man is in question or the hope of improving our professional knowledge on the subject, such experiments might just as well not be undertaken. Moreover, supposing that the various experiments that have been undertaken from time to time by private parties had been made public and conclusions deduced from them in the shape of rules and calculations, yet the same confidence could not be put in them as in those drawn from a thoroughly organised series carried on under the same conditions of time, place, and superintendence. The mere labour of compiling the results of a large number of heterogeneous experiments, of reconciling the discrepancies, and adjusting the differences would be exceedingly great, and the uncertainty of their accuracy would be still greater. Engineers would feel no confidence in them and their end would thus be completely frustrated. With these preliminary observations we turn to a consideration of the contents of the volume before us.

Any author who treats of compressive strain must, similarly to Mr. Stoney, draw nearly all his information from the researches of the late Mr. Eaton Hodgkinson and those who were associated with him in the elaborate series of experiments he undertook. So also to a certain extent with the subject of extension or tensile strain, especially so far as it affects cast iron. Practically the tensile strength of cast iron is of very little importance. Bearing in mind that it is not safe to strain cast iron in actual working beyond 1·25 tons per square inch of sectional area, it is clear that its duties in this capacity will always be of a very limited character in any design which is in accordance with the correct principles of construction. It is well known that in wrought iron the shearing strength and the tensile are practically the same. But the same identity does not exist in steel with reference to these two strains, since the shearing strength of rivet steel is only three-fourths of its tensile strength. The important point in connection with this difference is that it will very materially influence the arrangement of jointing and joining different pieces of steel. This will have to be very carefully considered in disposing the joints in the flanges of a steel girder or other structure of that material. So soon as the spans of bridges attained any degree of magnitude it became imperative to provide some means of permitting the alterations in the dimensions to take place unchecked. Arches and the cables of suspension bridges require no special provision of this kind. The former simply rise at the crown, and the latter drop at the lowest point of their catenary. Horizontal girders expand and contract in proportion to their length at their extremities, and it is clear that unless they can do this freely they will alternately push outwards and pull inwards the abutments upon which they rest. For small spans Mr. Stoney mentions that sliding surfaces may be used, and rollers for larger spans. There is only one point to be attended to in this matter, and that is, whether sliding surfaces or rollers be used, see that they act. It is worth bearing in mind that a change of temperature of 15deg. Centigrade in cast iron is equivalent to a strain of one ton per square inch, and that an alteration of only 8deg. is sufficient to cause the same result in wrought iron. Tubular girders and all those pertaining to the solid-sided type of construction are much more affected by alternations of temperature than the open or lattice web principle.

Our author, in his chapter on "Flanges," points out the manifest superiority, as regards stiffness, possessed by a number or pile of plates over the cellular system, thereby confirming the often expressed opinion of Mr. Hodgkinson that thick plates are the best protection against buckling. The argument that has been urged against the uniting together of a number of plates is invalid. There is no difficulty in getting the riveting well done, and rivets have been used eight inches in length, and the holes have been subsequently found perfectly filled up when the plate was sheared across to examine the state of the work. The minimum thickness that should be employed for the side of

* "The Theory of Strains in Girders and similar structures; with observations on the application of theory to practice, and tables of the strength and other properties of materials." By Bindon B. Stoney, B.A., Member of the Institution of Civil Engineers, and engineer to the Dublin Port and Docks Board. In two volumes, with numerous illustrations, engraved on wood by Oldham. Vol. 2. London: Longmans, Green, and Co. 1869.

a plate girder is put by Mr. Stoney at one quarter of an inch, but it is open to question whether this is not fining down the material too much. Many engineers will not use a plate less than three-eighths thick, and we are disposed to consider such a resolution a very wise one, although the lesser thickness is defended upon the ground that, by the aid of stiffening irons, sufficient strength can be imparted to it. Against this defence, which is valid to a certain extent, must be set the fact that no plate is stronger than its weakest part, and that a distinction must be drawn between increasing the whole sectional area, and consequently the strength of the whole web or side, and augmenting merely the strength of certain portions of it.

If there is one chapter more than another in the book that we should especially recommend to the notice and careful study of our readers, it is that on the "Working Load." The remarks are not confined to iron structures, but embrace those of timber, brickwork, and masonry. Considerable diversity of opinion has always prevailed among engineers from the earliest times respecting the ratio between the ultimate and the working strain of any material. At the present day the question is still undecided. As an example, the allowance of weight to be made per square foot, as the maximum that is to be provided for in designs for public road and street bridges, is variously estimated, and ranges from 70lb. to 147lb. per square foot. Our author recommends 100lb. as a safe limit, but a more convenient one for calculation and remembrance would be 112lb., which would give twenty square feet to the ton. An appendix and several plates are attached to the volume, the former containing a description of the principal types of bridge construction recognised by the profession, and the latter serving as illustrations to the text. Both Mr. Stoney's volumes should be in the possession of everyone who lays any claim to scientific designing and who may be desirous of possessing the most recent information with respect to so important a branch of knowledge as the theory of strains and the strength of materials.

TELEGRAPHIC NOTES.

WE are glad to be able to announce that the "Great Eastern," which carries the Bombay and Suez section of the British-Indian Submarine Cable, arrived at St. Vincent, Cape de Verds, on November 19, after a successful passage from Portland of thirteen days. Captain Halpin reports that the big ship behaved remarkably well during the voyage, and that the weather had been fine and the sea smooth the whole of the time. In consequence of an almost entire absence of wind no sails could be used, and the average steaming power was 7¾ knots per hour all the passage to St. Vincent. "Everything," says Captain Halpin, "has gone on most satisfactorily since we left; all hands are well, and if the water keeps smooth I expect to leave here on the 25th for the Cape of Good Hope. The weather here is unusually hot, and I am wishing myself at sea again." The passage from Portland to the Cape de Verds was unattended by a single hitch. After taking in supplies at the Cape of Good Hope the "Great Eastern" will proceed direct to Bombay, and commence at once to lay down the cable—a portion of which is now *en route* by the Suez Canal to the Red Sea.

We understand that the arrangements for the taking over of the telegraph system by the Government are now not likely to be completed before the end of January next. Meanwhile, it is believed that the negotiations between the Government and the companies with regard to the time and mode of payment of the compensation money have not yet been concluded, although an early announcement is expected. With regard to the financial aspect of the question, it appears that the total sum to be raised will probably be about £7,000,000, taking into account the expenses in connection with the reconstruction and enlargement of the general business. But the portion to meet the awards to the companies is limited to £5,715,048, and an impression is entertained that the large balances that will accumulate in the Exchequer in January from the new arrangements regarding the income and assessed taxes will, with or without some assistance from the Bank of England, prove sufficient for that purpose. Another account which has reached us says that the Chancellor of the Exchequer has arranged his resources for the purchase of the telegraphs on the 1st proximo. He will, it is alleged, borrow from the India Council, also from the Post-Office and other Savings Banks, and also from the Consolidated Fund. Should he require a little further assistance he may obtain an advance from the Bank on deficiency bills.

The Russian Government has granted a concession of thirty years to M. Titgen, Councillor of State to the King of Denmark, M. Erickson, a merchant, and M. Pallisen, consul-general for that country at St. Petersburg, for the establishment of submarine telegraphic lines between Asiatic Russia and Osaka, Yokohama, or Nangasaki, in Japan; and Shanghai, Fou-djaon, and Hong Kong in China. The company thus formed will ask for the authorisation of the Chinese and Japanese Governments, and the Russian executive will lend its good offices in the matter. The concessionaires bind themselves to attach this system of telegraphy to a station and telegraphic line of the state in Russia in Asia.

Captain R. B. Oldfield, of the Royal Navy, an experienced officer, has been granted leave by the Admiralty, and has proceeded, on behalf of the Telegraph Construction and Maintenance Company, to Siam and the Malay Peninsula for the purpose of exploring certain routes by which that company proposes to establish a telegraph communication from Burmah, the Tenasserim Provinces, and Siam with Penang, so as to throw the traffic upon the British Indian Extension Company's cable, which will be laid next year between the Straits of Malacca and Ceylon.

We learn that a company is in course of formation, to be called the Anglo-Australian and China Telegraph Company. They propose to establish a submarine telegraph between Calcutta and the Australian colonies, with intermediate stations at Penang, Malacca, Singapore, Batavia, and the Dutch settlement at Macassar, the cable terminating in Queensland, at the head of Gulf Carpentaria, to which point the telegraph system of Australia will be completed in 1870.

It is stated that several new submarine cable companies are coming out, and that they promise to increase during the next two or three months. A variety of mining enterprises, some of them American and Australian, are in course of organisation, so that the much-needed activity in industrial enterprise is anticipated.

In order to effect a direct communication between the French Atlantic Telegraph Cable and London, a submarine cable between Salcombe and Brest is now being laid. The shore end was on last Friday landed at Salcombe, Devon.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

TO DYE MACINTOSHES OR INDIA-RUBBER CLOTH.

THE india-rubber garments which still bear, and will perpetuate, the name of Macintosh, have not, it must be admitted, a pleasing appearance. Putting aside all objections on the score of fit and elegance in the coats, and granting that the ladies' capes do not leave much to be desired in their shape, there is still a sad want of variety of colour. We have merely a choice between funereal blackness and a staring dirty white, which is even more unpleasing. For this, unfortunately, there is every excuse. The mineral ingredients mixed with the rubber to give colour and substance to it are necessarily subject to the action of the sulphur employed to effect the vulcanisation, and although it would not be impossible to produce a few dull shades of colour even under these circumstances, manufacturers apparently do not care, or are not sufficiently instructed, to produce the necessary compounds. A mineral colour mixed with the rubber would have the recommendation of permanency; but, so far as we can speculate without making experiments, the shades producible would be somewhat dull. A process, however, comes to us from Germany which seems to make it possible that the brightest of the aniline colours may be applied to rubber garments. Necessarily, the material being quite impermeable, the first step is to get a surface to fix the colour—and this is done by coating the cloth with albumen, just as is done in the case of cotton, which alone will not take the aniline dyes. For this purpose, if we take the case of a zephyr cloth—that is, the rubber compound spread upon silk—the surface of the rubber should be brushed over with albumen, which must be allowed to dry thoroughly. The cloth may then be passed through the dyeing bath, and the colour would be taken both by the silk lining and the albumenised rubber. A reversible garment would thus be obtained, exhibiting pretty much the same shade of colour on both sides, and with aniline dyes a sufficient variety of shades could be procured to make ladies' cloaks, at all events, ornamental as well as useful. When the Lord Mayor or Royalty appears in public in wet weather every spectator sympathises with the flunkies, whose gorgeous liveries are concealed under dirty-drab macintoshes. Henceforward, thanks to this happy suggestion of a German chemist, the royal footmen may turn out in the worst weather in bright red, and those of the Lord Mayor (if such be his choice) in the clearest blue. We may commend this process to the notice of manufacturers, and also of dyers, and shall soon hope to see some applications of it.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this society on the 7th ins. Mr. C. H. Gregory, President, in the chair, the first ballot of the session 1869-70 was taken, when the following forty-seven candidates were duly elected, including six Members, viz.:—Mr. J. W. Blackburne, Oldham; Mr. F. Charlton, Northumberland; Mr. George Gilroy, Wigan; Mr. John Knowles, Pendlebury; Mr. Francis Mathew, Bombay and Baroda Railway; and Mr. H. F. Whyte, A.B., Bombay and Baroda Railway. Forty-one gentlemen were elected Associates, viz.:—Mr. J. Abernethy, jun., Alexandra Docks, Newport, Mon.; Mr. E. Armitage, Westminster; Mr. G. F. Armstrong, M.A., Norfolk-street; Mr. J. H. Babington, East Indian Railway; Mr. J. Battersby, East Indian Railway; Mr. G. Blaxland, jun., Cannon-street; Mr. A. B. Bradbury, Madras Irrigation Works; Major Frederic Brine, R.E., Simla; Mr. E. J. Bristow, Copthall-buildings; Mr. J. B. Cooper, Stafford Railway; Mr. J. Dixon, Laurence Pountney-hill; Mr. T. J. Ellis, Westminster; Mr. A. Field, Widnes; Mr. C. Flood, Falmouth Harbour Works; Mr. J. G. Gamble, B.A., Albert Dock, Hull; Mr. L. A. Golla, Extension Works, Chatham; Mr. F. B. Henslowe, Oudh; Mr. A. S. Hewitt, New York; Mr. W. Innes, Lieut. R.E.; Mr. E. Lawrence, B.A., Lambeth; Mr. A. Leslie, Edinburgh; Mr. F. Livesey, Gas Works, North Shields; Mr. W. H. Long, Union Club; Mr. J. W. Miers, late of Rio de Janeiro; Mr. J. W. Pease, M.P.; Major C. Pollard, R.E., Central Provinces, India; Mr. J. Prestwich, F.R.S., Shoreham; Mr. C. Prime, Ceylon; Mr. W. E. Rich, Southwark; Mr. W. I. Roach, Trinidad; Mr. W. R. Scanlan, Walsall; Mr. H. A. Taylor, Westminster; Mr. C. Thwaites, Bombay; Mr. H. C. A. Timmins, West Malling; Mr. R. H. Twigg; Mr. R. Vigors, Old Jewry; Mr. H. C. E. Wenden, Great Indian Peninsula Railway; Mr. C. Wilks, Melbourne; Mr. A. F. Wilson, Brazil; Mr. T. Wrightson, Stockton-on-Tees; and Mr. A. F. Yarrow, Poplar.

It was also announced that the Council had recently admitted the following candidates as students of the institution, viz.:—Messrs. E. A. Abbatt, J. V. Aguilar, R. D. Baillie, E. Bainbridge, G. H. T. Beamish, F. E. Burke, J. Cartmell, G. H. R. Deverell, G. W. Fuller, R. N. Hodges, R. S. Hodgson, H. F. Joel, C. U. King, R. Lathbury, S. Lambert, P. W. Meik, W. I. Noad, G. W. Randolph, G. Remington, jun., J. C. Searle, J. Strachan, J. J. Talman, A. G. Tengbergen, C. Thomson, F. E. Townshend, A. W. Tyrrell, G. W. Usill, D. Wallace, J. S. Webb, A. Wheatstone, and J. M. Wrench.

IT is said that in view of the opening of the Suez Canal, the Russian Navigation and Trading Company is about to establish, immediately, a through service of steamers between Odessa and Bombay.

STEAM FIRE ENGINE FOR LITTLEPORT.

A NEW steam engine has been recently supplied to the parish of Littleport, near Ely. This engine has been specially constructed for the Fen district, for it is well known that the roads in that part of the country are totally unlike our town roads, being very marshy, and covered with deep ruts. The practicability of transporting such a machine at a rapid rate was very much doubted, but owing to the visit of Mr. J. Compton Merryweather, one of the firm of the manufacturers of the engine, previous to its delivery, all such doubts were removed, as special arrangements were made in the construction of the wheels and carriage work to obviate this. The engine supplied is similar to those made by Messrs. Merryweather and Sons for her Majesty's Government, the Royal dockyards, various country towns, and one of this class was exhibited at the Smithfield Club Cattle Show. The Littleport engine was worked on its arrival in the town. Steam was raised to a working pressure of 100lb. in 10½ minutes, the coal used being very inferior and the wood damp. Half a mile of delivery hose was connected to the delivery of the engine, and the result was that an inch jet was discharged 65ft. from the nozzle, which would reach far above the highest house in the town. The trials were superintended by Mr. J. C. Merryweather and Mr. T. Stancliff, the manager to Messrs. Merryweather and Sons, and the brigade was drilled for some hours, during which different experiments were made much to the satisfaction of the overseers, parishioners, and various gentlemen who had come from Ely and the neighbouring towns to witness them.

SOCIETY OF ENGINEERS.

AT the last ordinary meeting of the Society of Engineers, held on Monday, the 6th inst., Mr. F. W. Bryant, President, in the chair, the adjourned discussion took place on Mr. Charles J. Light's paper on the need of further experiments on the strength of materials. After this discussion a paper was read on apparatus for measuring the velocity of ships, by Mr. Vaughan Pendred. The author pointed out the various attempts that had been made to produce instruments for this purpose, and described a few of the most practical, including those of Massey and others. He then proceeded to explain in detail, and by the aid of models and drawings, the beautiful invention of the Rev. Edward Lyon Berthon for measuring the speed of ships. It consists simply of a tube dipping a few inches below the bottom of the vessel and communicating with recording apparatus on deck or in a cabin. The tube is closed at the bottom, but has a hole in the side by which the water is admitted. Pressure is communicated to a column of mercury, which registers the speed of the ship. We purpose giving this paper *in extenso*, and therefore reserve our detailed description till then. An interesting discussion followed the reading of this paper, in which Admiral Halsted, the Rev. Mr. Berthon, and other gentlemen interested in the question took part. At the close of the discussion —which was adjourned to the 20th inst.— the following candidates were balloted for and duly elected as Members:—Mr. George Farren, C.E., Clynnog, Carnarvon; and Mr. Alfred Hope, gas engineer, The Hollies, Hastings. As a foreign member Mr. George Thomas Light, Adelaide, South Australia; and as an Associate Mr. Frederick Williams, Abingdon-street, Westminster.

STRENGTH OF THE ROYAL NAVY.

AN Admiralty return shows that the number of first-class boys in Her Majesty's service was 4,335 on April 1, 1866, 3,984 on that day in 1867, 4,621 in 1868, 4,738 in 1869; and of second-class boys (nearly all in training ships) 2,690, 3,174, 3,025, and 2,999 at the respective four periods. The number of boys entered for the first time on board Her Majesty's ships was 2,225 in the financial year 1865-66, 3,123 in 1866-67, 3,077 in 1867-68, 2,351 in 1868-69. The number of *bona fide* seamen who were rated from boys was 1,470, 2,399, 2,078, and 1,802 in the four years respectively. The number of *bona fide* seamen (exclusive of pensioners on the books of Her Majesty's ships and coastguard men on shore) on April 1 was 19,883 in 1866, 19,624 in 1867, 19,456 in 1868, 18,915 in 1869; and the number of coastguard fleet men on shore 3,745, 3,892, 3,980, and 3,795 respectively. The number of *bona fide* seamen who entered the Royal Navy from the shore, merchant, or other service for the first time in the year 1865-66 was 485; in 1866-67, 409; in 1867-68, 445; in 1868-69, 214; and the numbers who re-entered were 1,136, 920, 844, and 775 respectively in those four years. The number of *bona fide* seamen who left the service, being paid off to the shore, or discharged as "objectionable," &c., was 2,362 in 1865-66, 2,141 in 1866-67, 1,886 in 1867-68, 2,374 in 1868-69; and the number who left from other causes—death, invaliding, desertion, discharges with disgrace, by purchase, or on pension—2,007, 1,936, 1,612, 1,528 respectively. The number of boys who left the service from all causes was 430, 634, 550, and 552 respectively in the four years.

ANGLO-FRENCH COMMUNICATION.*

By Mr. Zerah Colburn.

FROM the period of the Roman invasion down to the present day, the English Channel has never been crossed otherwise than upon its own surface—unless the late Mr. Green's aerial voyage be an exception. Neither Julius Cæsar, however, nor William of Normandy lived in a railway age, and but for the miseries of sea sickness, they doubtless preferred the sail to the best roads of their respective times. But since railways have become the recognised means of communication on land, the question has been pressed, and of late very urgently pressed, whether they may not be also made available for communication—not exactly upon the water, although there is a floating railway across the Upper Rhine—but over or beneath the water, and especially over or under the comparatively narrow and shallow strait which separates our island from the continent. There are *soi-disant* patriots, it is true, who would on no account witness the loss of our absolutely insular position, patriots to whom England is a castle, and the stormy Channel its moat, and who would not have so much as a drawbridge thrown across that moat, or a hidden way mined beneath it. Such considerations are, however, apart from the present purpose, which is, not to inquire into the international policy or financial expediency of solving this great intercostal problem, whether by a bridge, a ferry, or a tunnel, but to examine, very briefly, the engineering and constructive aspects of these proposed works. It is probable that the greater the apparent impracticability of either or all of these schemes, the greater the general interest they attract, and perhaps the same interest may be said to exist also among the members of the engineering profession.

The question of bridging the Channel has been mooted, and at least one scheme has attained some degree of public prominence. The designer's first proposal was to jump the Channel at a single leap, but whether out of his regard, as has been asserted, for the wishes of the Emperor, or from a willingness to conform to certain immutable laws of nature which render such a plan impossible, he subsequently modified his design so as to include ten spans, and it has been since heard that he is willing to extend their number and reduce their width to twenty, of one mile each. Whether even such a superstructure, to say nothing of the piers in a maximum depth of 200ft. of water, and rising more than 200ft. above its surface, would or would not be practicable, is a question which may be safely left to those really competent to deal with it, and of these the designer himself can hardly be considered to be one.

Of the entire practicability and great advantage of a Channel ferry there can be no doubt whatever, whether it be established between Dover and Calais, or between Dover and Audresselles. It is quite practicable to ship and unship passenger and goods trains bodily, and thus to run them through, both ways, between London and Paris. Boats suited for this purpose, and harbours capable of receiving them, could be constructed within a few years at a cost much less than that of any tunnel, whether laid on the bed of the Channel, or carried through the chalk at any depth below it. Such boats would be in as striking contrast to the existing Channel service as that afforded by our finest hotels on the one hand, and the most uncomfortable lodging-houses on the other; or, if another illustration be needed, the most luxurious express saloon carriage and the most cheerless third-class conveyance to be found on any railway in the kingdom. But any boat service whatever, however excellent it may be, has its necessary drawbacks. No ferry-boat, even if nearly as large as the 'Great Eastern" herself, could wholly prevent the possibility of sea sickness, that unspeakable horror of so large a proportion of all landsmen, of whatever nationality. The time occupied in shipping and unshipping trains, however expeditiously the work was performed, would be considerable, and however high the speed of the boat as a boat, it could not exceed one-half that easily attainable by a railway train. As to the relative safety of a boat service and a train service, it is not now necessary to inquire, although something, if not, indeed, much, might be urged with reference to collisions in fogs or storms. But the chief objection to boats would be their high cost of working and maintenance. As it would not answer the convenience of the public to detain a boat until two, three, or more trains had arrived at either port, a boat would be required for every train, and its working charges might, therefore, be fairly compared with those of a single train. The consumption of coal alone, with boats of the proposed size and speed, would be from fifteen to twenty times as much as that for the train if run across by itself. The repairs and depreciation of the boats would be very much greater, per pound of their value, than that of the train, and the boats themselves could hardly cost less than £100,000 each, while the train carried, including the cost of engine and tender not carried, would not represent a cost much above £6,000 or £8,000. The wages of captain, engineers, firemen, stewards, porters, and crew would obviously be far beyond those of the three or four men working the train by itself, and these, and all other working charges, would be divided, mile for mile, upon a very much less number of miles per annum than the number made by the train if run by itself. There would not, of course, be any permanent way charges with which to debit the boat, running on nature's own highway, but as to capital charges, the interest upon the cost of the harbour works alone would probably be equal to that upon a railway costing £100,000 per mile. It is morally certain that a large Channel ferry, with a full complement of steamers, could be maintained only by a very decided advance in the fares, whether between the opposite coasts alone, or between London and Paris. Assuming that even as many as 100 passengers were taken across in a single train, the capital charges and working expenses would probably amount to £20 per trip, assuming the boat to make 1,000 trips of 20 miles each per annum, and thus the charge per passenger would be 4s. for 20 miles, or nearly 3d. per mile. The carriage of goods, specie, &c., would lessen this rate, but it is as likely also that the average number of passengers per trip would be very much less than 100. Nor is it at all certain that each boat could make four trips daily for 250 days in the year. None of these reasons, however, patent as they are to the observation of all, are conclusive against the Channel ferry. On the contrary, the ferry is the only means of maintaining comparatively expeditious and comfortable communication, of which the absolute practicability is beyond all question, while it could be got to work within probably two, three, or at most four years, and at a cost, including harbours, of probably little more than £2,500,000.

That branch of the question which possesses real interest—surpassing interest of uncertainty —at least for the engineer, is that relating to a subaqueous way across the bottom of the Channel, or a regularly excavated tunnel a hundred yards or so deeper down in the grey chalk or clay itself. It is, perhaps, the certainty (the question of first cost being for the moment dismissed) that a tunnel, once made, would prove the very best of all means of crossing the Channel, and the qualified uncertainty whether such a tunnel is even practicable at all, that give to the tunnel question its great, its even seductive interest to engineers. It need hardly be said that tunnels under water, or rather through the earth beneath the water, are anything but new or unusual. For very many years the tin miners of Botallack, in Cornwall, have driven their headings to a good distance beneath the very bed of the Atlantic itself. Just sixty years ago Trevithick nearly completed a tunnel beneath the Thames between Wapping and Rotherhithe, and but for imprudently making a bore hole from the roof through to the river bed, this tunnel would no doubt have been successfully opened. Ralph Dodd had made the same attempt before. Brunel's world-famed tunnel requires no remark, and it will be but a few weeks before Mr. Barlow's tubular subway will be carried through from the Middlesex to the Surrey shore. The longest tunnel under water is that, two miles in length, of the waterworks at Chicago, United

* Read before the Society of Arts.

States. This tunnel, although but 5ft. in diameter, is carried out to where the water above it is 40ft. deep, the tunnel itself being 30ft. below the bed of Lake Michigan. There is also a tunnel under the Chicago River at the same place. At home we have no less than three schemes for tunnelling beneath the Mersey, at Liverpool, and three for tunnelling beneath the Severn below Gloucester, and in both instances one of the three schemes will in all probability be yet carried out. Provided only the bed of the channel or river beneath which the tunnel is to be made is nearly or quite impervious, under-water tunnelling is no more difficult than underground tunnelling. And there may be shafts, even, to under-water tunnels, just as the Chicago Lake tunnel has its shaft through which the water supply is taken, but which was employed, during construction, for the ordinary purpose of giving a second working face and for discharging the excavated materials,—this shaft being two miles from shore. This tunnel was carried through a continuous bed of tenacious clay, as impervious to water as marble itself. But in the proposed Channel tunnel, to be made at a depth of about 500ft. beneath the surface of the sea, it is needless to remark that a single fissure in the chalk, however narrow, would be rapidly widened by the tremendous abrasion of water under the great pressure of 200lb. per square inch; so rapidly that probably no efforts to clear the workings could be expected to succeed. A fault of great vertical magnitude is well known to divide the chalk beneath London, although neither the precise line of this fault, to within a few yards, nor the width, if any, to which the chalk bed is separated at the point, are known. Whatever may be inferred from the geological analogies of the chalk on the English and French coasts, it cannot for a moment be positively asserted that a fault beneath the middle of the Channel does not exist, nor, it is as well to add, can it be asserted, on the contrary, that a fault does exist. The question can only be settled by a trial heading or driftway, and, whatever the real danger, there are plenty of navvies and miners who, knowing no fear, are ready and willing to face it when the eminent engineer, whose name is connected with the proposed undertaking, finds himself in a position to give the word. Let two headings, each eleven miles long, once be carried out to meet each other beneath mid-channel, and the success of the tunnel, so far as its completion is concerned, is assured. It would be a matter of long and tedious boring and blasting, and one in which uncertain millions would certainly be swallowed up, but it would all come right at last, supposing, of course, that by previous experiments upon that thirsty material, chalk, no excessive infiltration of water under a maximum pressure of 200lb. per square inch was found to take place, and there would be 24 acres of roof of each heading of 9ft. in width, the ceiling, if it may be so termed, of each heading of 9ft. width amounting to rather more than an acre per mile.

There are two distinct schemes for a tunnel beneath the bed of the Channel, but the same general certainties and uncertainties apply to both. It is only from geological inferences that either can claim superiority over the other. It would require space far beyond the limits of the present paper to deal even with the geological aspect of the question alone. It is but right, however, to remark that geological evidence, as far as it goes —for the materials at command are scanty—points strongly to the probability of the complete continuity and homogeneity of the chalk which forms the upper beds of the broad and shallow submarine valley separating our island from the Continent.

Bridging, steam-ferrying, and tunnelling fall within the ordinary range of engineering. But no engineer has yet attempted to lay down a railway upon the bottom of the sea itself—a railway, the passengers of which, like the Israelites of old, should go over, or, rather, under, dryshod, not only with a dense wall of water on either side, but with 80 fathoms or so over their heads. It is not the purpose here to enter at length on the relative advantages and disadvantages of subaqueous ways—a term employed merely to distinguish railways on the Channel bed from those in tunnels beneath it, as compared with railways deep down in the chalk. As, however, the remainder of the present paper will be chiefly devoted to the examination of the mode of constructing subaqueous ways, it will be but fair to enumerate the objections which may be urged against them. They are these:

Beyond some amount of uncertainty necessarily attaching to the laying of such ways, they might possibly be injured by the dragging anchors of vessels, or broken in two by the sinking wreck of an iron steamer dropping upon them. They might, possibly, suffer at the shore ends, where they rose to within the action of the waves in heavy storms. They could always be destroyed wantonly, and with little fear of detection, by sinking a charge of gunpowder upon them, at any portion of their length, and then firing the charge, at a safe distance, by electric wires. It might be urged, too, that a large tube, especially where it rose like a huge groyne, in shore, might cause injurious disturbances of the Channel bed, thus affecting navigation. In any case, the tube could be started and carried forward from but one end only, as it would be out of the question to attempt to bring together, water tight, the two closed ends, or for that matter the open ends, of two tubes in mid-channel.

These appear to be the principal, if not all, of the possible objections which could be urged against subaqueous ways. The weight of these objections depends probably more upon the individual opinions of those who advance or refute them than upon any evidence capable of demonstration. As for the dragging of anchors, the various proposals (and there are several) for tubes on the bed of the Channel provide for routes well off the Varne and Colbert banks, and, it need hardly be said, miles to the westward of the Goodwins; routes upon which vessels would seldom have occasion to anchor at all, even in the worst storms. Where an anchor dragged, however, with a force of even 150 tons—the highest chain cable test of Lloyd's proving house—this could not make any definite impression upon a continuous tube weighing 8 tons or more per foot of its length, for to move at all at least a quarter of a mile of tube weighing 10,000 tons would have to be dragged upon the Channel bottom. As for breaking the tube, say 4½in. thick of cast iron with a lining of 1ft. of brickwork, the chances would appear extremely improbable. But a greater security will appear when it is considered that a cast-iron tube, say 14ft. in diameter, and having no outer flanges, presents no point upon which an anchor could bite. The chances of an iron vessel foundering exactly across the line of the tube are, to say the least, by no means numerous. In shore, that is to say in shoal water, the tube would require to be protected by strong parallel breakwaters, as much to prevent vessels grounding across it as to prevent the action of the waves upon it. The risk of possible destruction by malice—the crushing in of the crown of the tube by the explosion of gunpowder upon it in ten, twenty, or thirty fathoms of water—is a risk of which each one must form his own estimate. This mode of destruction, the consequences of which would be irreparable for all time, could most certainly be resorted to by hostile or merely malicious feeling, with almost no chance at all of detection, whereas neither a bridge, nor a tunnel deep down in the chalk, could be destroyed without some difficulty, and the certainty of the timely discovery of the attempt.

The various proposals for laying subaqueous ways upon the bed of the Channel are as distinct from the ordinary range of bridge and tunnel engineering as the making and laying of submarine cables are distinct from the construction of land telegraph lines. Of what is technically distinguished as mechanical engineering, very little is now required for the construction of an iron bridge or a tunnel in earth and rock, but the construction and laying of a subaqueous way would be, to a large extent, the work of the mechanical engineer. Such a work, upon any plan, would be one attended with many contingencies, and so far as mere ingenuity is concerned (not that the necessity for greater ingenuity is in itself an objection), the subaqueous way would incontestably require far more originality of design for its making and laying than any other mode whatever of crossing the Channel. But as engineers always rise to the occasion, it may be assumed that a plan, physically possible in the abstract, would never fall through from the want of that elaboration and improvement which are summed up in the mind of the engineer in the single word "detail."

Perhaps the first quasi-practicable plan proposed for crossing the English Channel by means of a subaqueous way was that contained in an anonymous pamphlet printed in Dublin in 1858. The author proposed to construct a 15ft. tube from Dover to Calais, extending it, foot by foot, along the bed of the Channel, from the English to the French coast. Starting from the English coast, within a structure named a "head," or a "bell," this head fitting, water-tight, around the exterior of the tube to be extended, he proposed to put together each successive length of the tube within the head, and to push the latter forward as fast as the work proceeded, the head meanwhile lying on the bed of the Channel. The calculations of resistance, and of the quantities to be employed in the tube itself, were carefully worked out, and so far as the author has tested them, these calculations were correct upon the *data* assumed. This mode of construction ensures the advantage, if it be an advantage, that each portion, whether of 10ft. or even a mile, of the length of the tube, once laid, is not again disturbed at any subsequent stage of the work. But the designer appears to have foreseen an element of possible weakness when he asserted that even were the tube rolled over in the Channel no harm could result to the passengers, and no interruption to the train service. Inasmuch as the atmospheric system was relied upon for propulsion, and the passenger compartments were to be shot through circular tubes, it might not perhaps make any difference to the passengers whether their carriages bottomed upon one part of the tube or another, but it would be interesting to know what would become of the shore ends, and, for that matter, the passengers themselves within the tube, if a few miles of the latter were really to turn over in mid-channel.

The anonymous idea of 1858 has been lately worked out in much greater detail by an eminent English engineer, whose labours have been assisted by an Austrian member of the same profession. Their plan, which has now been for some weeks before the public, provides for a cast-iron tube of 18ft. internal diameter and 4in. thickness, to be carried out in 10ft. lengths, each length being formed of six segments. The work of putting together the successive lengths of the tube is to be performed on the bottom of the Channel, within a cast-iron "bell," as it is termed, this bell or shield being 80ft. long, 18ft. in diameter, and 8in. thick. The tube is to be packed, water-tight, within this bell, and the bell itself is to be forced forward 10ft. at a time, after that length of tube has been added to the portion already laid. For forcing forward the bell four hydraulic presses, each of a maximum force of 1,000 tons, are to be employed. The details of the scheme are most ingenious; at the same time perhaps not too much so, for many a mechanical project has been ruined by too much ingenuity. It is evident that from the very confined space but a dozen men or so at most could be effectively employed at a time within the end of the tube in putting the segments together, although a much larger number, were they required merely to work the hydraulic machinery, could find room in the forward portion of the bell, and it is evident that the rate of progress of the tube would be measured by the rate of working of the dozen or so of men employed in putting the segments together, the segments being brought, when the tube was nearly completed, from a distance of (say) twenty miles through the tube itself. The segments and bolts once made ready on shore, the whole labour of putting the tube together, the whole task of maintaining its intended course, and the whole of the responsible duty of inspection as the work goes on, would be performed under water, in an artificial light and with artificial ventilation, and where, upon the occurrence of any accident causing the sudden inroad of water, all within the tube must hopelessly perish. Should the tube crack and fill with water during the process of laying it is also hopelessly lost, since no moorings are or can be attached to it during the process of laying or afterwards. That the tube might crack at some point while the shield was being advanced under a force, according to the depth and the nature of the bottom, of from 1,000 to 4,000 tons, would be nothing very improbable. And what might be the chances of leakage, with nearly 65,000 joints made in the dark, or, rather, in a very feeble light, and under water, must be left to the imagination, the joints themselves being upwards of 200 miles in aggregate length, and, taking them as 8in. wide each, presenting a total surface, for the two parts brought together, at each joint of about thirty-four acres. There is probably, nothing physically impossible in the scheme, although it would be one attended with many improbabilities of success. Nor could this plan of construction be adapted to the irregularities of the Channel bottom, upon which the gradient would occasionally require to change from level to 1 in 100, making a difference of 1½in. between the joints on the upper and lower sides of the tube, thus necessitating special castings, or involving the risk of leaking. The particular tube now under consideration would have a multitude of external flanges, and it is not improbable that it might suffer from dragging anchors. These flanges and ribs are not essential, however, to the general plan.

(To be continued.)

IMPROVED VENTILATING FAN.

BY MR. J. LLOYD.

FIG. 1.

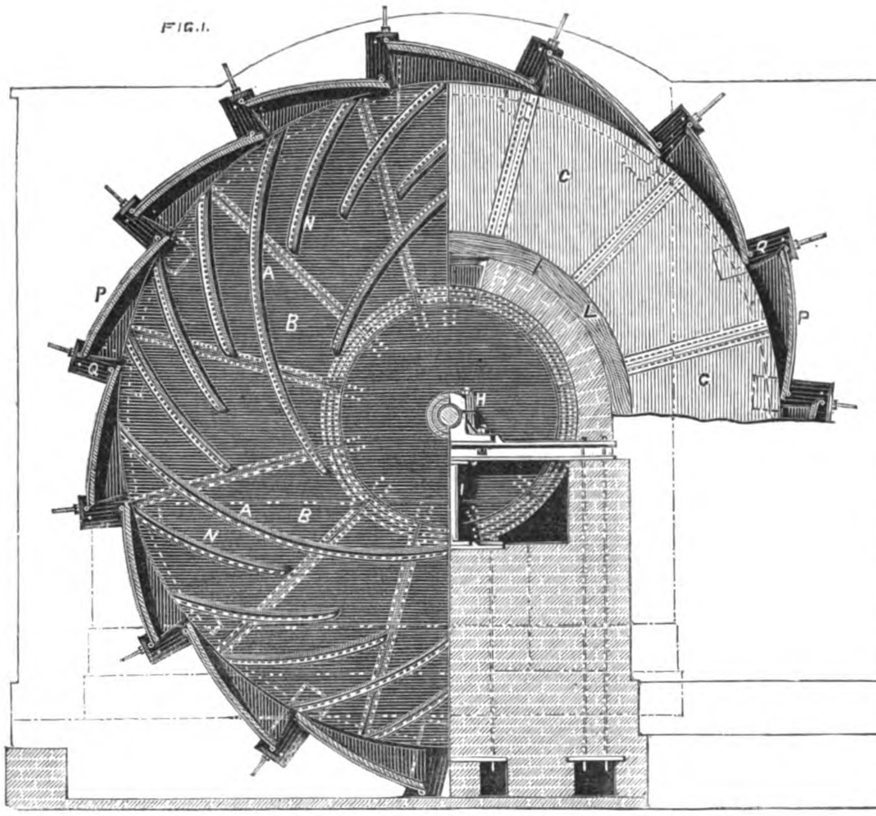
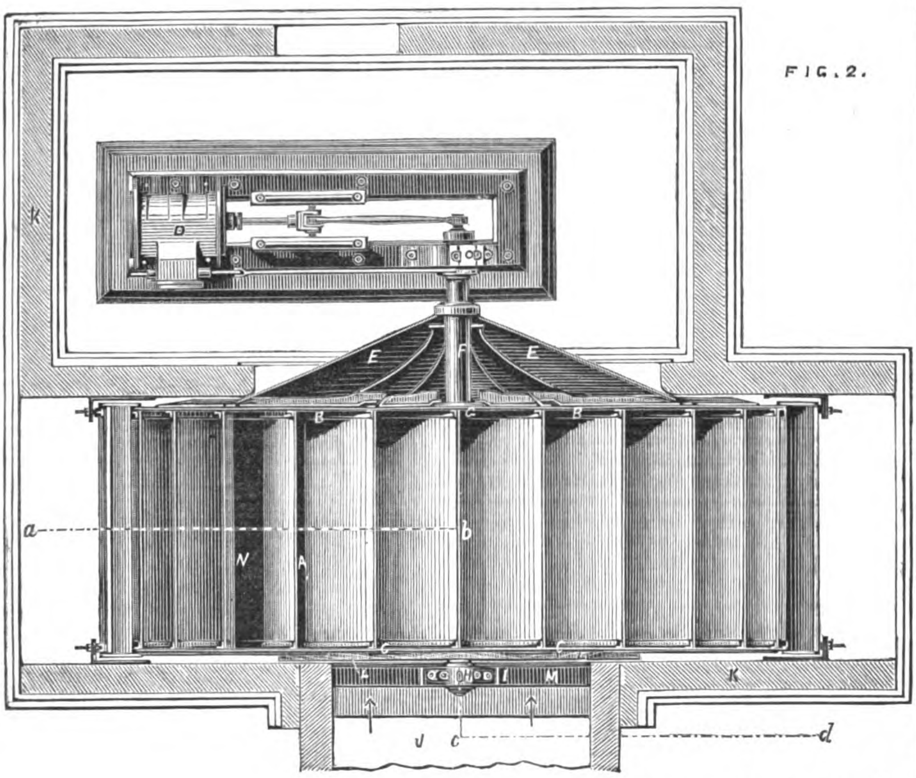


FIG. 2.



VENTILATING FANS.

MR. JOHN LLOYD, engineer to the Lilleshall Iron Company, near Shifnal, Salop, has just patented, through Messrs. Robertson, Brooman, and Co., patent agents, of 166, Fleet-street, some improvements in the construction of ventilating fans. The object of the invention is to construct the fans with a series of vanes or blades of varying lengths, and fitted between two discs. One of the discs is solid, while the other has a hole in its centre, through which the air is drawn. The solid disc is fitted to a face plate, by which it is rotated, or a shaft may be fitted through the solid disc, and bolted on the inside of it. Each blade is formed of a segment of a circle.

In the accompanying engraving, fig. 1 is a half sectional view taken through the line *a b c d* of fig. 2, which is a plan view of the same. A A are the blades, which are fitted to the insides of the discs B C; these blades are arranged in segments of circles from the outer edges of the discs to near the central portions, and are secured to them by means of angle irons and rivets. The disc D, which is nearest the engine D, is perfect, and has connected to it arms E, which are spread outwards near the centre for the purpose of being fitted to the axle or shaft F, by which the fan is rotated. The shaft is likewise connected to the disc B by means of a collar or socket G, which forms an additional support to the fan, and ensures its steadiness while revolving. The shaft passes through to the opposite side of the fan and finds a bearing in the plummer block H, which is fitted on the pedestal I. The disc C has the opposite sides of the blades A A attached to it by angle irons and rivets in a similar manner to the disc B. There is a hole in the central part of the disc C, which is in connection with the drift or air shaft or passage J, and as the fan revolves it draws air through the passage into and between the blades and drives it out into the atmosphere from the periphery.

To ensure the fan working as closely as possible to the wall K of the drift to prevent a re-entry of air, a ring of wood L is fitted on the outside of the disc C, which just touches the wall without producing unnecessary friction, and that part of the wall is covered with cement, in order to obtain a comparatively smooth surface for the wood ring to work against. In some cases, Mr. Lloyd fits a girder M across the opening of the drift and secures the pedestal to it. The girder gives rigidity to the fan shafts, and also serves to strengthen the wall or structure. Inside the discs B C are fitted shorter blades N N, which spring from the periphery towards the centre. They are fastened to the discs in a similar manner to the blades A A, and act as spreaders or dispersers of the vitiated air which accumulates at the centre of the fan. The periphery of the fan is enclosed by a series of adjustable flaps P, which are held in position by plates Q fitted on the side walls; one end of each of the flaps is hinged or jointed to the plates while the other ends are fitted to threaded rods, which pass through projections on the plates. Nuts are placed on the rods, so that the height of the free end of the flaps can be regulated to suit the speed at which the fan may be rotated in order to produce a steady withdrawal of the air from the mine or other place to which it may be fitted.

IMPROVED CARRIAGE LAMP.

SOME improvements in carriage lamps have been patented by Messrs. Howes and Burley, of Birmingham, and which are shown in the annexed engraving. Fig. 1 represents a portion

FIG. 1.

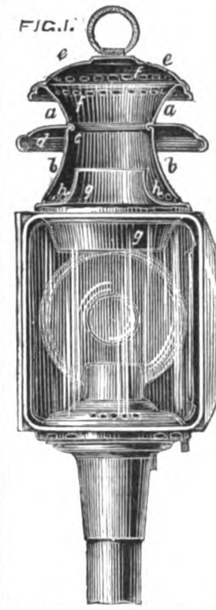
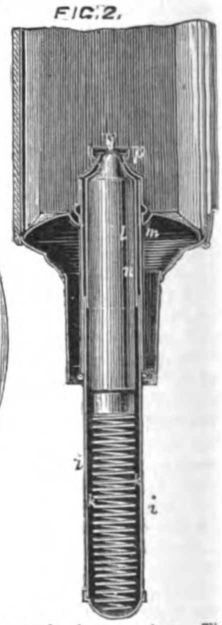


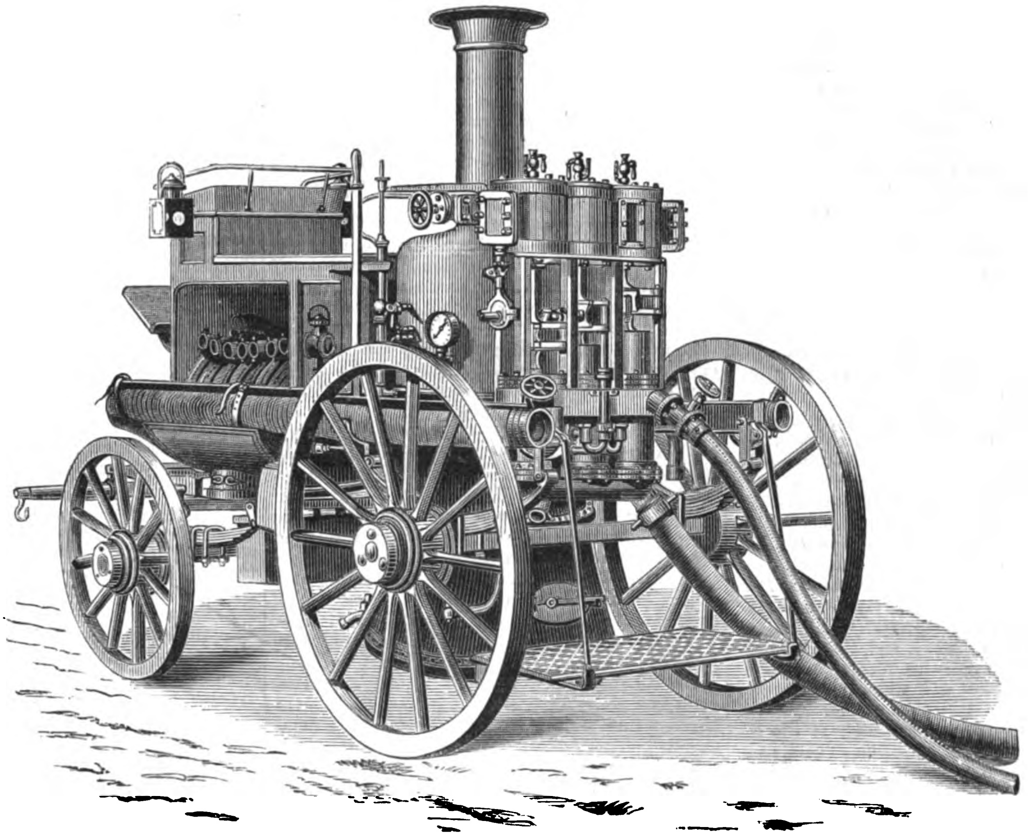
FIG. 2.



of the improved lamp, partly in section. The body of the chimney is made in two parts *a b*, which are secured together by their edges being closed upon one another by pressure. The junction of the two parts *a b* is marked *c*, and the manner in which the edges of the parts are closed upon one another will be understood by an examination of the sectional part of fig. 1. The middle flange *d* of the chimney is also secured between the two parts *a b* at the same time that the parts are closed upon one another. The closing of the two parts of the chimney with the middle flange *d* between them is effected by means of dies worked in a press. The top hollow flange or cover *e* of the chimney where it joins the top of the body is secured by pressure in the same way as the body and middle flange. In the upper part *a* of the chimney and top hollow flange *e* are holes *f f* for the escape of the vitiated air from the lamp instead of having holes in the vertical sides of the chimney for that purpose, as is usual. The position of the holes *f f* prevents the entrance of

EQUILIBRIUM STEAM FIRE ENGINE FOR DARLINGTON.

BY MESSRS. SHAND, MASON, AND CO.



air into the lamp in windy weather, and thereby ensures a steady flame. At the bottom of the ordinary chimney and projecting into the lamp and situated over the flame is an internal chimney *g*. At the bottom of the outer chimney of the lamp is a series of holes *h* through which air is admitted around the inner chimney *g* for keeping it cool. By the use of an internal chimney *g* over the flame an increased draught is obtained and a brighter light from the candle secured.

Fig. 2 represents in section the lower part of a carriage lamp provided with Messrs. Howes and Burley's arrangement for preventing the sticking of the candle in the lamp. *i* is the movable candle tube of the lamp in which the spring *k* for forcing up the candle is placed; *m* is the fixed candle tube, and *n* is the supplementary tube between the candle tube *m* and candle *l*. The supplementary tube *n* is contracted at top and rests on the top of the candle. It will be seen that the wax or tallow from the candle *l* is prevented by the supplementary tube *n* from coming in contact with the interior of the fixed candle tube *m*, and hence the sticking of the candle in the tube *m*, as frequently happens, is prevented. The inventors apply to the nozzle of the candle tube *m* a cup *p* in which the wax or tallow from the candle, should it gutter or run, accumulates. The wax or tallow is thereby prevented from passing on to the nozzle of the candle tube *m*.

Messrs. Howes and Burley's invention also consists of the following improvements in lamp irons and the parts of carriage lamps by which they are connected to the irons. The lamp irons consist of an arm fixed to the carriage having at its end a short tube or barrel into which the socket of the lamp fits. The barrel of the irons is lined with a metal not liable to corrosion by moisture. By this means the sticking of the candle socket of the lamp in the barrel of the arm is prevented. A rim is also made at the bottom of the barrel of the lamp iron to prevent the losing of the candle tube and spring by falling from the barrel. In order to fasten the socket of the lamp more effectually in the barrel of the lamp iron the rim at the bottom of the socket is capable of turning upon the barrel, and a screw thread is cut in the interior of the rotary rim. On the socket of the lamp is cut a screw thread of a size proper to take into that in the rotary rim of the barrel. When the lamp socket has been put in its place in the barrel by turning the rim at the bottom of the barrel the lamp is securely fastened to the rim and barrel.

THE MONCRIEFF GUN CARRIAGE.

YESTERDAY week a trial was made at Woolwich of the first service 7-inch barbette gun carriages constructed upon the Moncrieff principle. Since the system was tried at Shoeburyness, various modifications have been introduced by which the carriage has been simplified. The pawl and brake can now be worked by one hand, and the carriage altogether involves less labour in handling. On the present occasion five rounds were fired, one with 18lb., and the rest with 22lb. charges, and 110lb. shot, to test the recoil and action. The carriage worked with perfect success, although no previous adjusting round had been fired, as is the practice with ordinary carriages. The recoil was easy and gentle, the gun coming down exactly to its bearings with the recoil from the battering charges to the force of which it was theoretically adjusted, and with the 18lb. charge it came down far enough for loading. The carriage was not put upon racers but was laid down on the wood platform, the trucks resting upon pieces of smooth, flat iron. There was no pivot nor anything to prevent it driving back during firing; nevertheless, not the slightest backward movement was perceptible, the inference being that racers may be dispensed with and the carriage placed in position on a cast-iron floor, as has been proposed by Captain Moncrieff. Altogether the experiments were considered highly satisfactory.

STEAM FIRE ENGINE FOR DARLINGTON.

THE accompanying engraving represents an equilibrium fire engine, which is now in course of construction for the town of Darlington. Mr. Pease, of that place, having determined on presenting to his town a steam fire engine, deputed Mr. Cudworth, of the South-Eastern Railway, to select one. After careful investigation, Mr. Cudworth decided to recommend the equilibrium steam fire engine of Messrs. Shand, Mason, and Co., and that firm are now constructing the engine we have engraved. It consists of a treble set of pumps, which are worked direct by a corresponding set of treble steam cylinders, the whole fixed to the boiler and forming a most compact and equable steam fire engine. By using three pumps a perfect uniformity is obtained in the flow of water through the hose and suction pipes, avoiding all shocks of the engine or pipes, and producing a jet quite as steady as those obtained by pressure from gravitation. The boiler, by an arrangement of inclined water tubes, combines the greatest possible rapidity in generating steam with economy of fuel, and is extremely simple in construction. This engine is similar to that supplied by Messrs. Shand and Mason to the Local Fire Commission of Hamburgh in October last, and which was described by us at page 246 of the present volume. The performances of that engine are thus referred to in the Hamburgh "Nachrichten," which reports the official trial before the local authorities:—"The water was drawn from a reservoir in the neighbourhood of the English planke (a street), and the height to which the water should be projected was to be ascertained by marks on the church tower, but, owing to the exceedingly strong wind which prevailed at the time, the height could not be ascertained. At half-past nine the trial commenced with the lighting of the fire, and in the space of seven and a half minutes there was 100lb. of steam pressure, and the engine began her duty in earnest through a line of hose 80ft. long; the steam pressure quickly rose to 120lb., and was kept at this pressure with the most perfect ease. After this the fire engine was taken to the harbour, when it was again tried, and did her work in a most excellent manner. It drew water from the river Elbe for a depth of 20ft., and, notwithstanding this, it threw the water to a very considerable height. At both trials, the president of the deputation, Senator Peterson, as well as several other members of the deputation, were present, and expressed their entire satisfaction at the results attained."

A NEW steamship, the "Alnwick Castle," built by Messrs. C. Mitchell and Co., Low Walker, on the Tyne, for the Northumberland Steam Shipping Company, was launched on Saturday. She is intended for the Indian trade, *via* the Suez Canal, and she has been specially constructed for the purpose. Her rig will be that of a four-masted schooner, and she will have engines of 600-horse power. If the Suez Canal proves a safe waterway for steamers to proceed from the Mediterranean to the Red Sea, it in likely that a good deal of new iron steam tonnage building for Tyne shipowners will be employed in the East India trade by this route.

INDIARUBBER HORSESHOE.

At a recent meeting of the Liverpool Polytechnic Society, Mr. J. T. King, President, in the chair, the following paper by Mr. Hay Downie, on Downie and Harris's Patent Shoes for Horses, was read :—

What is the best style of shoe for a horse? and what is the best method of applying it? are questions that have long puzzled the whole veterinary faculty; and while much has been said, little has been accomplished towards the achievement of a practical result. Many inventions of a more or less meritorious nature have from time to time been brought before the public, but either owing to defective construction, the difficulty experienced in applying them, inutility, or other general inaptness, have failed to meet the end in view, leaving the unfortunate quadruped to trudge along under all the disadvantages of the old system. The matter has at last received a highly satisfactory solution in the invention of the rubber horseshoe by Mr. Hay Downie, of Corstorphine, for which, in conjunction with Mr. Harris, of Castle Mills, Edinburgh, he has obtained a patent.

The shoe is an ingenious and novel combination of iron and rubber, and the chief features of the invention are, first, a light narrow shoe of wrought iron without either tips or coulthers, of the same thickness from toe to heel, and having a perfectly level bearing throughout; second, an india-rubber web, which is placed between the shoe and the hoof, covering the whole of the foot, and fitting close round the frog, which is left exposed. Part of the web which lies immediately beneath the shoe is composed of some material which, united with the rubber, is non-elastic, and, therefore, has no power to draw or otherwise loosen the nails; third, that part of the web which touches the inner rim of the iron is much thicker than the rest of it, and forms a cushion, which at the toe stands 1-16in. above the tread surface of the iron, and gradually slopes upwards to the heels, where it stands ⅛in. above the tread surface. The shoe is fastened on in the ordinary way, but the nails are so far forward as not to interfere with the proper expansion and contraction of the hoof when in action, and when finished has a very neat appearance.

Although the advantages arising from the use of the shoe just described are many and obvious, it might be well to enumerate a few of them, and endeavour to show to what extent the invention is a cure and preventive of existing evils. It is in our large cities, where thousands of horses are daily at work on the hard paved, steep, and slippery streets, that the benefits of the system become most apparent. Every step taken by the animal gives a shock to the muscular system of the limb, and creates a heat in the hoof, which in a comparatively short time operates with telling severity. As already stated, the rubber projects beyond the tread surface of the iron part of the shoe, in certain proportions between the toe and the heel, thus coming first in contact with the ground and effectually preventing concussion, the results of which are so much to be deplored.

No one can have failed to notice the pain and difficulty experienced by omnibus, cab, and draught horses in ascending and descending steep and slippery inclines. Their strength is not so much taxed in pulling their load as in maintaining their footing, in endeavouring to do which a great strain necessarily falls on the hind legs. To this severe exertion of the hind legs may easily be traced spavins, sprains of the hock, back, sinews, and fetlock joints, and even severe and lasting injury to the spine and loins. Here again the projecting part of the rubber comes to the animal's assistance, affording a secure footing on the smoothest pavement and greasiest causeway. Even on ice the horse will walk with the most perfect safety and comfort. The experiment has been successfully made, accordingly the necessity for sharpening in frosty weather is entirely obviated. These tests clearly prove the invention to be a complete safeguard againt slipping, and a horse going at a brisk trot can thus be brought to a stand almost instantaneously, without a single shuffle. The cushion of rubber keeps the foot moist, preserves its natural level, and encourages the growth of the hoof. The shoe has conduced largely and most effectually towards recovery of lameness, groggy horses especially becoming comparatively sound. Leaving the streets of the city, the accruing advantages on the macadamised country road are, the effectual prevention of stone carrying and balling with snow. The rubber pad is also impenetrable to sharp granite, slag, or other road metal, old nails, and even broken glass.

In shoeing, any inequality is rasped down, and the knife is little used, therefore the foot suffers but little or nothing by the process of paring, which may be accounted a matter of no little importance, when, as is well known, by many, if not all other systems, in order to obtain a fit, the hoof is so much cut away as to inflict on it a permanent injury. This is at least very frequently the case. The base of the frog and heels are cleared out, that the rubber may fit in and form a stay between them. The frog is preserved entire and allowed to attain and keep its natural growth, while burning the hoof is never resorted to. In regard to the mode of fastening the shoe, it has been stated that the nails are so far forward as not to interfere with the proper expansion and contraction of the hoof when in action—a circumstance of no mean consequence. By the old system, the foot is all but encircled by the shoe, and is thus so tightly bound as to render expansion and contraction almost impossible.

Many veterinary surgeons and farriers have expressed their unqualified approval of the invention, and many gentlemen who have tried it on their horses testify to its general excellence, but perhaps one of the strongest proofs of its worth is its having been awarded a silver medal by the Highland Society of Scotland, at their recent show in Edinburgh. It is now becoming an article of very general use, and a company has been formed to prosecute the sale of it. Though somewhat more expensive at first than the old system of sh eing, when it is taken into consideration that one set of rubbers last out two and three sets of irons, it is cheaper in the end. Possessing, as it does, many merits, it cannot fail to become not only generally but universally used, and that not only in Great Britain but throughout foreign countries. Thus in a short time a large reduction may be hoped for all the ills, tear and wear, that horse flesh is heir to.

The Chairman then exhibited several of the shoes. He explained that the distinguishing peculiarity of the patentee's invention was allowing the rubber to project over or beyond the surface of the metal, so as to give an elastic tread and prevent the horse from striking its foot upon the ground with a dead blow, and said it had been found in practice that the rubbers would last out two metals. He stated that the patent shoes had been in use for about the last six months. In answer to a question as to the effect of using them in frosty weather, he stated that horses had not the same tendency to slip with them.

Mr. Arnott said that whilst at the Agricultural Show at Edinburgh, he was informed by a gentleman who had used them for his horses, which travelled over the heavy road from Leith to Edinburgh, that their adoption resulted in a very great saving. The principle now admitted to be correct in reference to horse-shoeing was to enable the frog of the hoof to get hold of the ground. The practice hitherto had been to shave off the frog, and so prevent the horse's foot from properly reaching the ground. But now the horse had got fair play in this respect. The next improvement would be to give the animal liberty with his head, for unless he had that the horse was cruelly treated. In America there were at the present time societies the object of which was to prevent the use of bearing-reins.

GUY'S TABULAR CALENDAR.

A very useful adjunct to the office, the library, or, in fact, to any place of business, has just been registered by Mr. T. J. Guy, of 252, Goswell-road, London. It consists of a framed almanack and monthly memorandum, with vacant spaces for memoranda for every day throughout the year. A tin frame about 12in. wide by 10in. deep carries a set of six cards, each side of which is divided into spaces for all the days of the month, one side of each card being devoted to each month. When one side of the card—say that for January, 1870—is filled it is reversed in the frame, the back showing the month of February. As each card is filled it can be placed at the back of the rest and thus be preserved for reference. A socket is attached to the frame in which a pencil is kept, so that this useful calendar and memorandum tablet is rendered complete in all respects.

At a recent meeting of the leading agriculturists of Notts it was resolved to establish a chamber of agriculture in that county. An influential committee was appointed to carry out the object of the meeting.

FURNACES FOR MELTING STEEL.

Mr. J. Suter, of Hereford, and Mr. T. Hinde, of Fownhope, near Hereford, have patented an invention which consists in constructing furnaces for melting steel and for other purposes, and in the combustion of fuel in the furnaces, by which means great economy of fuel is said to be effected, a higher temperature obtained, and great control over the action of the furnaces at the same time secured. These improvements are also applicable to the furnaces of steam boilers. The furnace is constructed of three principal parts, namely, of a gas-generating chamber, a combustion chamber, and a superheating chamber. In the first or gas chamber, the solid fuel is converted into gaseous fuel by being ignited and supplied with a sufficient quantity of air to convert the carbon of the fuel into carbonic oxide. The second chamber of the furnace consists of a reverberatory chamber, into which gaseous fuel produced in the first chamber mixed with the requisite quantity of air for combustion is burned. In the third or supplementary chamber the gaseous fuel is heated prior to being burned in the combustion chamber. The gas-generating chamber is of iron lined with fire-brick, and having an opening at bottom through which the clinker can readily be removed; or the clinker may be fluxed out by charging a little lime with the fuel.

Fuel is supplied to the gas-generating chamber by an opening at top closed by a valve, which permits of the introduction of the fuel without material loss of gas. The requisite quantity of air is introduced into the gas-generating chamber from a fan, and is delivered into the chamber by a tuyere. In order the more effectually to bring the air into contact with the ignited fuel where the fuel is very small or in a fine state of division, it is delivered into the chamber by a series of small openings in the tuyeres instead of by one or two large openings. The combustion chamber, in which the gaseous fuel is burnt, and in which the steel is melted or the other operations of the furnace performed, has a size and form suitable to the particular use to which the furnace is applied. The gaseous fuel is heated before it is introduced into the combustion chamber, so as to raise its temperature, and thereby produce a more intense heat in the furnace, either by passing it through heated tubes or by allowing it to undergo combustion. When the gaseous fuel is heated by the former method, a heating chamber is constructed above or in connection with the combustion chamber, through which heating chamber the waste heat from the combustion chamber is passed. Fire-clay tubes passing through the heating chamber conduct the gaseous fuel to the combustion chamber, which gaseous fuel is superheated in its passage through the tubes. When the heating of the gaseous fuel is effected by its own combustion, atmospheric air is mixed with it and it is ignited. The gaseous fuel which has thus been burned is passed through ignited carbonaceous matter, whereby it takes up carbon, and becoming revivified or reconverted into combustible gas passes to the combustion chamber strongly heated and with its full combustible power. By heating gaseous fuel in the ways described an intense heat is produced in the combustion chamber. When the furnace is used for reducing metallic ores the gaseous fuel is not superheated by the waste heat from the combustion chamber, but the gaseous fuel passes into and through the combustion chamber to the superheating chamber and is burnt in the superheating chamber.

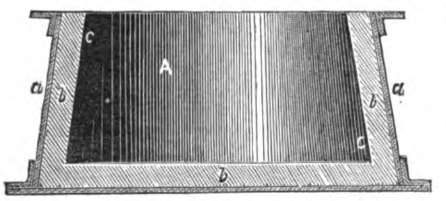
In applying these improvements to the furnaces of steam engine boilers, the superheating of the gaseous fuel is unnecessary. By varying the quantity of air mixed with the gaseous fuel during combustion, the character of the flame produced may be varied so as to possess either a reducing or an oxidising action. As a convenient means of ascertaining the character of the flame, the inventors employ in the furnace a small lump of coal and a lump of peroxide of manganese. When the flame has an oxidising character, the gaseous fuel volatilised from the coal burns with a bright light while there is no apparent action on the manganese. When the flame has a reducing character, there is no flame from the coal, but the lump of oxide of manganese becomes intensely ignited by the combustion which takes place on its surface between the oxygen evolved from it and the carbonaceous matter of the gaseous fuel.

We learn that the Postal Convention with England has been concluded at Washington, providing for the reduction of the single letter postage to 6c. The Convention will come into effect on Jan. 1, 1870

OBTAINING MALLEABLE IRON OR STEEL FROM CAST IRON.

MR. J. BERGER SPENCE, of Manchester, has patented an invention which relates to that method of obtaining malleable iron or steel from cast iron in which nitrate of soda or other similar chemical salts are used for oxidizing substances contained in the iron. It consists in a method of using the salts whereby their decomposition is to a certain extent retarded. For this purpose he brings the nitrate into a more or less solid body before the melted iron is allowed access to it. The annexed cut represents the vessel which is to contain the nitrate of soda. It consists of a metallic casing *a* lined with fireclay or brick *b*, and the sides may be inclined outward from the top as shown at *c*. Into this vessel A the nitrate of soda or other salt is placed and fused therein, or it may be previously fused and then poured into the vessel. When cold this salt will be more or less in a solid block. The whole is then removed to the bottom of the furnace and confined to it by clamps, the joints being luted. The molten metal to be converted being now poured through an aperture in the furnace decomposes the salt in the vessel, but as that salt is in a solid block, in contradistinction to the disintegrated condition of that usually employed, such decomposition will be retarded, and the products will not to so great an extent be driven off without producing useful effect.

The solidification of the salt may be obtained by fusion as above mentioned, but that object may also be attained by pressure, and this process may be effected in the vessel A or in separate moulds to be afterwards adapted thereto. As shown in the engraving, the sides of the vessel A are bevelled



The object of this is to prevent a rising of the cake or the passage of the metal beneath it, but when this form of vessel is adopted, the salt must be fused in it, or poured into it in a fused state, or the vessel must be made with a movable part to admit of the separately fused cake being adapted, and the like keeping down of the cake may be effected by projections.

THE MONITOR-TURRET AND THE CASEMATE.

AN opportunity of instituting a direct comparison between the monitor-turret and the fixed casemate has at last been furnished by the completion of the Turkish armour-clad war vessel "Moyini Zaffre," which was launched on the Thames last June. The building and arming of this ironclad being the result of the joint efforts of Sir William Armstrong, Samuda, and Ravenhill, we have a guarantee that whatever merits the fixed casemate system possesses have been fairly developed in this the latest attempt to supersede the monitor. The United States "Army and Navy Journal," from which the present article is taken, illustrates the two systems by a plan of the "Moyini Zaffre" (fig. 1)—length, 230ft.; beam, 35ft. 6in.; armament, four 12-ton guns; and a plan of a monitor with two turrets (fig. 2)—length, 230ft.; beam, 35ft. 6in.; and armament, four 24-ton guns. It cannot fail to be noticed—continues our contemporary—on careful examination of our engravings, that the planning of the casemate of the "Moyini Zaffre" shows much thought and elaboration; also that the complication which characterises its form is evidence that the planner was dealing with a difficult subject. Nor can the attentive observer fail to see at a glance how imperfectly the disadvantages attending the elongation and immobility of the battery, viz., the limited horizontal range of the guns, have been overcome by the combination of curvatures and angles resorted to by the constructor of this substitute for the monitor-turret. Our engraving, besides representing a top view of the "Moyini Zaffre," accurately drawn to scale, also represents top view of a monitor provided with two turrets of the same diameter as those of the "Passaic" class, viz., 21ft. internally. The length of the Turkish vessel is 230ft., with 35ft. 6in. beam. The monitor, for the sake of exact comparison, has the same dimensions; but the thickness of its armour is greater than that of the former, and so proportioned that the weight of armour of both vessels is alike. The freeboard of the "Moyini Zaffre," as in all

THE MONITOR-TURRET AND THE CASEMATE.

FIG. 1.

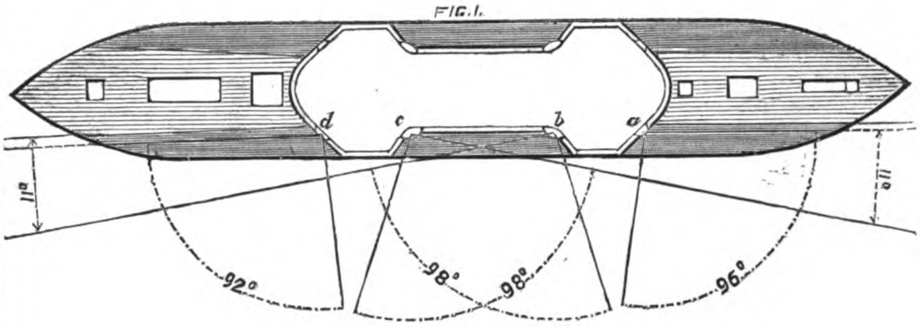
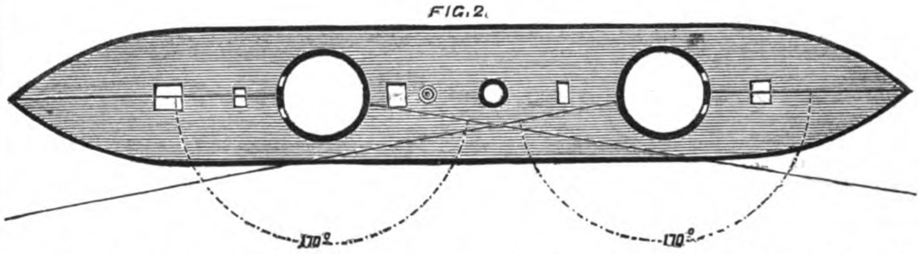


FIG. 2.



ironclads built by English engineers, is several times higher than that of the monitor, and, consequently, deeper armour below water must be applied to afford protection; increased rolling being the inevitable result of high freeboard. Referring to the plan, it will be seen that the circumference of the fixed battery is greater than that of the two turrets in the ratio of 25 to 15.

The English mechanical journals point with apparent satisfaction to the circumstance that this casemate ship, which is intended for the defence of the Bosphorus, has armour-plates generally 6in. in thickness, the whole of the battery (backed with wood) being cased with 5-inch plates. The battery, though pierced for eight guns, will only carry four of Armstrong's 12-ton rifles. The intention being to transfer the pieces from one side of the battery to the other during action, Sir William has unquestionably reached the limit of weight, considering the difficulty of changing sides with the rapidity called for during contest with screw-propelled assailants. But the constructor of the monitor-turret, which, as our engraving shows, commands 340deg. of the horizon, is not hampered by considerations of weight of metal, a 24-ton gun, or even one weighing 48 tons, being pointed as readily by turning the turret as the lightest field-piece. Accordingly, the monitor which our engraving represents is mounted with four 24-ton guns. Making proper allowance for the greater area of side armour and battery plating of the "Moyini Zaffre," it will be found that our double-turreted monitor will, on the same draught of water, support 10-inch thick side armour, 15-inch thick turret plating, and carry four 24-ton guns. The greater security—we might say, the impregnability—thus attained by the monitor form is, however, only a part of the advantage of this system over that which is represented by the Turkish ironclad—the latest endeavour of our transatlantic rivals to demonstrate that the conflict at Hampton Roads was not, after all, so significant as supposed. Impregnability and calibre, although very important, by no means decide the superiority of armoured vessels—horizontal range is in many cases of equal importance. A monitor hull provided with a fixed battery may be made as impregnable as a complete monitor, but at least two-thirds of the guns of such a craft will be ineffective in battle. Samuda, evidently, was fully aware of the impotency of his artillery, owing to limited horizontal range, when he adopted the complicated form of the battery of the "Moyini Zaffre."

We now propose to consider in detail this question of horizontal range, and beg the reader to inspect closely the extent of ranges marked on our engraving for each gun separately. We will first consider the ranges obtained by the fixed battery of Samuda's construction. To avoid confusion, we have lettered the several ports *a b c* and *d*, the first letter denoting the forward port of the battery and also the muzzle of the piece belonging thereto. Beginning with the first-mentioned port, it will be seen that each gun respectively ranges over a field of 96, 98, 98, and 92deg. Referring to the plan of the monitor, it will be seen that each of the four guns sweeps a field of 170deg. It should be observed that the ranges marked on the engraving have reference only to the starboard side of the line of keel.

It will be proper, before assigning a numerical value to the efficiency of each of the systems under consideration, to remember that the real power of naval artillery is determined by multiplying the weight of shot by the horizontal range, the position of the vessel remaining constant. Modern target practice having demonstrated that a 24-ton gun is capable of throwing a projectile of 600lb. with adequate force and that a 12-ton gun is about the proper size for 300lb. projectiles, we are enabled, by applying the rule before mentioned, to determine with exactness the relative efficiency of the monitor-turret and the fixed battery or casemate. The power of the forward gun *a* of the casemate, will accordingly be represented by 300 × 96deg. = 28,800. In like manner, by multiplying the weight of the projectiles of the remaining three guns by their respective ranges, in degrees, we obtain a sum total of 115,200. Applying the same mode of computation to the monitor, viz., multiplying 600 × 170 × 4, we establish the important fact that the actual efficiency of the monitor is to that of the casemate vessel as 408 to 115. Apart from this superiority as regards the artillery of the monitor over that of the Turkish ironclad, the armour of both battery and hull of the latter is wholly insufficient to compete with the former. The inference therefore is obvious and irresistible, that the monitor represented by our engraving could readily destroy Samuda's casemate vessel. But it is not our intention to prove the worthlessness of the "Moyini Zaffre" as a war vessel, our object in discussing the subject being simply that of instituting a comparison between the two systems represented by our engraving.

Attention is called to the fact that, besides the limited horizontal range of all the guns of the "Moyini Zaffre," only one of the four can be pointed in the line of the ship's course; and that *c*, the only other gun capable of firing ahead, cannot point nearer than 11deg. of the line of keel. At a distance of a mile ahead, there is, consequently, a field of 1,200ft. which an assailant may occupy exposed to only one 12-ton gun. Chased by an enemy, the Turkish war-ship, with the Samuda-Armstrong battery, will be equally important; the gun marked *d* on the plan being her only defensive weapon. It will be found, on inspection, that the piece marked *b* cannot come nearer than 11deg. of the line of keel.

Let us now turn to the monitor. It will be seen that four 24-ton guns, two forward and two aft, fire in a direct line with the keel; there being no safe position, as in the case of the fixed battery, for the enemy's vessel to occupy. The entire field, viewed from stem to stern, as the plan shows, is swept by all the guns of the monitor. Bearing in mind that these powerful guns are protected by 15-inch thickness of iron, which, if applied in two thicknesses, is proof against any artillery yet conceived, while the 12-ton guns of the Samuda-Armstrong battery are protected by armour which a 7-inch rifle will pierce through and through, the argument in favour of the monitor-turret becomes overwhelming. It will be asked, in view of these incontrovertible facts, why do constructors advocate the fixed battery? We know of no other reason than the assumption that the joint between the rotating turret and the deck cannot be made secure. English engineers, relying on the accounts of the performances of the monitors published by the enemies of the Union during the war, apparently do not take the trouble to investigate the matter; while American experts, who have written about turrets—Mr. Eads, civil and mechanical engineer from St. Louis, among others—do not understand the subject, and evidently are ignorant of the most important facts connected therewith.

For instance, Mr. Eads, in a report to the Navy Department, informs the Secretary that "the baud round the base of the turret on the 'Dictator' weighs over 20,000lb.," and points out how much better this great weight of iron might be applied for other purposes. Now, this turret has no baud round its base, nor was it ever intended to have one! Mr. Eads also tells the Secretary that any downward swelling of the plating, produced by the impact of projectiles striking low, will stop the rotation of the turret by friction under its base. This assertion proves ignorance of the fact that the "Dictator" turret rests wholly on the four inner courses of plating (which cannot be swelled), and that the intermediate wrought slabs and outer plating (together 11in. in thickness) do not reach the deck, and therefore can, by no possibility, cause the predicted stoppage. Again, the apprehensions expressed in the report, with reference to the base of the pilot-house in connection with the rotation of turret, show that another very important circumstance had been overlooked, viz., that the turret is projected considerably above said base in order to protect it.

The fear entertained by Mr. Eads that the "pilot-house may be lost overboard" and the rotation of the turret stopped by the impact of "projectiles possessing insufficient power to overcome the inertia of the pilot-house itself" (held in place by a wrought iron shaft 14in. in diameter, and weighing upwards of 80,000lb.), will amuse our young friends at West Point and at the Naval Academy. Lastly, the rotation of the turret will, agreeably to the report, inevitably be checked should a shot strike it opposite the ends of the gun-slides, as the impact would cause binding of said slide, productive of general internal derangement. Mr. Eads, on this point, ignores the fact that in the "Dictator" and numerous other monitor ironclads, the ends of the gun-slides do not reach the turret wall, the gap between the end of the slide and the wall greatly exceeding the momentary yielding of the plating under the impact of projectiles. We have thus proved the untenable character of the principal objections raised, and exposed the misstatements which have been published relative to the monitor-turret, and, we believe, fully demonstrated its superiority over the Samuda-Armstrong battery of the "Moyini Zaffre."

CEDAR-WOOD CABINETS FOR SPECIMENS.

At a recent meeting of the Manchester Literary and Philosophical Society, Mr. Joseph Sidebottom made the following communication:—About fifteen years ago, I had a large cabinet made of forty-five drawers, to contain shells and carpological specimens, the drawers being made of pencil cedar. Very soon I found that the resinous vapour from the wood became deposited on some of the fruits and shells, making them appear as if they had been dipped in varnish. Chloroform appeared to be the only solvent, and the specimens were obliged to be washed with it. This became so bad that I had the whole of the drawers removed, and replaced with drawers of baywood. Sometime afterwards, Mr. Carter advised me to have the cedar drawers sized and papered inside, and a new cabinet made to contain them; accordingly he made me one to contain thirty drawers. These drawers were exposed to the air for twelve months, and very well sized inside, and papered, but the resinous vapour is still deposited on the objects in the drawers as before, and so far is a warning to everyone never to use pencil cedar for such a purpose. I should not, however, have thought this matter worthy of mention before the Section had it not been for the very curious and capricious way in which some objects are coated with this resin while others are left entirely free, and for which I am totally unable to account. In shells the genera Conus and Oliva are never touched by it, nor are Cyprea or Mitra, whilst Helix, Bulimus, and Pecten are coated over; this is the case when there are specimens of these and other genera in the same drawer. As this deposit is on the genera I have named, and never on the others, it would seem to indicate that the texture of some shells would attract the vapour and not others. But in the case of birds' eggs, the very strange manner in which some species are picked out as it were and others left, is most remarkable. In the owl's eggs, for instance, the barn owl is always free, while the tawny owl is covered with the varnish, although side by side. The song thrush is never attacked, and the missel thrush always.

THE number of Cornish pumping-engines reported for October is 20. They have consumed 1,556 tons of coal, and lifted 10·6 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 45,900,000lb. lifted 1ft. high by the consumption of 112lb. of coal.

ANVILS.

THE face or table of anvils as at present made is often defective, having frequently hard and soft places after hardening, which face should be equally hard all over its surface, and the steel in some instances not being properly welded to the iron part or butt which forms the lower part, the anvil is thereby rendered unsound and not fit for use. Some improvements recently patented by Mr. J. N. Askham, of Sheffield, have for their object the removal of such defects, and consist in so making anvils that the face may be equally hard all over when finished, and in so casting or welding the butt to the head or upper table that the parts may be thoroughly amalgamated and the anvil made more durable at a less expense than hitherto.

Mr. Askham first prepares a model of the size and shape of the anvil to be produced. He then places it in a box, covers it with composition, and fills up the box with sand in the ordinary manner. After the model is removed and the sand perfectly dry (this being done in the usual way), he first pours in the molten steel to form the face or table, then, through the same aperture (after the steel on the table is sufficiently cool), he pours in a very mild molten steel, which flows over the table and gives the requisite toughness and solidity to the steel beck. After a proper time has elapsed, he pours in through another opening the iron or metal, which also runs upon the steel and forms the lower part or butt of the anvil, and a perfect amalgamation takes place between the iron and steel. The casting being complete, it is then finished in the ordinary manner for castings.

To harden the work, a large metal bosh or trough, 6in. or 8in. deep, is formed, in which is inserted a number of perforated sharp-edged bars of metal, on which the anvil is allowed to rest on its face or upper surface, either flat or slanting. A sluice communicating with a reservoir of water is then opened, and a force of cold water is allowed to flow upon the face by an upward cast and to pass under the anvil and over the bars to any depth required. By these means a much harder and more regular surface is obtained than by the present mode of manufacture. After this the surface is ground in the ordinary way.

OUR ORDNANCE AND PROJECTILES.

THE visit of Mr. Childers during the past week to the Whitworth Gun Manufactory at Manchester certainly appears to lend some confirmation to the rumour obtained to a certain extent in the navy, that the First Lord of the Admiralty is not quite so well satisfied with the present ordnance and their projectiles, mounted on the decks of our most recently commissioned ironclads, as may generally be supposed. We have been so long accustomed to praise so highly the coil-built gun and its ogival-headed Palliser projectile, that possibly the known defects of both have been ignored, and a false belief engendered of their infallibility. If the First Lord really entertains any doubt as to the efficiency of our present rifled naval gun and its projectile as an armour-destroying power in any future action between the ships of this and any other country at sea, he is not at all singular in that respect. For some time past a feeling has been growing up among naval officers and others acquainted with the subject, that, as we increased the size of our naval ordnance to 12, 18, 25, and now to 30 tons weight, we were drifting rapidly into a state of things that, as yet, was not by any means clearly defined or understood, but which it was just possible might be attended by two primary conditions that should render the guns of our ships practically harmless against an enemy's armour. The two conditions that threaten the efficiency of the artillery of the navy are—1, the acknowledged weakness of the gun itself, and its incapability to withstand the burning of very largely increased powder charges; and, 2, the defective properties of the projectiles and their brittleness. The weakness of the guns has been officially acknowledged by the order to give the turret guns for the new ship, the "Devastation," five tons weight of metal each in excess of those of the "Monarch," although the guns of each ship will be of the same calibre, and will throw the same weight of projectile. Their weakness was also very fully entered into and illustrated by Sir Joseph Whitworth, in a paper read by him before the British Association at Exeter, in August last, where he stated that the battering charges to which the 25-ton guns of the "Monarch" were limited was 70lb. of powder, when the charge due to their weight of metal was actually 150lb.

The defects of the ogival-headed projectile are known and admitted beyond all dispute. As, therefore, it is equally beyond dispute that all naval actions in future will be fought, not muzzle to muzzle, or with each pegging away at the thickest part of his enemy's armour and opposed to a concentrated fire from his heaviest guns, but, as far as may be possible on obtuse angles, and with the shot striking obliquely, where lies the fighting value of the ogival-headed projectile? If it strikes the side of an armoured ship obliquely—as in the firing at the turret of the "Royal Sovereign"—it flies off at an opposite angle to that of its flight from the mouth of the gun to the ship's side, for it has no "bite," or it breaks up into a thousand pieces. It has made good penetration into and through plating and targets, but with such work done by it the gun has been fired at right angles with the plate pierced, and then the cone-headed form of the shot enabled the latter to shoulder its way through. There is no record of oblique firing at armour plates or plated targets with the present naval gun, nor does there appear to be any record in existence, at the Admiralty or elsewhere, of the question having been closely considered in its application to ironclad fleets of the present day. It is to be hoped that Mr. Childers will, in this instance of the guns and their projectiles for her Majesty's ironclads, act as he has done in other instances at Whitehall—see into the matter personally, and form his opinions independently of any interested advice, however vehemently it may be tendered. The subject is one of such vital interest to the efficiency of the navy that no neglect or compromising measures can ever hide it from public sight.—"Times."

THE STEAM ENGINERY OF THE NAVY.

THE following condensed report of the Board of Civilian Engineers, appointed in 1863 to examine the screw engines of the navy, appears in the U.S. "Army and Navy Journal":—

Philadelphia, July 14, 1869.

Hon. George M. Robeson, Secretary of the Navy.

SIR,—In reply to your communication of June 25, 1869, of which the receipt has been acknowledged, I have the honour to report as follows:—

This board was appointed January 9, 1863, by the Secretary of the Navy for the purpose of having made "a more thorough examination of the screw engines, boilers, and condensers designed for the naval service by the Bureau of Steam Engineering."

On January 16, 1863, instructions were more fully given, embodying the special points on which information was desired.

On February 6, 1863, in obedience to the first part of these instructions, the board reported upon the designs for the screw machinery of the "Juniata" class of vessels, and on the paddle machinery for the "double enders," as follows:—

First, that the screw vessels of the navy should be capable of a speed of at least twelve knots per hour, under steam alone, and that their machinery should possess certain qualifications enumerated.

Second, that, judged by the standard thus laid down, the machinery designed by the Bureau for screw vessels was in type and in all other respects inferior to that in general use for naval and mercantile vessels; that it occupied more space in all directions, was more liable to derangement, used more steam, weighed much more, and was much more costly in construction, requiring also additional displacement to carry it.

Third, that in the engines of the "Juniata" class of sloops, at least sixty tons more weight and twenty per cent. more space was used than was necessary or proper.

Fourth, that the type of boiler (Martin's) used by the Bureau to the exclusion of others (and not used by other parties then or since) was in most respects inferior, and in none superior to other types; requiring to be at least one-third larger to equal the ordinary horizontal tubular boiler in power, with natural draught; of no greater economy on the average; of much greater weight and cost; incapable of being forced to an equal extent, and when forced continuously liable to serious derangement.

Fifth, that the paddle engines designed by the Bureau were open to serious objections as to proportions, excessive weight and cost, and inferior economy in the use of steam.

Finally, that the power of the machinery for these vessels, by changes in type and detail, could have been increased at least one-third over that attainable by the Bureau's machinery, without adding to the space occupied, decreasing the coal stowage, or equalling the total weight or cost.

Some of the foregoing conclusions having been questioned by the department, the board replied, February 20, 1863, now in detail, showing that, by comparison with machinery for either vessel in the navy designed by private firms, the "Juniata" actually occupied about twice the space, whether cubically or upon the floor, per unit of cylinder capacity.

On January 21, 1863, certain questions were addressed by the department to the board relative to engines, boilers, and condensers for vessels of the navy.

A reply furnishing the opinions of the board was made under date of February 19, 1863.

On February 13, 1863, the opinion of the board was requested by the department in regard to the propriety of modifying the regulations for the admission and promotion in the Engineer Corps of the navy.

A report was made upon the subject on the 20th of the same month.

On February 18, 1863, the board, in obedience to instructions contained in the communication of January 16, above referred to, reported upon the "7,500 ton iron-clads," designed by the Bureau of Steam Engineering, as follows:—

First, that the proposed machinery, when driven to utmost capacity, would only give a speed of twelve knots instead of sixteen, for which it was designed; or, in other words, was of less than half the required power; and that this result would be attainable only after essential modifications in detail.

Second, that the boilers proposed were of inferior design; and the use of one propelling screw for such a vessel was condemned.

Third, that by certain indicated changes in the boilers and screws, and by the use of properly designed "direct acting" engines (in lieu of the geared engines proposed, which were on the same general plan as those afterwards designed and put in the "Wampanoag" class by the Bureau) an absolute saving of space, weight, and cost could be effected, while the power would be doubled, and the speed of the vessel increased by at least three knots per hour.

As a result of this report the construction of several vessels for which bids had been received on these plans, was abandoned, and a saving of millions of dollars was effected.

On April 25, 1864, the department requested the board to examine and report upon the machinery of the "Pensacola," with a view to determine whether it should be repaired, modified, or removed; and in the latter case to recommend suitable machinery in its place.

On May 7, 1864, the board recommended that the latter course should be pursued; and after a critical examination of the designs for the "sixty-inch" engines and boilers (of which several unappropriated sets were then in hand), they recommended in preference the construction of new machinery similar to that designed by private parties and placed in the other vessels of the same date and class.

On July 26, 1865, the board was supplied with a copy of the contract for the construction of the "Algonquin," and was directed to institute a competitive test between her machinery (designed by private parties) and that of the "Winooski" (designed by the Bureau), with a view to determine if the stipulations of the contract had been fulfilled.

The board drew up a programme for this test, supervised the same, and on the 30th of March, 1866, reported the results attained, and their opinion that the contract had not been fulfilled; in consequence of which the machinery of the vessel was rejected by the department.

On February 19, 1863, the board was desired to experiment with the boilers on the "San Jacinto," both of which had been designed by the Bureau, for the purpose of comparing the merits of the type exclusively adopted by the Bureau, and that adopted generally for naval and commercial vessels throughout the world.

This test, the board, in March, 1863, declined making, not only for the reason that it would have detained a valuable ship for an indefinite period, at a time when every available resource of the navy was taxed to its utmost, but also because the boilers in question were not properly designed for comparison. The board, however, suggested as an alternative, that two experimental boilers should be designed by them, for a comparison, and be built by the department; announcing in such a case their willingness to undertake the necessary competitive tests.

On March 20, 1863, the department adopted this suggestion and ordered the construction of the boilers.

When these boilers were completely ready for trial, the department, by letter dated October 1, 1864, associated B. F. Isherwood, then chief of the Bureau of Steam Engineering, with the board, and a programme was adopted covering a large addition to the field of experiment originally contemplated by the board, and therefore requiring a considerably increased duration for the trials. As the department was at this time expending immense sums in the construction of new boilers, and the results of the experiments were constantly forwarded to the Bureau, and as constantly availed of by it, in modifying the designs for the boilers under construction, the original programme of experiments was still further enlarged from time to time, as the results of successive tests indicated the necessity of additional ones.

These modifications of design effected a great saving in cost of construction, in space occupied, and in weight, besides adding greatly to the efficiency of the boilers when built.

In no other way than by such experiments could this saving have been effected.

Thus reports of the board were made during these experiments almost weekly to the Bureau, and, at their conclusion, under date of October 26, 1868, a final report was made to the department, in which all the "logs" of the experiments were tabulated, the apparatus described, and the results presented in a comparative chart, thus avoiding a long and verbose comparison without detracting from its value to the engineer.

In conclusion, the reports of the board above alluded to have disclosed the general inferiority of the machinery designed by the Bureau of Steam Engineering to the practice of marine engine constructors in this and every other maritime country; from which practice it differed in essential points and with lamentable results.

These differences may be summed up, as consisting of the persistent use of an inferior type of boiler, inferior types of engines, highly improper proportions in their important details, and a very injurious and costly excess in weight over that required, or used by machinery builders of extensive practice and world-wide reputation.

All of which is respectfully submitted.

J. VAUGHAN MERRITT, Secretary of the Board.

The above summary is approved.

W. E. EVERETT, President.
CHAS W. COPELAND.
WM. WRIGHT.
B. H. BARTOL.
WM. BROMLEY.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular, December 8.)

IN the chemical market a moderate amount of business has been done, principally for export to the continental ports, which are frequently closed during the winter months. In the alkali trade no appreciable rise has yet taken place, but it is generally anticipated that a slight advance will occur in the beginning of the year, as in many instances producers have placed the greater part of their manufacture for the first six months of 1870, and are depending on a better price for the balance to increase their average. In minerals there is nothing special to communicate, the consignments from foreign ports being sufficiently large to keep uniform rates on the home production. There has been a moderate business doing in metals generally during the week; and in pig iron the excitement still continues, and a large trade has been done at advancing rates. Staffordshire iron is difficult to place at the price, except for a few first-class brands. Copper is in fair demand, and the present low prices are inducing orders. Tin is firm at the reduction. Lead selling freely at our quotation. Spelter continues dull, with no alteration in prices. Soda: Soda ash and caustic soda are firmer, and £7 for 48 of the former, and £13 for 60 of the latter is readily obtainable; soda crystals at £3 17s. 6d., and salt cake at 57s., are in fair request; bi-carbonate inactive at £9 5s. Nitrate of soda: sales at Liverpool are at £15 per ton. Potash: muriate is still in short supply, and prices rule at £7 7s. to £7 10s. for 80. Saltpetre: a better trade in foreign, at £23 for 5 refraction; refined at £26 10s. Alum: is firm, with a regular demand, prices remaining as before, £6 5s. for home, and £7 for export. Ammonia: considerable sales of sulphate, at £16 10s. for ordinary to £17 5s. for fine white; muriate at £22 to £23. Copperas: for green and rusty there is not much inquiry; in dry a considerable business has been done, at 50s. Pyrites: arrivals having been irregular have slightly deranged supplies in a few instances. Prices remain at 7d. to 8d. per unit for present consumption. Lime: phosphate rather quiet, at 52s. 6d. for 65; bleaching powder is firm at £8, and advancing, though contracts are still entered into at less; disinfectants bought freely, at £5 5s. for best quality. Manganese: meets with a slow sale, at old rates. Iron ores: hematite obtains 15s. to 18s.; oolitic finds an extensive market at 6s. to 8s. in Staffordshire. Guano: for best Peruvian, £13 7s. 6d. to £13 10s. is obtained; second sells at £11.

METALS.—Iron: Scotch pigs steady at 56s. 0d. to 56s. 1d. Cleveland, 46s. for forge, and 51s. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire bars, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: firm; English tough, £71 to £73; Chili slab, £67 to £68. Tin: English ingots, £119 to £120; Straits, £116. Lead: in good demand. P. G. best English soft pig lead, £19. Spelter: inanimate. English, £20 10s.; Silesian, special brands, £19 10s. to £20; hard spelter, for export, £16 10s.

THE "Journal de St. Petersbourg" of the 1st inst. states that on November 29, the Tamboff-Kozloff Railway had been provisionally opened, that the first train passed from Kozloff to Tamboff in the presence of a large concourse of people and of the troops of the garrison, and that the regular service of the line will commence very shortly.

Legal Intelligence.

COURT OF CHANCERY, LINCOLN'S INN.

DECEMBER 8.

(Before the LORD CHANCELLOR and Lord Justice GIFFARD.)

RE YATES' PATENT.

THIS was a petition to the Lord Chancellor for the sealing of a patent. Mr. W. Yates, on June 15 last, applied for letters patent for an improved method of supplying air to the fire of a furnace. The sealing was now opposed by Mr. Fletcher, who had obtained a patent for the same purpose on April 5 last. He had not opposed the granting of the patent to Yates when the matter was originally before the law officer of the Crown, but he explained this by saying that he did not know of the application till too late. He consequently, having no other course left open, opposed the petition of Yates to the Lord Chancellor for the sealing of the patent. The Lord Chancellor, when the matter came before him, referred it to the Solicitor-General to determine whether, under the circumstances, a patent ought to be granted to Mr. Yates. The Solicitor-General decided that Mr. Fletcher's invention, previously patented, was the same as that of Mr. Yates, and consequently that no patent ought to be granted to the latter. The matter now came on again to be mentioned, the decision of the Solicitor-General being conclusive on the merits.

Mr. Macrory, on behalf of Mr. Yates, only urged that his petition ought to be dismissed without costs. There was no suggestion of bad faith on his part, and, in fact, he knew nothing of Fletcher's patent till after the application for the sealing.

Mr. T. Aston appeared for Mr. Fletcher.

The Lord Chancellor saw no reason why the petition should not be dismissed in the ordinary way with costs. The person who failed ought to pay the costs.

VICE-CHANCELLOR'S COURT.

DECEMBER 2.

(Before VICE-CHANCELLOR SIR R. MALINS.)

NORRIS V. THE BIRMINGHAM SMALL ARMS COMPANY.

MR. THEODORE ASTON (with whom was Mr. F. Harrison) moved to restrain the defendants from manufacturing certain arms, alleged to be an infringement of the plaintiff's patent for improvements in the apparatus for breech-loading arms generally. An inspection also was asked for. These arms were for exportation to Russia.

Mr. Cotton, Q.C., for the defendants, asked for security for costs, which being given, he offered to keep an account, but asked for time, the manager and secretary being in Russia.

After some discussion,

The Vice-Chancellor directed the motion to stand over for a fortnight without any terms as to inspection, the defendants keeping an account. It was impossible to decide a question of patent except upon affidavits on both sides.

Correspondence.

HOWARD'S BATTERY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Instead of constructing the zinc and copper cells in Howard's battery as described in the MECHANICS' MAGAZINE of October 1, 1869, I take a plate of zinc and a plate of copper and simply bend them into a cylinder, which will answer the purpose apparently quite as well as going to the trouble and expense of making cells. I varnish one side of the zinc plate previous to bending it, and it will, perhaps, be better to tie a piece of twine to keep it in a cylindrical form; the copper will do so without the twine. I have reversed the arrangement described by putting the copper rod and cylinder into the porous cell, and the zinc rod and cylinder into the outer jar. This battery is very cheap, and easily constructed. It seems to be much easier to obtain a powdery deposit than a reguline deposit of zinc.—I am, Sir, yours, &c.,

JAMES HOWARD.

95, Cross-lane, Salford, December 7.

Meetings for the Week.

MON.—Society of Engineers.—Annual General Meeting for the Election of Officers for the ensuing year, at 7.30 p.m.

TUES.—Institution of Civil Engineers.—On "Ocean Steam Navigation, with a view to its further development," by Mr. John Grantham, M. Inst. C.E., at 8 p.m.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

"A Seafaring Man of the Modern School" has not enclosed his name and address, which are not required for publication, but as a guarantee of good faith. Upon receiving these his letter will appear, and we doubt not that he information he asks will be forthcoming.

ERRATUM.—As some of our readers may have been puzzled with the curves (as compared with the tabular figures) in the second diagram which accompanies Mr. Strachan's paper on the Height of the Barometer, &c., published in our last issue, we may mention that the engraved block was accidentally reversed.

RECEIVED.—F. C.—R. and Co.—T. C.—E. L. J.—T. and P.—B. C. and Co.—T. W. T.—R. J.—J. D.—T. M.—E. A.—I. C. E.—A. M.—B. P.—F. W.—W. D. M.—G. T.—H. F.—M. S.—L. G.—R. M'C.—R. H. W.—C. L. L.—C. B. K.—J. H.—W. S.—E. T.—R. S. A.—J. T. E.—T. W. T.—R. P.—W. H.—T. A. B.—J. W.—G. W. H.—S. E.—R. P.

Naval, Military, and Gunnery Items.

WE learn by the Bombay papers that orders have been received from the India Office for the Bombay native army to be reduced by five regiments; and it is also said that the Madras army is to be reduced by seven regiments of native infantry. Besides these important reductions others are reported to be in contemplation.

WE, "Portsmouth Times," understand that several shipwrights who have been discharged from the dockyard have been re-entered as "mechanical labourers" at 18s. per week, and that they have found themselves expected to do precisely the same work as that on which they were previously employed at 27s. per week. We are also informed that labourers who were earning 14s. per week have been discharged, but have been allowed to enter on the reduced pittance of 12s. But economy is the order of the day, and if Mr. Childers is likely to be able to show a reduction in the navy estimates we must hold our peace.

ON the 2nd inst. eight of her Majesty's war vessels, viz., the screw sloop "Wasp," 974 tons; the screw sloop "Sharpshooter," 503 tons; the screw frigate "Emerald," 2,913 tons; the screw sloop "Miranda," 1,039 tons; the screw sloop "Niger," 1,072 tons; the paddle-wheel steamship "Thais," 302 tons; and the "Coronation" and "Plym," were offered at public auction, by order of the Lords Commissioners of the Admiralty. The bidding was very spirited, and the prices realised, though not a third of what the vessels originally cost, were, it is stated, more than was anticipated. The following is the result of the sale:—The "Sharpshooter," built at Blackwall in 1846, £1,675. The screw frigate "Emerald," built at Deptford in 1856, £9,000. The "Miranda," built at Sheerness in 1851, £2,550. The "Niger," built at Woolwich in 1846, £4,000. The "Thais," built at Birkenhead in 1856, £775; the "Coronation," £75; and the "Plym," £95. The "Wasp" was bought in at £2,500.

THE Clyde shipbuilding yards have set afloat no fewer than 18 vessels during the month of November. Nine of the launches were at Glasgow, 4 at Greenock, 3 at Dumbarton, 1 at Port Glasgow, and 1 at Rothesay. Nine were steamers, and 9 sailing ships, and, as usual, the large proportion were iron vessels. The total tonnage represented was close on 20,000. The largest vessel of the 18 is the "Scandinavian," an iron screw steamer of about 3,000 tons, built by Messrs. R. Steele and Co., Greenock, for the Allan Montreal Line. Next in size is the "Elbe," a screw steamer of 2,657 tons, built by Mr. John Elder, Govan, for the West India Mail service. The "Apis," an iron screw steamer of 1,200 tons, built by Messrs. Denny, Dumbarton, for the Austrian Lloyd's Service; the "Afrique," a screw steamer of 1,800 tons, built by Messrs. Napier and Sons, Govan, for the Marseilles and Alexandria trade; and the "Shang Tung," a screw steamer of 1,500 tons, built by Messrs. A. and J. Inglis, Glasgow, for the Shanghai Steam Navigation Company, stand next in the list.

THE traffic from the opening of the Suez Canal to the 28th—that is, in eleven days, is reported to have been as follows:—52 vessels arrived from Port Said at Lake Timsah between the 17th and 19th of November, and seven between the 20th and 28th; 51 vessels left Lake Timsah for Suez from the 19th to the 21st, and five from the 22nd to the 28th. The arrivals at Port Said from Suez in the interval between the 18th and 28th were altogether 45. Of these vessels seven were from eastern seas on their way to Europe; nine were from the Mediterranean on their way to the Indies. The total number of vessels that passed through the Canal during the period referred to was 130, the aggregate tonnage of which was 80,000 tons. The telegram from M. de Lesseps with reference to the passage of these vessels was:—"Notwithstanding this extraordinary traffic only six vessels touched the ground slightly; of these four got off without aid, and but two required a little assistance to set them afloat. No loss of cargo, no vessel damaged; neither the bottom nor the sides of the vessel injured.

Miscellanea.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending December 4, was 1,494. Total number since the opening of the Museum, free daily (May 12, 1858), 1,684,665.

A "WORLD'S FAIR" is to be held at Washington in 1871, and subscriptions equal to £240,000 are said to have been already obtained from persons willing to guarantee the required funds, President Grant being among the number for £1,000.

THE annual dinner of the Society of Engineers will take place at the Westminster Palace Hotel, Victoria-street, on Friday, December 17, 1869. Tickets may be obtained at the offices of the Society, 6, Westminster Chambers, S.W., on or before December 13. Members and Associates may introduce friends.

AT the general monthly meeting of the Royal Institution of Great Britain, held on Monday, December 6, Mr. George Busk, F.R.S., in the chair, Mr. George Henderson Gibb, Mr. William Harbottle, Mr. John Henderson, and Mr. Henry Musgrave Musgrave were elected members of the Royal Institution.

THIS evening (Friday) Dr. William Brewer, M.P., will distribute, at the Royal Polytechnic Institution, Regent-street, the certificates and prizes which have been awarded to the students of the evening classes of the above institution. The chair will be taken at eight o'clock, and we hope to see the chairman well supported upon this interesting occasion.

ACCORDING to the latest accounts an extensive area of ground has been taken up for diamond mining on the Cudgegong River, New South Wales, the only locality in that colony where diamond mining has as yet been prosecuted on a large scale. The Australian Diamond Company have provided themselves with a steam-engine for working their gem machinery.

WE learn from "Nature" that Dr. John Davy, brother of Sir Humphrey Davy, has bequeathed to the Royal Society, in fulfilment of an expressed wish of his illustrious brother, a service of plate, presented to Sir Humphrey Davy for the invention of the safety lamp, to be employed in founding a medal to be given annually for the most important discovery in chemistry made in Europe or Anglo-America.

THE number of visitors to the South Kensington Museum during the week ending December 4, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,016; Meyrick and other galleries, 1,203; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,855; Meyrick and other galleries, 84; total, 12,158. Average of corresponding week in former years, 8,226. Total from opening of Museum, 8,981,016.

THE obituary of the "Times" of Saturday, the 27th ult., contained some rare illustrations of prolonged existence, especially so in the case of three ladies and four gentlemen, whose united ages amounted to 602 years, giving an average of exactly 86 years to each of these seven persons. Of the ladies, the eldest had reached the great age of 90 years, the youngest 81; of the opposite sex the oldest was also 90, and the youngest 81 years of age. There were respectively two at 81, one at 85, one at 87, one at 88, and two at 90.

LAST Monday morning, at about 8 o'clock, the roof of the dining-hall of King's College suddenly gave way, and, breaking through the floor, was precipitated into kitchens and offices beneath. The large room which is thus destroyed fronted the river, and the roof formed part of the terrace continued from Somerset House. This roof was supported by iron girders, which have broken in half, and these, together with the brickwork and the superincumbent earth and turf, falling suddenly upon the floor of the dining-hall, the latter was unable to bear the shock, and descended with the rest of the falling mass into the lower storey. Most fortunately no one was injured.

ON the evening of the same day the passenger-shed of the new Caledonian Railway station at the Lothian-road fell with a loud noise. The shed had been completed with the exception of the work to be done by the slaters on the roof, and during the day about 100 men had been employed upon it. When the accident occurred all the workmen had left with the exception of four, who were in one end of the building; but fortunately they escaped uninjured. A horse was caught by some of the beams, but was ultimately rescued without sustaining much damage. The building, which was constructed chiefly of wood, was about 400ft. in length and 90ft. in breadth. The damage is estimated at about £1,200.

THE earthquakes at Gross-Gerau, Germany, continue; down to the evening of the 28th ult. the shocks were frequent, but slight. On the 27th they were rarer than usual, and on the following day only two were observed. At nineteen minutes past ten o'clock in the evening, however, without any previous warning, the ground began to tremble far more violently than it had done since the 22nd ult. Three separate shocks were distinguished, and they lasted together seven or eight seconds. The sensation is described as resembling what would be felt if the whole surface of the earth were sliding down an inclined plane. No other shocks were observed during the night, but this only increased the terror of the inhabitants, who have begun to look on every cessation of these interesting but uncomfortable phenomena as only a sign that an outbreak of more than usual violence is at hand.

ON Wednesday week an extraordinary explosion took place on the premises of Mr. Valentine Blanchard, a well-known authority on English photography. He was engaged in work when some gun cotton and collodion suddenly took fire, exploded with great force, threw Mr. Blanchard into the garden flat on his back, and blew to pieces all the valuable cameras and other appliances of photography, collected and selected after the labour of years. According to the "Standard," Mr. Blanchard was somewhat shaken and had his hand wounded, but his personal injury is as nothing compared with the damage done to his studio and its valuable contents, which he will feel the more acutely as he was about to leave the neighbourhood where the accident took place for the purpose of moving westward. The sympathies of all photographers and of all lovers of the art will be with Mr. Blanchard, whose contributions to the Photographic Exhibition in Conduit-street this year have so materially added to the attractions of that excellent collection of landscapes and portraits.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1503

BUILDINGS AND BUILDING MATERIALS—1495, 1499, 1518, 1534, 1543, 1552, 1558, 1563, 1570

CHEMISTRY AND PHOTOGRAPHY—1493, 1522, 1523, 1540

CULTIVATION OF THE SOIL, including agricultural implements and machines—1518

ELECTRICAL APPARATUS—1560, 1564

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1483, 1500, 1504, 1507, 1509, 1537, 1541, 1545, 1558, 1561

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—1511, 1525, 1539, 1550, 1568

FURNITURE AND APPAREL, including household utensils time-keepers, jewellery, musical instruments, &c.—1482, 1484, 1496, 1501, 1502, 1515, 1525, 1527, 1528, 1531, 1519, 1559, 1666

GENERAL MACHINERY—1488, 1512, 1517, 1569

LIGHTING, HEATING, AND VENTILATING—1551

METALS, including apparatus for their manufacture—1505, 1520, 1524, 1562

MISCELLANEOUS—1486, 1489, 1495, 1498, 1514, 1516, 1521, 1526, 1566

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1481, 1485, 1487, 1491-1492, 1506, 1508, 1519, 1529, 1532, 1533, 1538, 1542, 1544, 1546, 1548, 1554

SHIPS AND BOATS, including their fittings—1447, 1567

STEAM ENGINES—1555

WARFARE—1490, 1510, 1530, 1547

1481 W. FINLEY, Stockport. *Working railway brakes.* Dated May 14, 1869.

The pressure of the buffer rods of the carriages or waggons is made available to apply the brake power, so that when the driver closes the throttle valve, and consequently shuts off the steam, the brakes of the tender become tightened up, and as it were a resistance is thus produced ahead of the train, and, provided these improved "brakes" are fitted to each carriage composing the train, all the carriages throughout the train may have the wheels skidded if the driver considers it necessary to do so.—Patent abandoned.

1482 H. B. BARLOW, Manchester. *Cases for bottles.* (A communication.) Dated May 14, 1869.

This consists in making the cases for bottles and drinking cups of three or more parts screwed or otherwise secured together. The cases may be made of wood or other material. When the case is made of two parts, the lower is made to hold the bottle, and reaches up to about the shoulder of the bottle; the middle part is annular, and passes over the neck of the bottle, and the upper part is made large enough to cover the stopper of the bottle and to contain a drinking cup in an inverted position, the rim of the cup fitting in a circular recess in the upper end of the middle part. India-rubber or other packing is placed in the circular recess, and in the inside of the upper part, to protect the drinking cup when made of glass or porcelain.—Patent completed.

1483 G. F. HENRY, I. A. F. BANG, F. R. C. MONESTIER, and J. P. A. FIGUIER, Paris. *Wool lubrication.* Dated May 14, 1869.

This consists in replacing the oil or matters hitherto made use of for the purpose of lubricating wool by a solution in water, or other suitable menstruum, of any suitable hygroscopic delinquent, salt, or combination of such salts, with which solution the inventors imbibe or lubricate the sheep's or other wool or other similar animal textile fibrous materials intended to be submitted to carding, combing, spinning, or other similar operations, which have been previously deprived of the yolk or adhering natural grease.—Patent completed.

1484 M. WOLFSKY, Pilgrim-street, Ludgate-hill. *Lock for purses.* Dated May 14, 1869.

The mechanism of this lock consists of a plate fixed to the body of the purse; this plate has two grooves formed in it. An upper or movable plate made to slide on or over the first plate. The second plate has on its under side two clips which work in the grooves. A spring is fixed under the first plate, and this acting or pressing on the clips controls its sliding movement.—Patent abandoned.

1485 F. HEDLEY, Richmond. *Horseshoes.* Dated May 14, 1869.

This consists in constructing horseshoes flanged on the outer surface, or so that the inside edge is considerably thicker than the outer edge. The surface of the shoe next the foot may be either perfectly flat or slightly hollowed as preferred. The nail holes are made in the outer or flange portion of the shoe, and consequently the nail head cannot come into actual contact with the hard surface of a road or street until the shoe is nearly worn out.—Patent completed.

1486 J. H. JOHNSON, Lincoln's Inn-fields. *Treatment of beetroot.* (A communication.) Dated May 14, 1869.

The object is to provide a straining or filtering surface for the pressing cylinders used in treating beetroot which shall not be liable to become clogged by the adhering thereto or the accumulation thereon of the solid or tenuous particles of the pulp, the openings being at all times perfectly permeable, whilst the juice itself is allowed to pass through them in a highly pure condition. This result is obtained by the use of a smooth metallic, filtering, or straining surface, that is to say, a surface presenting no rough parts to which the pulp can attach itself.—Patent completed.

1487 C. E. SPOONER, Bron-y-Garth, and G. A. HUDDART, Brynkir, Carnarvonshire. *Railways.* Dated May 14, 1869.

The abutting ends of the rails, whether they be double-headed or formed with a flat base, the inventors propose to clip between two plates suitably shaped to embrace the web and the foot or lower head of the rail, and of such depth that when applied they will extend vertically a sufficient distance below the rail to form a girder or stiff rib, and admit of being secured by spring clamps or otherwise.—Patent completed.

1488 G. T. BOUSFIELD, Loughborough Park, Brixton. *Lifting apparatus.* (A communication.) Dated May 14, 1869.

The lifting apparatus consists of two similar bent levers connected together back to back by a link joined to each lever at a point intermediate of its length. One end of each lifting lever is intended to enter a hole formed for it in the stone or other block. These holes may be cut in an inclined direction so as to recede from each other as they descend into the block, and the ends of the lifting levers which enter them have each a small tooth. The outer ends of the lifting levers stand outwards away from each other, and are connected by a short chain with a ring link in the middle, and the lifting chain is connected with the ring by a hook. When the strain comes on the lifting chain, the teeth on the lifting levers penetrate the outer sides of the lever holes, and prevent the withdrawal of the levers.—Patent completed.

1489 C. H. GARDNER, West Harding-street, E.C., and J. BICKERTON, Oldham. *Lithographic and zincographic printing machines.* Dated May 14, 1869.

A cylinder or roller of the sponge generally known as the india-rubber sponge, or of such like spongy material, is used, to which water or other fluid is supplied either externally or through a perforated hollow tube forming the axis of the roller. A bed, sheet, or slab of india-rubber sponge or similar spongy material is placed in such position with respect to the roller that it is brought by the motion or stroke of the machine into contact with the roller, which is thus allowed to run upon the bed, slab, or sheet. By this contact the moisture of the roller is equalised, and the roller afterwards distributes the moisture to the lithographic stone or zincographic plate.—Patent completed.

1490 I. M. MILBANK, Connecticut, U.S.A. *Cartridges for breechloaders.* Dated May 15, 1869.

The sheet metal case is shown with the base and hollow flange, the latter enabling the breechloading mechanism to draw the case or sheet out of the barrel by means of a retractor taking hold of the flange. The sheet metal cup and the disc are to be soldered into the inside of the shell or case, the solder running into the flange, and also filling the space between the cup or disc and the base caused by countersinking the base for the flange of the priming tube.—Patent completed.

1491 V. R. BATCHELOR, Marylebone. *Giving motion to wheels.* Dated May 15, 1869.

This consists in the application of a triangular or otherwise angled arrangement of rods to the side of each wheel, as for instance, by securing the angle to the pin, so that such rods may stand at such a distance from the side that they may be used as handles for imparting rotation to the wheel or wheels, in order to effect propulsion of the hand carriage.—Patent abandoned.

1492 S. CORBETT, Wellington. *Velocipedes.* Dated May 15, 1869.

In order to enable velocipedes to be converted into two wheel velocipedes or three wheel velocipedes at pleasure, the inventor provides two independent and detachable front axles for the front or driving wheels. One of these axles has a wheel fixed to it at its middle, and is provided with cranks outside the wheel as usual. The other axle he makes much longer than the first mentioned one, and provides each of its ends with a wheel, the cranks on the axle being situate inside the wheels. The inventor so arranges the bearings of each of these axles that one or other of the axles can at pleasure be fixed to the bottom of the fork of the velocipede, at the top of which fork the spindle and cross arm for guiding the velocipede are fixed.—Patent abandoned.

1493 L. A. V. DUBOURG, Leicester-street. *Manufacture of gas.* Dated May 15, 1869.

The apparatus consists of two parts, comprising first the gas generator with a purifier attached thereto, and, second, the carburetter for imparting to the hydrogen gas the requisite amount of carbon to convert it into an illuminating gas. In the generator, the process is carried on automatically, and the gas is produced by the decomposition of water by means of the chemical action of acidulated water on metals. The gas arrives in the carburetter in a nascent state, and by being made to bubble up through the liquid hydrocarbon contained therein takes up the carbon vapour which gives it its illuminating power.—Patent completed.

1494 A petition to extend the time for filing this specification is pending.

1495 W. WILKINSON and M. BOSS, Seymour-street, N.W. *Embossing glass and other surfaces.* Dated May 15, 1869.

This consists, first, in embossing the surface of glass or metal by placing a strip of glass or metal upon a flat movable lid arranged to rise and fall. Upon this lace or other open worked fabric or perforated metal sheets are attached by gum or otherwise. The fabric or metal sheet is then dusted over with powdered resin and other matter. The glass or metal is then removed from the fabric or perforated sheet and placed upon a hot bed or over heated oven, sufficiently to cause the powder to adhere firmly. The glass or metal plate is then removed and fluoric acid poured over its surface. Second, in producing designs upon glass, metal, wood, canvas, &c., by taking a sheet of transfer paper with a loose ground consisting of starch. The surface of the starch is covered with a coating of varnish. The prepared surface of the transfer paper is printed with designs in mineral or vegetable colour. The printed paper is then coated with turpentine or varnish, and then laid on the surface to be ornamented previously coated with adhesive matter. The design is then left on the glass or metal which is heated to evaporate the dampness from it. Third, in preparing the surface of metal plates to receive the enamelling medium by cutting or rolling by means of cut rollers or dies or other contrivances operated upon either in a hot or cold state. The metal plates are also coated with clay as an absorbent by dipping or otherwise. Fourth, in ornamenting the surface of canvas prepared with paint. The print or impression printed on the transfer paper is given a coating of varnish. The canvas is then coated with the same varnish and presented to the surface of the transfer paper. Fifth, in ornamenting wood veneers by embossing by the employment of dies or cut rollers or by means of perforated metal or other plates.—Patent completed.

1496 J. S. JARVIS, Wood-street, Cheapside. *Seamless collar.* Dated May 15, 1869.

This consists in producing by cutting or otherwise a combined collar and tie in one piece and without seams; the portions forming the tie and band are printed or otherwise impressed in one or more colours to imitate silk or other fabric.—Patent abandoned.

1497 T. BERNEY, Bracon Hall, Norfolk. *Mounting armour.* Dated May 15, 1869.

This consists, first, in converting and arranging the armour which by a previous invention is used as a counterweight into and as defensive armour. The inventor prefers, second, to make this defensive covering armour in two parts. The armour is made of any suitable forms and materials, for the purposes required, but by preference of hollow figures presenting rounded forms, so as to tend to cause falling projectiles to glance from off it or them externally.—Patent abandoned.

1498 F. KOHN, Robert-street, Adelphi. *Extracting juice from sugar.* (A communication.) Dated May 17, 1869.

This consists in carrying out the whole process of diffusion in one single vessel or diffuser, in which the sugar extraction is carried on continuously by introducing the slices of cane, beetroot, or other plants through a feeding apparatus at the bottom of the vessel, from which they rise slowly and gradually to the top, while the fresh water is constantly running in at the top of the diffusion vessel, and is drawn off at the bottom as diffusion juice, after having remained in contact with the slices for a sufficient length of time.—Patent completed.

1499 R., J. J., and L. R. BODMER, Notting-hill. *Firegrates.* Dated May 17, 1869.

This consists in the application and use of rollers or cylinders forming a grate surface in lieu of either stationary or movable flat grates, or in combination with either or with both. The rollers, supported in suitable bearings, are ranged parallel to each other, with sufficient space between each two to prevent contact from expansion of the metal.—Patent completed.

1500 R. WILSON, Patricroft, near Manchester. *Spinning and doubling cotton.* Dated May 17, 1869.

The inventor uses a bottom or driving spindle, and a top or flyer and bobbin spindle; on the driving spindle is fixed the wharve or pulley by which the motion is received from the driving drum, or the spindle may be driven in any other ordinary manner; the bottom end of this spindle runs in a footstep in the footstep rail, and the top end runs in a bush in the bolster line. The top end of this spindle is constructed with a clutch socket to receive and turn the top or flyer and bobbin spindle, the bottom end of which is made with suitable projections to fit the clutch socket of the driving spindle, that both may revolve together correctly and yet be easily detached. On the top spindle is fixed the flyer and the top end above the flyer is bored out to form it into a tube through which the roving or yarn passes down to the flyer, and from the flyer to the bobbin or spool, on which it is wound in the ordinary manner by the friction or drag on the lifting rail of the usual construction, on which the bobbin is supported.—Patent completed.

1501 H. DE GARRS, Sheffield. *Gas pendants and chandeliers.* Dated May 17, 1869.

The inventor inserts in the inside of the gas pendants and chandeliers an elastic or spring tube for conveying the gas to the burner, so that the gas pipe retains an unbroken connection, whether the pendant be slid up or down.—Patent abandoned.

1502 H. G. WHITEHEAD, Ecclesall Bierlow, Yorkshire. *Knife cutlery.* Dated May 17, 1869.

The inventor files or punches the springs out of sheet steel of the exact size and shape required according to the pattern of the knives intended to be made instead of punching them larger and then hammering and filing them into shape as is now customary. He then stamps the springs in a boss, which has a recess in it to receive the spring, and prevents the spring from changing its shape while being stamped. He also has dotting points in the impression on the boss to mark the springs for boring, so that the springs are marked for boring in the proper places at the same time that they are stamped. He treats the blade tangs in the same way.—Patent completed.

1503 R. HARLOW, Heaton Norris. *Hot water boilers.* Dated May 17, 1869.

This consists in a cylindrical enclosed casing formed of cast or wrought-iron, copper, or other suitable material tapering or narrowing towards the upper end, in the centre of which the fire is placed. In the body of such casing and concentric with it is suspended a tapered tube or inner casing communicating with the interior of the outer casing and also with the interior of a flat hollow annular dish or flange which surrounds and partially covers the mouth of the outer casing so that as the flame escapes from the neck or narrow mouth of such casing it impinges against the under surface of such dish or flange, and at the same time communicates its heat to the outer casing and tapered tube before mentioned.—Patent abandoned.

1504 D. HITCHEN, Halifax, *Looms.* Dated May 17, 1869.

This consists in substituting in lieu of one of the healds now used a pair of plain, smooth rods or bars of iron or other rigid material for those threads of the warp to pass betwixt which would otherwise have passed through the nails of the heald thus supplanted. The rods are connected at each end to a frame which is capable of sliding up and down in slots affixed to or formed in the loom-frame and operated by the ordinary treadling, tapped, and jack rod or other equivalent and suitable means.—Patent completed.

1505 A. DUNN and A. LIDDELL, White-street, Southwark. *Metal cans.* Dated May 17, 1869.

This consists in constructing metal cans or tins in such a manner as to occupy little space in storage. The first improvement consists in protecting the edges of the vessel from injury by the employment of a twin drum, hoop, or band over the edge of the head or bottom of the tin. Second, in forming the tops or covers for metal cans or tins with a double turned over edge or edges in the manner and for the purpose hereinbefore described. Third, in forming the bottoms for metal cans or tins with double turned over edges in the manner and for the purpose hereinbefore described. Fourth, in the employment of the tops or covers of the bottoms of metal cans or tins with extended and sunken portions.—Patent completed.

1506 C. E. BROOMAN, Fleet-street. *Applying railway brakes.* (A communication.) Dated May 17, 1869.

This consists in fitting to the body or framework of railway carriages, engines, or tenders a series of links or connecting rods for supporting the brakes which are caused to bear upon the ordinary rails or upon an additional rail laid in the space between the ordinary rails. The brakes are actuated by screw or other power either direct or by the intervention of other rods or appliances.—Patent abandoned.

1507 T. WRIGHT and I. FOX, Nottingham. *Bobbin net lace.* Dated May 17, 1869.

The inventors make Ensor net with finings and open work by a stump bar or bars placed above the bottom bars. When they employ one stump bar only the slots formed by the parts of such bar are eight in number, from the front of the machine to the back of the machine. When they employ two stump bars there are five slots in each bar from the front of the machine to the back of the machine.—Patent abandoned.

1508 S. W. CLARK and W. R. SYKES, Clapham. *Railway signal lamps.* Dated May 17, 1869.

The invention mainly consists in placing two or more different coloured shades, curved or flat glasses, in a casing within the lamp, which casing works on a central pivot placed in the lamp casing proper and on the lower part of the same. Upon the upper part of the lamp casing are three or more rollers, upon or against which the internal shade casing revolves or turns, and upon the edge of this casing there are three or more indentations to act as stops to the various glass shades, by means of which they remain secure in proper position. The rollers may be placed in various positions either internally or externally to the lamp casing or casings.—Patent completed.

1509 W. E. NEWTON, Chancery-lane. *Sliver cans.* (A communication.) Dated May 17, 1869.

This consists in making these cans of what is known as "leather board," an article made of leather scraps combined with fibre and other substances.—Patent abandoned.

1510 W. R. LAKE, Southampton-buildings. *Revolvers.* (A communication.) Dated May 17, 1869.

The arm is furnished with an extractor having a flat plate or head, which lies in a recess at the rear of the revolving cylinder in such a position as to form a part of the surface against which the rim of each cartridge shell lies when the same is inserted into its chamber in the cylinder. The extractor also has a tank, which extends through the centre of the revolving cylinder and through a hollow centre pin, upon which the revolving cylinder turns. Where the shank passes through the rear end of the revolving cylinder it is made square, so that it has to turn with the cylinder when the latter is revolved. To the forward end of this extractor is attached a rack by a coupling joint, which allows the extractor to revolve without turning the rack. This latter may be made flat, or may be a circular rod with the teeth cut entirely around it, and for many reasons the latter form is preferable.—Patent completed.

1511 W. R. LAKE, Southampton-buildings. *Drying sugar.* (A communication.) Dated May 17, 1869.

The time for drying sugar loaves in the ordinary manner is from eight to twelve days, but with this improved apparatus the time is reduced to twenty-four hours. This improvement is obtained by producing complete currents of heated air in the loaves themselves.—Patent abandoned.

1512 W. R. LAKE, Southampton-buildings. (A communication.) *Forming screw threads.* Dated May 17, 1869.

This consists in forming such threads by compression between plates having concentric projections upon their faces set at an angle to one another, and revolving upon axes in different planes.—Patent completed.

1513 T. NORRIS, Frome. *Mowing.* Dated May 18, 1869.

The two sides of the frame have each an elbow situate about 16in. from the hind end, and which dips about 20in. At the bottom part of each elbow is a hole through which passes the main axletree and in which it works. Passing through the length of the frame, and about the middle of it, is a part similar to the side of the frame without the elbow, and fastened by means of screws at each end. In this part are two bearings for two minor axle trees, the other bearings of which are in the right-hand side of the frame.—Patent abandoned.

1514 A. TATHAM, Ilkestone. *Barbed needles.* Dated May 18, 1869.

This consists in manufacturing the needles employed in making hosiery and lace which are known as "barbed needles," by stamping them between dies which are acted upon by mechanical means instead of by hand labour, as at present.—Patent abandoned.

1515 T. and J. FAGG, Haymarket. *Overalls.* Dated May 18, 1869.

This consists in the application to garments of a series of elastic tubes of vulcanised india-rubber or other material of a sufficient thickness and strength to resist any ordinary compression, but still of sufficient elasticity to yield freely to the movements of the wearer. These tubes are attached to the interior of the garments by strips, bands, or covering coated with adhesive solution, or they may be attached by other means.—Patent completed.

1516 C. MOSELEY, Manchester. *India-rubber bags.* Dated May 18, 1869.

This consists in making india-rubber bags for felt hats in one piece, and, consequently, without joints.—Patent completed.

1517 J. NORTON, Sheffield. *Cocks.* Dated May 18, 1869.

This ballcock has a chamber in the centre of the cylinder, through which works a cone valve attached to the lever of the ball, which by direct action opens or shuts the valve and prevents it sticking.—Patent abandoned.

1518 J. WATERWORTH, Burnley. *Firegrates.* Dated May 18, 1869.

This consists in combining with ordinary firegrates a movable plate. This plate is placed underneath the grate, and projections or prongs are formed thereon corresponding to certain of the spaces between the bars.—Patent abandoned.

1519 A. M. CLARK, Chancery-lane. *Locomotives.* (A communication.) Dated May 18, 1869.

The inventor makes locomotives as small and as light as possible, the parts being made of steel, and hollow where practicable. These locomotives are relatively of great power, but at the same time save much wear and tear of the road. Two arrangements of driving wheels are provided, the one consisting of large wheels for running on levels and slight inclines, and the other of a system of smaller wheels for ascending steep inclines.—Patent completed.

1520 G. ALLAN, Leadenhall-street. *Securing sheet metal.* Dated May 18, 1869.

In place of fixing the sheet metal or plate direct to the purlins or other objects the inventor secures it to a metal strap passing round or partially round the purlin or other object and arranged either so that both ends of the strap are fixed to the sheet metal or plate by one and the same bolt or bolts or rivets, or so that each end is fixed by a separate bolt or bolts or rivets. The straps or loops, whilst made to grip each purlin tight, are at the same time so shaped as to leave sufficient play between them and the sides of the purlins to allow of the extreme amount of the expansion of the metal covering in one direction, while in the other direction the straps are free to slide upon the purlins.—Patent completed.

1521 F. WALTON, Wolverhampton. *Coal vases.* Dated May 18, 1869.

In constructing coal barges according to this invention the inventor makes them of an outer metallic case and an inner metallic case or frame, the inner case or frame supporting a box in which the coal is placed. This box may either be capable or incapable of removal. The front or one side of the outer case is open, and to the bottom edge thereof the inner case or frame is jointed. By turning the inner case or frame upon its joint it moves in a vertical plane, and can be turned into the outer case, so as to close the vase, or be withdrawn from the outer case so as to open the case.—Patent completed.

1522 J. WOODWARD, Manchester. *Gas water meters.* Dated May 18, 1869.

This consists in the combination of an india-rubber or other elastic or flexible diaphragm with concave or recessed plates or castings having ports and passages in them for the gas or liquid to communicate with each side of the diaphragm, and a slide or other valve or valves to open and shut the communication alternately with the supply and outlet pipe.—Patent abandoned.

1523 W. BENSON, Hexham. *Reducing ores.* Dated May 18, 1869.

This consists in the employment for that purpose of an arrangement of edge runners in place of stamps which have hitherto been employed. The ores or minerals are fed to the runners by means of an upright hollow shaft, the lower portion of which is provided with lateral openings in inclined spouts, over which spouts and through the openings in the shaft the ores or minerals are carried by thin streams of water to the bottom of the pan or saucer, and underneath the edge rolls, by which means the ores or minerals are ground or reduced to a fine thin sludge or slime.—Patent completed.

1524 J. L. CLARK, Westminster, and J. L. BROTHERTON, Wolverhampton. *Iron and steel tubes.* Dated May 18, 1869

The inventor takes a strip of iron or steel, and bends it into a skelp of a suitable form on a bending machine, and then passes it through rolls of suitable section, and with or without a mandrel or core or through draw tongs. for the purpose of producing one, two, or any required number of longitudinal flanges or ribs upon the tube, the two meeting edges being welded in the process, so as to form one of such flanges or ribs.—Patent abandoned.

1525 A. V. NEWTON, Chancery-lane. *Paper hangings.* (A communication.) Dated May 18, 1869.

The object is to produce wall papers that will admit of being washed like painted surfaces without injury thereto. To this end, instead of using distemper colour for the ground of paper hangings, oil colour is applied to the ordinary paper.—Patent abandoned.

1526 E. C. WARBURTON, Bristol. *Registering votes.* Dated May 18, 1869.

The apparatus which the inventor employs when simply votes aye or no require to be recorded consists in two channels formed in a suitable case, which he prefers should form part of the door of a closet in which the voter is enclosed whilst voting; into one or other of these channels, which correspond the one to an affirmative the other to a negative vote, the voter whilst hidden from view deposits the ballot ball, which in running down the passage into which it is introduced touches two triggers, the first as it is moved drives one step forward, the first of a train of counting wheels which give motion to tell-tale hands on dials visible to the voter, and to those exterior to the voting closet. The first triggers of both the ballot ball passages are geared together, so that the tell-tale hands which they actuate indicate the total number of voters using the apparatus. After moving the first trigger the ball rolls on down the passage and touches a second and independent trigger, which also in a similar manner actuates counting wheels indicating on dials the number of motions of the trigger, and, consequently, the number of voters placing the ball in this passage, and as each passage is thus furnished with dials in connection with it, the indications on these dials will show the numbers of the affirmative and negative votes.—Patent completed.

1527 F. JOHNSON and W. HATCHMAN, Little Love-lane. *Umbrellas.* Dated May 18, 1869.

The inventors employ as the thickening material a fibre having the property of resisting the formation of sharp well defined creases; cotton and linen are fibres very suitable for use for the purpose, and by their use in this manner the durability of the umbrella is much increased.—Patent completed.

1528 W. GREEN, Garforth, near Leeds. *Cleaning flower pots.* Dated May 18, 1869.

The apparatus consists of a box or trough (made of wood, metal, or earthenware) holding water. In this box or trough a circular brush is made to revolve on a spindle and working partly in the water. A guard is fitted on one side to prevent splashing, sufficient surface of the brush remaining exposed to effect the object in view.—Patent abandoned.

1529 W. NAYLOR, Mildmay Park. *Railway brakes.* Dated May 18, 1869.

The inventor connects the brake lever with a piston or plunger working in a cylinder containing water or other liquid, which liquid is displaced by the descent of the plunger during the time the brake lever is falling and escapes through a small aperture into an outer chamber surrounding the cylinder, thereby controlling or checking the descent of such lever. In lieu of liquid air may be employed, in which case the outer chamber may be dispensed with. On lifting the brake off again, a valve either in the piston or plunger (or in the bottom of the cylinder) allows the liquid to return again freely into the cylinder.—Patent completed.

1530 J. H. JOHNSON, Lincoln's Inn-fields. *Firearms* (A communication.) Dated May 18, 1869.

One essential feature of this invention consists in the peculiar arrangement of the trigger mechanism, which consists of such a combination of levers that the pressure exerted by the finger on the trigger does not as hitherto involve a powerful friction against the bolt. To obviate this defect, the trigger spring operates on the end of the shorter arm of the trigger, which in its turn transmits its action to the shorter arm of the curved tumbler or lever. This lever is so constructed as never to miss entering to the bottom of the full cock, bent or notch, during the forward movement of the latter, by reason of the end of the tumbler being situate above the axis on which the lever itself works.—Patent completed.

1531 E. TAYLOR, Blackburn. *Washing machine.* Dated May 18, 1869.

The inventor has one or more tubes standing upright, in which the process of washing, churning, or mixing fluids is carried on, and he has a pair of rollers between which the wringing and mangling is carried on. A system of framework supports or fixes the position of the whole. In each tub is an upright dasher made with bars placed either upright, horizontal, or at angle, or composed of flat wings pierced with holes, or a combination of each or any of these. This dasher turns about on a pivot placed at the bottom of the tub, the dasher having a hole in the end for the reception of the pivot; or when it is desired to drive from below a square spike or socket comes through a stuffing box in the bottom of the tub, and which socket or spike the dasher end fits, and which communicates the necessary motion to the dasher. The dasher is supported near the top end by a round or half round bush, which drops into a suitable hole in the framing, which is so arranged that by lifting out the bush the dasher can be removed at pleasure.—Patent completed.

1532 H. LIVESEY and T. COLLINSON, Blackburn. *Velocipedes.* Dated May 18, 1869.

The inventors make the height of the machine adjustable to suit different persons, by making the bearings of the front wheel or that carrying them capable of being moved up or down the legs of the front fork. They make the treadles of gutta-percha, and either bush the hole with metal or not.—Patent abandoned.

1533 J. SAWYER and J. WOODMAN, Islington. *Propelling velocipedes.* Dated May 18, 1869.

This consists in the use of elastic bands, so combined and arranged as to store a portion of the power to each effort of the operator, for the purpose of accelerating and rendering uniform the motion of the vehicle.—Patent abandoned.

1534 R. E. KEEN, Red Lion-court. *Securing panes of glass.* Dated May 18, 1869.

The inventor constructs a metal frame, which is composed of an upper and lower band, united by bars at the corners of the lantern. The panes or sheets of glass are placed upon the outside of these corner bars, and are then secured by metal bars or dips of a V shaped or concavo convex sectional form. These clips extend from the top to the bottom of each pane, and are secured to the upper and lower bands of the frame by means of sockets, screws, pins, or other devices, which will hold them firmly but will also allow them to be readily removed when desired. The bottom of the frame is provided with a fillet to receive the lower edge of the panes of glass, and it is preferred that this fillet should be perforated at the bottom.—Patent completed.

1535 A. VAN WINKLE, Southampton-street. *Securing corks.* (A communication.) Dated May 18, 1869.

This consists of a clip or fastener the ends of which are jointed or secured in eyes or loops formed in a band or ring encircling the neck of the bottle. The clip or fastener is formed with two arms extending up at the sides of the cork, which arms are united by a cross piece designed to rest upon the top of the cork when the same is inserted in the bottle; the inventor prefers to form this clip or fastener of iron wire, which should be coated or covered with tin, lead, or other comparatively non-oxidable metal or material. The top or cross piece is curved or bent in such a manner that the central part projects over and secures the cork when the same is released from the coiling machine.—Patent completed.

1536 W. R. LAKE, Southampton-buildings. *Bottle capsules.* (A communication.) Dated May 18, 1869.

The principle upon which this system is based is the arrangement of the dies in degrees or steps, so that the material, having been subjected to the first pressure in the die at the upper step, falls into the die at the next step, where it is subjected to a second pressure and so on. The number of the steps will be varied according to the number of punches which are to operate in the machine.—Patent completed.

1537 E. H. and A. I. SOLLY, J. F. HALL, and R. BAILEY, Congleton. *Twisting yarn.* Dated May 19, 1869.

Two or more spinning spindles are fixed in a frame, each fitted with an egg-ended fly. The twisted ends from these spindles are collected and passed over a roller, and then guided down to a bobbin on a spindle with a steel fly.—Patent abandoned.

1538 W. MARTIN, Manchester. *Perambulators.* Dated May 19, 1869.

This consists in making the bodies of the perambulators capable of being reversed on their frames when required, for the purpose of preventing the occupants from being inconvenienced by the wind or rain.—Patent completed.

1539 W. R. LAKE, Southampton-buildings. *Obtaining gelatine.* (A communication.) Dated May 19, 1869.

This consists in obtaining pure gelatine or glue stock from such substances as contain glue, forming materials by culminating, and saving the oils and fats therein contained, and is accomplished by means of benzine, naphtha, or other equivalent hydrocarbon.—Patent completed.

1540 G. MARTIN, Dursley. *Generating gases.* Dated May 19, 1869.

The main part of the apparatus is in the form of a cylinder, and is placed either vertically or horizontally, and of such dimensions as may be necessary for the quantity of chemicals which it is designed to employ. The cylindrical vessel may be made of any suitable material, but it is preferred to construct it of iron Through the centre of the cylinder is placed a spindle or shaft, to which are attached arms capable of being adjusted and carrying blades or scrapers, or the arms themselves may be of such form as to act as scrapers.—Patent completed.

1541 P. M'GREGOR, Manchester. *Spinning and doubling.* Dated May 19, 1869.

The inventor proposes to make the copping or ring rails of wrought iron, steel, or cast malleable iron or steel of any form, the thickness of which will not project either above or below the edges of the ring. By this improvement in the construction of the copping or ring rails, when an end breaks the loose end is at liberty to fly, off centrifugally without coming in contact with any portion of the rail, and, therefore, the yarn or thread is not liable to be soiled by the dirt on the rail as heretofore; the peculiar form of the rail also affords great facility in cleaning.—Patent completed.

1542 J. T. LUCAS, Brecknock-road, N.W. *Velocipedes* Dated May 19, 1869.

This consists in adding to the usual pedal action a manual action to be applied to the hind wheels, of which there are two, which manual action also serves as a brake, doing away with the necessity for the usual strap brake.—Patent abandoned.

1543 J. E. and A. DOWSON, Victoria-street. *Foundations for piers.* Dated May 19, 1869.

The inventors propose to apply bearing or base plates beneath the bottom edge of the cylinder, caisson, or tube, such plates being formed with a flat under surface or with one or both surfaces curvilinear or diagonal to the base line. The upper surface, which is passed under the cylinder, caisson, or tube, is oblique or in the form of a wedge or

otherwise, and terminates in a plane surface for the support of the cylinder, caisson, or tube, immediately within which a flange of L iron or other form of iron on the base plate bears against the internal surface of the cylinder, caisson, or tube, and the horizontal portion of the flange is then bolted to a corresponding flange formed on the interior of the cylinder, caisson, or tube, and thus the two are firmly secured together in any other convenient manner.—Patent completed.

1544 A. W. BANKS, Newgate-street. *Velocipedes, &c.* Dated May 19, 1869.
The inventor places the wheels not all in one line, but alternately to the right and left of the fore and aft line of the velocipede.—Patent abandoned.

1545 W. MITCHELL, Waterfoot. *Felted cloth.* Dated May 19, 1869.
The inventor employs three separate carding engines and folders arranged side by side, or otherwise, and each delivering its own sliver into the same "ball cloth" but superposed, that is one over the other, so that the upper one may be of fine wool, the lower one of inferior wool, and the central or middle one of almost any inferior or other fibrous material or mixture of materials capable of being corded.—Patent completed.

1546 D. ROBERGE, New York, U.S.A. *Horseshoes.* Dated May 19, 1869.
The inventor first makes use of a test shoe, made with hind calks, a centre calk, and a short toe calk set towards the back or inner edge of the shoe. He prefers to apply this shoe in the first instance, and in it an injured horse can walk with comparative ease, and frequently go to his labour immediately. By wearing this shoe for a few days it can be ascertained in what position the under side of the hoof should stand to the level surface, because this calk becomes a pivot, and the foot when at rest has no leverage against it to distort any of the joints, muscles, or tendons, and a measurement can be taken and a shoe made therefrom, so that the hoof will bear on the surface in the most comfortable position.—Patent completed.

1547 G. V. FOSBERY, Cowley. *Breech-loading firearms.* Dated May 19, 1869.
The block slides in vertical grooves in the breech chamber, and is raised or depressed therein by a lever pivoted at the rear of the chamber. The firing pin extends through the block and lever. The block and lever are depressed to open the breech, and the empty cartridge shell is ejected and the piece cocked by one movement of a sliding extractor bar, which is arranged at the side of the breech chamber. A stud on this sliding bar works in an inclined slot or passage in the lever, and acts as a cam to raise or depress the same. The main spring is attached to the under side of the block lever. The cork is provided with a hammer, which, by means of an ordinary trigger, is caused to drive forward the firing pin. The block lever is sometimes provided with a plate, which is caused by the extractor bar to start the pin from the base of the shell.—Patent completed.

1548 F. ZYSEL and O. BURDETT, Birmingham. *Velocipedes.* Dated May 19, 1869.
This consists, first, in cranking the axles of both the fore wheel and hind wheel or wheels, by which means the motive power can be applied on a tread connected to the fore and hind cranks, both the fore and hind wheel or wheels being thereby made traction wheel. Second, in making wheels for velocipedes by casting them of suitable metal in two parts, by which strength and lightness will be obtained.—Patent abandoned.

1549 W. M'ADAM, Glasgow. *Manufacture of pottery.* Dated May 19, 1869.
The mechanism consists of a horizontally revolving table having an intermittent action, so that it stops at certain intervals and allows time for the several operations of the manufacture. The table is arranged to receive five or any other required number of moulds in order to admit of the required number of motions to go on simultaneously.—Patent completed.

1550 W. M. MOORE, Balscaddin Howth, Dublin. *Caps for bottles.* Dated May 19, 1869.
The inventor constructs a hollow cap of india-rubber or other elastic material, which, upon being pressed or sprung on to or over the neck of a bottle, effectually closes the opening and prevents the contents of the bottle from escaping the lip or lower edge of the cap by springing into the hollow in the exterior of the bottle neck.—Patent abandoned.

1551 J. LANGHAM, Leicester. *Ash pans.* Dated May 19, 1869.
The inventor employs a movable ash pan, such as now commonly used, to receive the ashes from a firegrate, and within this ash pan and fitting closely to the sides thereof, he places a sifter or riddle with a perforated or open work bottom, which is kept a slight distance above the bottom of the ash pan to allow the ashes which pass through the riddle to accumulate in the ash pan beneath it.—Patent completed.

1552 W. F. FULLER, Bank, Worthing. *Securing safe doors.* Dated May 19, 1869.
The inventor makes the stem of the bolt with a screw thread upon it, so that by turning the screw stem by a hand wheel upon its upper end the bolt may readily and with very little exertion be raised and lowered or moved to and fro. With the upper end of the stem of the bolt the inventor also combines a lock, by which, when the bolt is fastening the door of the safe or strong room, the stem of the bolt may be locked and prevented from turning.—Patent abandoned.

1553 J. BOWMAN, Peasholme Green, York. *Window blind fittings.* Dated May 19, 1869.
The inventor mounts a ratchet wheel on the stud or pivot, on which the roller turns as the blind is drawn up; a pawl, carried by the roller, then runs over the teeth of the ratchet, and when the blind is raised to the height required, by dropping between the teeth of the wheel prevents the blind running back. This part has a disc at its end which is nipped and held between two levers jointed to the blind frame. These levers are at their lower ends connected together by a screw, and by turning this screw the levers can be made to nip the disc on the stud or pivot with any required amount of pressure.—Patent abandoned.

1554 A. J. DUDGEON, Millwall. *Propelling vessels.* Dated May 19, 1869.
The inventor employs for this purpose turbines mounted on horizontal axes, and driven by steam engines or other suitable motive power. The turbines draw in water by passages through the bottom or sides of the ship, and discharge it horizontally through curved passages terminating in orifices projecting from the side of the ship.—Patent abandoned.

1555 1556 Petitions to extend the time for filing these specifications are pending.

1557 Z. E. COFFIN, Newton Center, U.S.A. *Stop cock.* Dated May 20, 1869.
The case of the cock is connected to the pipe or pipes by couplings, bolts, or otherwise, and the case contains two flat valve seats facing each other, and standing at an inclination to each other. Between these seats the valves work, and they are slidden off the seats to open the cock, or forced down between the inclined seats to close the same.—Patent completed.

1558 C. C. PARKER, Brooklyn, U.S.A. *Cord tighteners.* Dated May 20, 1869.
This consists in a cord tightener in which the grooved pulley is fitted on a slide with a helical spring that yields as the cord expands or contracts, and there is no possibility of the slide becoming wedged or obstructed because this slide is L-shaped, one arm carrying the pulley and the other arm setting within the helical spring, so that the helical spring intervenes between the slide and the case and prevents the parts sticking.—Patent completed.

1559 G. PERKIN, Derby. *Cup and ball castor.* Dated May 20, 1869.
The improvement in the ball-bearing cup consists in forming it with an internal and circular step, the nosing or projecting edge of which, slightly rounded, rests upon the ball and forms its bearing. The inventor makes the diameter of this circular bearing step about two thirds (more or less) of that of the diameter of the ball or globe which forms the runner of the castor.—Patent completed.

1560 A. A. ROSSIGNOL, Paris. *Electric clocks.* Dated May 20, 1869.
A spiral spring of suitable strength is fixed at one end on an arbor of the mechanism to be moved, and at the other end on a ratchet wheel movable on this arbor. A stop spring holds the wheel in the position required for giving the necessary tension to the spring. This spring draws round the arbor and the centre wheel which turns the second wheel by means of a pinion. The second wheel is provided with pins serving to raise a light copper rod or spring for shutting off the current from a battery passing through the electro-magnet.—Patent completed.

1561 J. REID, Glasgow. *Communicating in looms.* Dated May 20, 1869.
This consists in putting a toothed wheel on to an axle of each carriage, and near this toothed wheel another similar wheel is situated having a crank attached to it. The second toothed wheel is provided with means such as a clutch or some analogous contrivance by which it may be put into gear with the toothed wheel on the axle; wires, ropes, or chains pass from the connections of the second toothed wheel to the interior of each compartment of the carriage, and these are again connected to handles in connection with indicating dials.—Patent abandoned.

1562 J. M'MILLAN, Dumbarton, and J. M'GREGOR, Glasgow. *Iron and steel preserving.* Dated May 20, 1869.
This consists in covering the iron or steel or structures composed thereof with sulphur. In applying the sulphur it is melted, and on being brought into contact with the cold iron or steel it is suddenly chilled and sets into a hard thin layer of sulphur covering them.—Patent abandoned.

1563 M. JARVIS, Mansell-street, E., and E. MILLWARD, Skinner-street, Somers Town. *Lock spindles and door knobs.* Dated May 20, 1869.
This consists in the employment of a sliding plate or catch working within a suitable opening formed to receive it in the bushings of the door knob, such plate or catch working in connection with notches or recesses formed on one or more sides of the lock spindle.—Patent completed.

1564 T. HERBERT and J. C. FOWLER, Riverhall-street. *Electric signals.* Dated May 20, 1869.
The inventors first form a hole in the desired position large enough to admit of the outer tubular contact piece being readily pushed in without hammering. This tubular contact piece is provided with lugs or projections on the outer end thereof to ensure its being kept in proper position, and it is insulated from the metal washer or disc by means of a disc of indiarubber or other suitable material interposed between the two.—Patent completed.

1565 H. E. NEWTON, Chancery-lane. *Coffee mill.* (A communication.) Dated May 20, 1869.
The bowl is provided with a cover which is fastened to it by clamps adjusted to handles, the clamps having grooves for the reception of the handles, thus forming a kind of bayonet joint which is fastened by slightly turning the cover round. Under the cover is fixed a hopper having at its bottom a box or casing for the grinding block. The axle of this block is supported by a box below and by a collar above the cover.—Patent abandoned.

1566 J. P. NOLAN, Shoeburyness. *Distance measuring.* Dated May 20, 1869.
The instruments and fittings consist of two metal Y's and V's to each gun fitted with the instruments, consisting of a pair of angle finders, of a roller or mechanical calculator, and of a measuring tape wound round a spinning rack. The best way of fitting the Y's and V's is to make the stem of one of them the same shape as the tangent sight bar of a gun so that it can be slipped into the place of an ordinary tangent sight at will, and be fastened permanently by screws or otherwise. A second Y or V is attached (permanently if required) about 14in. in front of the other to the gun.—Patent completed.

1567 W. R. LAKE, Southampton-buildings. *Boat detaching apparatus.* (A communication.) Dated May 20, 1869.
Two corresponding metallic plates are connected together parallel with each other by an intervening block of like material, and having proper spaces for the insertion of three adjustable parts. One of the parts is curved at one end and forms the hook proper, its other end being articulated to and between the lower ends of the connected plates so as to swing freely below the connecting block of the plates.—Patent completed.

1568 G. JOHNSTON, San Francisco. *Distilling.* Dated May 20, 1869.
This relates to an arrangement of the furnace with two discharge flues, one of which connects with the space beneath the alembic or retort, and the other with the chimney, so that by means of a slide or damper the current of heat may be directed into either passage at pleasure, and thus obviate the necessity for withdrawing the fires during the process of charging and discharging the still. The retort has a series of horizontal diaphragms or partitions commencing near the bottom and reaching to the top, which separate it into chambers, the lower ones being connected by means of hollow return columns, the next ones having distributors so contrived as to thoroughly pass the hot vapours through the liquid contained within the chambers, while the upper chamber of all contains a number of coils of pipe, or other device, through which the vapours pass, and thus heat a charge of alcoholic liquid contained within the chamber.—Patent completed.

1569 J. G. TONGUE, Southampton-buildings, Chancery-lane. *Cutting machines.* (A communicaton.) Dated May 21, 1869.
Two simultaneous movements are employed, one for the advancement or progression (more or less slow) of the wood or other material to be cut, the other for the perpendicular or oblique transverse movement of the blades or knives; the speed of this movement depends on the nature of the woods or substances to be cut.—Patent completed.

1570 S. JACKSON, Bradford. *Window shutters.* Dated May 21, 1869.
This consists in constructing window shutters of laths or narrow strips of wood or other suitable material arranged horizontally and hinged together, the joints being on alternate sides so as to allow them to fold in a zigzag manner one upon another. A box or receptacle is also formed or provided under the window bottom betwixt the masonry and the lining of suitable dimensions to receive and contain the shutters when folded.—Patent completed.

APPLICATIONS FOR LETTERS PATENT.

Dated November 30, 1869.

3459 W. H. Shaw and J. M. Audus, Elland, near Halifax, Yorkshire. Improved machinery or apparatus for dressing millstones.

3460 J., J., and W. H. Wood, Hollinwood, Lancashire. Improvements in ventilating hats or other coverings for the head.

3461 C. H. Hudson, New York, U.S.A. Cots or bedsteads, and guards to be attached thereto, which latter may also be used in other positions.

3462 E. T. Hughes, Chancery-lane. Improvements in the manufacture of elliptic springs, and in apparatus employed therein.

3463 A. W. Pocock, Claverton-street, Pimlico. Improvements in meters or apparatus for measuring water and other liquids.

3464 W. H. Willis, Long-acre. A new or improved apparatus for registering or indicating the points of games, also applicable to calenders and other similar useful purposes.

3465 B. Acton and J. Mustard, Stroud, Gloucestershire. Improvements in machinery for feeding carding engines.

3466 W. Avery, Redditch, Worcestershire. Improvements in umbrellas and parasols.

3467 E. Ensor, jun., Woodville, near Burton-on-Trent, Staffordshire. Improvements in kilns for burning pottery and salt glaze ware, applicable also to the burning of bricks and to the annealing of iron.

3468 A. V. Newton, Chancery-lane. Improved apparatus for converting reciprocating motion into rotary motion.

3469 R. Milburn and T. Browning, Church-lane, Whitechapel. Improvements in drying machines.

3470 J. F. Crease, Eastney, Southampton. Improvements in the construction of tank filters, and in the conversion of tanks into filters.

3471 R. Hornsby and J. E. Phillips, Spittlegate Iron Works, Grantham, Lincolnshire. Improvements in reaping and mowing machines, and in apparatus for sharpening the knives of such machines.

Dated December 1, 1869.

3472 W. Spence, Quality-court, Chancery-lane. Improvements in the manufacture of soda crystals.

3473 T. G. Green, Church Gresley Pottery, Derbyshire. Improved machinery or appliances for use in the manufacture of articles of earthenware and chinaware.

3474 J. Forbes, Perthshire. Improvements in desiccating malt, grain, and other similar substances, and in means employed therefor.

3475 J. James, Princes-street, Stamford-street. Improvements in apparatus for stamping or marking letters, packets, or other articles.

3476 A. C. Henderson, Charing Cross. Improvements in apparatus for shearing or clipping animals, the said apparatus being also applicable to shaving skins.

3477 J. T. Griffin, Upper Thames-street, City. Improvements in preparing, treating, and curing sponge to render it elastic and suitable for use as a stuffing for beds, cushions, seats, and other similar articles.

3478 W. Bennett, Aston, near Birmingham, and J. Currall, Birmingham. Improvements in kitchen ranges and fireplaces or stoves for cooking and heating, and in apparatus connected therewith.

3479 F. N. Target, Colyton, Devonshire. Improvements in waterclosets.

3480 J. Peirce, Stamford-street, Lambeth. An improved compound machine for cutting tenons and mortises and sawing wood.

3481 W. Richards, Birmingham. Improvements in firearms and cartridges.

3482 H. C. Ash, Oxford-street. Improvements in the manufacture of churns.

3483 R. Robey and J. Richardson, Lincoln. Improvements in steam engine governors and apparatus connected therewith.

3484 R. N. Slight and W. F. Denholm, Chirnside Bridge, Berwickshire. Improvements in the straining of paper pulp, and in the machinery, mechanism, or apparatus therefor or connected therewith.

3485 G. Hammer, Griffin-court, Mayfair. Improvements in cork-cutting machines.

Dated December 2, 1869.

3486 H. C. Pennell, Woodlands, Weybridge. Improvements in rifles, fowling pieces, and small arms.

3487 J. B. Wilson, J. Higginbottom, and I. Royse, Stockport, Cheshire. Improvements in bowls or rollers used in calendering and other pressing or squeezing machinery.
3488 A. Mitchell, Leith, Mid Lothian. Improvements in caissons or apparatus to facilitate the building of bridge piers and similar structures under water.
3489 F. C. Webb, Northumberland-terrace, Regent's Park-road. Improvements in the manufacture of submarine telegraphic cables, and in the machinery employed in such manufacture.
3490 A. P. Stirling, Peebles, North Britain. An improved spittoon, specially applicable to railway carriages.
3491 J. H. Johnson, Lincoln's Inn-fields. Improvements in spring mattresses.
3492 H. H. Mayden, Mansfield, Nottinghamshire. Improvements in machinery or apparatus for spinning tobacco.
3493 J. W. and E. Whittaker, Carlisle Villa, Moses Gate, near Bolton-le-Moors, Lancashire. Improvements in steam boiler furnaces and flues.
3494 P. A. S. Langlois and L. S. Tomassin, Boulevart St. Martin, Paris. Improvements in the manufacture of sulphuric acid.
3495 E. Field, Chandos Chambers, Adelphi, Westminster. Improvements in valves for steam fire engines and other pumps.

Dated December 3 ,1869.

3496 W. Tatham, Rochdale, Lancashire. Improvements in machinery for opening and breaking hard waste rags of cotton, woollen, flax, or silk, and for scutching and carding cotton, wool, and other fibrous substances.
3497 J. Smith, Carshalton, and T. Eastwood, Lambeth. Improvements in working and reversing the valves of steam and other engines.
3498 J. M. Macintosh, Grosvenor-road, Pimlico. Improvements in apparatus for taking up, carrying, and laying sheets of paper delivered by a paper cutting or other machine.
3499 J. C. Wilson, Martin's-lane, Cannon-street, City. An improved revolving engine and pump, applicable as a fluid meter.
3500 W. M'Lean, Glasgow. Improvements in printing, lithographing, and zincographing, and in the means or apparatus employed therefor.
3501 J. Jeavons, Atlas Works, Sheffield. Improvements in the manipulation and manufacture of armour plates and other heavy forms of malleable iron.
3502 E. V. Neale, Lincoln's Inn. An improved method of fastening objects capable of rotating on hinge joints.
3503 T. W. Tobin, Royal Polytechnic Institution, Regent-street. A new or improved electric telegraph apparatus.
3504 T. R. Crampton, Great George-street, Westminster. Improvements in burning powdered fuel and in furnaces and apparatus for burning powdered fuel, also in adapting such furnaces for the melting and working of glass, iron, steel, and other material, and to heating steam boilers.
3505 H. Larkin, Torriano Cottages, Leighton-road, and W. White, Thurlow-road, Hampstead. Improvements in the production of potassium, sodium, and zinc.
3506 J. and S. Loebl, Aldermanbury, City. Improvements in fastenings and locks for bags and other like articles.

Dated December 4, 1868.

3507 J. Boyd, Glasgow. Improvements in machinery for winding yarn or thread upon conical surfaces.
3508 C. W. Petersen, City-road. Improvements in the construction of lifeboats and other floating bodies, and in the mode of propelling and ventilating the same, and in steam boilers to be used therewith.
3509 J. F. Kent, Thornton Heath. An improved mortising, tenoning, and sawing machine.
3510 H. M. Nicholls, Arundel-street, Strand. Improvements in apparatus for cutting continuous paper into sheets, and in piling or disposing of the same when cut.
3511 S. Alley, Glasgow. Improvements in breakwaters.
3512 J. Knowles, Burnley, Lancashire. Improvements in rotary engines to be worked by steam, air, water, or other fluid, which improvements are also applicable for raising fluids.
3513 J. Walker, Clayton-le-Moors, Lancashire. Improved material to be employed in the manufacture of blankets known as washing blankets, as used by calico printers, and for other purposes requiring a waterproof material having an absorbent surface.
3514 H. Alexandre, Rue St. Appoline, Paris. Improvements in organs and similar musical instruments.
3515 W. Brookes, Chancery-lane. Improvements in fluid lenses.
3516 T. Magguire, South-terrace, Inchicore, Dublin. Improvements in the packing glands of steam and other engines.
3517 A. Ripley, West-square, St. George's-road, Southwark, and J. Wormald, Blackfriars-road, Southwark. A new or improved pipe wrench.
3518 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in harness for draught animals.
3519 T. Clark, Cheapside, City. Improvements in the covers of umbrellas and parasols.
3520 S. Chatwood and J. Crompton, Bolton-le-Moors, Lancashire. An improved self-acting escape valve for drawing off the condensed fluids from steam engines, pipes, and other steam vessels.

Dated December 6, 1869.

3521 J. L. Booth, Rochester, New York, U.S.A. Improvements in the manufacture of rails for railroads.
3523 T. Prideaux, Sheffield. Improvements in purifying and calcining gas and soap limes and other chemical refuse of lime which has been used in the manufacture of such articles.
3523 W. Shanks, Johnstone, Renfrewshire. Improvements in machinery for forging horseshoes and similar articles.
3524 H. H. Murdoch, Staple Inn. Improvements in, and apparatus for, forming and joining the ends of iron and other tubes or pipes.
3525 J. B. Spence, Manchester. Improvements in the manufacture of alum.
3526 J. B. Spence, Manchester. Improvement in the production of a substance to be used in the manufacture of paper in a similar manner to alum or sulphate of alumina, which substance is also applicable as a mordant in calico printing, and to other manufacturing purposes in which alum or sulphate of alumina is employed.
3527 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in machinery for hulling grain or seed.
3528 W. Geeves, Thornhill-square, Barnsbury. Improvements in the manufacture of capsules or packages for containing tea and other like articles, and in apparatus mployed in such manufacture.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," December 7, 1869.

2225 W. Warren
2241 J. H. Johnson
2244 S. Cotton
2277 D. T. Bostel
2281 W. A. Lyttle
2286 A. Burdess
2295 J. S. Kipping
2298 G. Allibon
2310 J. Beckett
2315 L. W. Wright
2325 W. E. Gedge
2331 T. Livesey and T. Abbott
2335 G. S. Hazlehurst
2341 J. Elce and R. Bond
2360 G. Nickerson
2377 J. H. Johnson
2385 T. Hancox
2387 E. T. Hughes
2398 C. D. Watson
2454 B. Hunt
2492 L. B. Fortin and J. Ferrabee
2557 R. H. Herriott and C. and W. A. Plumbe
2603 G. Henley
2692 T. Restell
2777 B. Hunt
2753 W. J. Cunningham and A. P. M'Carthy
2852 E. A. A. Hugo
2879 J. B. Bradshaw
2954 A. V. Newton
2961 T. Cope, J. Hignett, and G. Lauder
3017 H. M. Marsden
3125 W. Brookes
3134 J. James
3165 E. Ford
3203 E. Edmonds
3219 J. C. Heywood
3226 W. R. Lake
3239 H. Lee
3250 W. R. Lake
3308 J. Oppenheimer
3320 G. R. Sweetser and G. Wadman
3322 J. Woodward
3332 J. Dockray
3351 T. Aitken
3359 J. H. Fraser
3361 Sir J. M'Neill
3363 J. Burroughs
3375 E. E. Allen
3379 S. G. Arnold
3456 W. R. Lake

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list, who have given notice of their intention to proceed within twenty-one days from the date of the "Gazette" in which the notice appears by leaving at the Commissioners' office, particulars in writing of the objection to the application

LIST OF SEALED PATENTS.

Sealed December 3, 1869.

1724 J. Edge
1737 T. Wilkins and W. Fisk
1750 W. B. Leachman
1758 F. Heckner
1759 W. Sellers
1760 G. Fenner
1764 C. E. de Loriere
1782 A. St. C. Radisson
1802 E. T. Hughes
1812 J. H. Brown
1814 W. R. Lake
1823 W. R. Lake
1926 S. Joy
2007 J. Steward
2024 W. R. Lake
2232 R. Boyd
2354 W. R. Lake
2355 W. R. Lake
2537 W. R. Lake
2625 S. F. and A. B. Ibbotson
2697 W. E. Newton
2789 H. A. Bonneville
3025 J. Player
3028 J. M. A. Stroh

Sealed December 7, 1869.

1767 H. Carter and G. H. Edwards
1768 D. Cole
1774 W. E. Gedge
1776 D. J. Field and I. W. Lister
1777 J. Mabson
1792 J. Blair
1799 J. G. Marshall
1809 A. Lafargue
1888 J. B. Brooks and G. Picken
1891 S. Nicholls
1902 C. D. Abel
1918 A. J. Deblon
1921 A. M. Clark
1931 A. H. Still and D. Lane
1966 B. Templar
1991 E. Roe
2026 W. E. Newton
2050 W. E. Newton
2323 A. Louden
2763 R. C. Wallace and D. Crawford
2834 W. and A. Kempe
2922 G. W. Hawksley and M. Wild
2988 C. W. Siemens
2990 E. Lane
3106 J. Sheldon

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3155 P. M'Gregor
3171 J. T. A. Mallet
3178 W. H. Harfield
3179 J. A. Coffey
3189 W. H. Richardson
3190 E. L. Paraire
3193 T. Bayley and J. Taylor
3195 C. E. Brooman
3222 J. C. M'Donald and J. Calverley
3237 G. Haseltine

PATENTS ON WHICH THE STAMP DUTY OE £100 HAS BEEN PAID.

3230 G. F. Blumberg
3259 R. Hornsby
3310 S. B. Whitfield
3262 L. Cristoph, W. Hawksworth, and G. P. Harding

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following uumbers:—

2795	3314	3336	3349	3363	3376	3391	3401
3089	3320	3337	3351	3364	3377	3393	3402
3121	3323	3338	3352	3365	3379	3394	3404
3219	3325	3339	3353	3367	3384	3395	3406
3231	3327	3340	3354	3368	3385	3396	3408
3260	3329	3341	3356	3369	3386	3397	3410
3270	3331	3343	3359	3370	3387	3398	3412
3274	3332	3344	3360	3371	3388	3399	3414
3285	3333	3345	3361	3372	3389	3400	3416
3301	3334	3346	3362	3375	3390		

LIST OF SPECIFICATIONS PUBLISHED

For the week ending December 4, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s d.		s. d.		s. d.		s. d.		s. d.
1081	0 8	1169	0 10	1228	0 10	1279	0 8	1301	0 4	1325	0 4
1091	0 10	1171	0 8	1234	0 8	1281	0 6	1302	0 4	1326	0 10
1097	1 0	1177	1 0	1239	0 4	1282	0 4	1303	0 4	1328	0 8
1117	0 10	1178	0 8	1242	0 10	1283	0 4	1306	0 4	1330	0 4
1128	1 2	1180	1 6	1252	1 4	1287	0 6	1307	0 4	1331	0 4
1130	0 10	1190	0 8	1253	0 8	1288	0 8	1309	0 4	1336	0 8
1132	0 8	1194	0 8	1254	0 10	1290	0 8	1310	0 4	1340	0 4
1136	0 8	1205	0 10	1260	0 10	1294	0 4	1314	0 4	1442	0 10
1145	1 6	1209	0 10	1262	0 4	1297	0 4	1317	0 4	1458	0 4
1152	1 0	1211	0 8	1268	1 2	1299	0 4	1320	0 4	1563	0 8
1167	1 4	1212	0 10	1274	0 10	1300	0 4	1323	0 4	1683	0 10
1168	0 8	1216	1 4	1275	1 0						

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and Co., Patent Department. 166, Fleet-street, London, E.C. ,to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, DECEMBER 17, 1869.

THE AUSTRIAN TORPEDO.

THE most recent addition to the history of the Torpedo question and its practical development is furnished by some experiments which have lately been carried out in Austria with a submarine self-propelling torpedo. Our pages bear ample testimony to the ingenuity which has been for several years past expended upon instruments of the torpedo class for defence against the attack of war vessels. During the Russian war Cronstadt was defended by this class of weapon sunk in the channels of approach and ready to be fired by electricity. Later on, during the American war, similar means were resorted to for coast and harbour defence. In the present instance we have a powerful agent of destruction, which may be seen at the little port of Fiume in the Adriatic. We are not able to place a detailed description of this machine before our readers, inasmuch as the important parts are kept secret by the inventor, who prefers to do this rather than to patent his principle, and thereby expose its peculiarity. We can, however, furnish a general idea of its external form and what it is capable of doing, having been favoured with these particulars by a correspondent—Mr. Andrew Leighton, of Liverpool—who has recently returned from Fiume, where he witnessed the experiments with the torpedo. In appearance this formidable weapon is like a fish, approximating to the form of the sword-fish. But, besides a projecting snout, it possesses a vertical and two lateral projections, all of which are triggers, and any one of which impinging upon an object with sufficient force explodes the machine. It has therefore, when in operation, four chances of effecting its purpose—by the direct stroke in front, or the oblique from either side, or the hit above in passing under the bottom of any object against which it may be launched. It can be charged with any explosive material—gunpowder, gun-cotton, dynamite, or nitroglycerine, and the explosion can be of such force as to drive a hole into the strongest ironclad sufficient to sink her at once.

The most prominent and important feature in the invention is the means by which it can be propelled at any required depth below the surface of the water. When the depth at which it is to proceed is fixed upon it can be driven in a horizontal plane at that depth, towards any mark, at a maximum speed of ten knots an hour. While Mr. Leighton was at Fiume, a commission from the United States, consisting of Admiral Radford and two officers of the United States frigate "Franklin," was engaged in investigating its nature and powers. The experiments had just closed when Mr. Leighton reached the scene, but the inventor subsequently showed the torpedo in operation. It was set off from the side of a boat, and after attaining a depth of some six or eight feet from the surface, it kept as nearly as could be judged the same level, and made three circuits, of from 100 to 150 yards each, round the boat, coming to the surface when its propelling power—compressed air—was exhausted. The water at Fiume is very deep and remarkably clear, so that the monster fish was perfectly defined at the depth stated. Its course could also be seen by the bubbles of air coming to the surface in its wake at a considerable distance behind it. The invention of this torpedo is due to Mr. Robert Whitehead, an English engineer resident at Fiume, and chief of an engineering establishment there. The idea was first started by Captain Luppis, a retired officer of the Austrian navy, who suggested to Mr. Whitehead the desirability of a floating and running torpedo, the forepart to be filled with explosive material and the after-part with the motive power, which latter was to be steam. But, on giving his attention to it, Mr. Whitehead soon saw that Captain Luppis's notions were wholly impracticable; that a surface-floating body would never answer the purpose; and that fire or steam in close proximity to explosive material would be so dangerous that this idea of the gallant captain had to be abandoned as worse than useless. He, therefore, set to work upon an idea altogether his own, which was to form a fish instead of a steamboat; and, after innumerable mistakes, failures, and disappointments, his perseverance was at length rewarded by the triumphant success already indicated. Thus to English, and not to Austrian, mechanical genius—as has been incorrectly stated in some quarters—belongs the honour of this latest achievement in the art of defensive warfare, which, if it does not render other coast defences needless, must at least be acknowledged as a potent auxiliary for maintaining our island home invulnerable; that is, if our government have had the wisdom to possess themselves of its secret. It is impossible for anyone who has seen this torpedo in operation to hesitate in his judgment as to its superiority over anything of the kind hitherto invented; and it is difficult to estimate the extent to which this single invention will modify the arts of attack and defence by sea.

PERMANENT PHOTOGRAPHS IN CARBON.

SINCE Mr. J. W. Swan, of Newcastle-upon-Tyne, first published a process in carbon which could be practically worked for the production of permanent photographs, several improvements have been made, and at the present time such pictures are readily purchasable in London at very moderate rates. All the carbon processes have been patented, and they have been bought up by the Autotype Company. The ordinary photographs upon albumenised paper are, as we have often pointed out, sure to fade after a greater or less lapse of time, and are therefore of no historical value; but where the shadows of a picture consist of carbon pigments, the imperishability of this most durable of all colouring substances necessarily ensures the permanence of the pictures. Carbon was the base of the most imperishable of the inks used by the monks of old, and is the cause of the durability of so many ancient black-letter manuscripts.

The principle of the carbon processes has already been published in these columns, but it is best to briefly state it once more, in order to more clearly explain the nature of the improvements recently made in the manipulations. Gelatine, mixed with solution of bichromate of potash or ammonia, and dried, is soluble again in warm water provided light has not been allowed to act upon the substance throughout the operations. Light, however, makes it insoluble in warm water, and the longer it is exposed to light the deeper does the action penetrate, so that a great thickness of it may in time be thus made insoluble. These facts were originally discovered by Mr. Mungo Ponton, F.R.S.E., of Clifton. In carbon processes, Indian ink or other colouring matter is added to the gelatine and bichromate of potash; a film of the dark mixture is made, dried, and exposed to light under a negative. Next, it is mounted on white paper, and subjected to the action of warm water. Where the light has not acted, the carbon tissue is all dissolved away, leaving the white paper to form the lights of the picture. Where the light has acted vigorously, a dark black deposit is left to form the darkest shadows of the picture, and where the light has acted only to a moderate extent thinner deposits of colouring matter remain behind to form the half-tones.

In the old carbon process, a glass plate was coated with collodion and dried by heat; the warm gelatine pigment was then poured on in a thick pool, the plate was next placed accurately in a horizontal position, and the whole left for several hours to dry in the dark. When dry, one corner of the film was lifted by the aid of a penknife, and the whole of it then gently peeled off the plate by pulling it steadily with the fingers. In this state the surface which had been nearest to the glass resembled exquisitely polished patent leather. This polished surface was placed next the varnished side of the negative, exposed to light, and mounted upon paper. It was absolutely necessary that the polished surface should be the one fixed in contact with the paper, because the light had acted from that surface to different depths, rarely penetrating the whole film. Therefore, if the other surface were attached to the paper, the whole of the delicate shadows would be lost in the warm water, simply because they would have nothing to attach them to the paper when the pigment behind them dissolved off. This double transfer from glass to paper was the most troublesome part of the operations, and the pigment could only be satisfactorily attached to the paper by means of a solution of benzole in indiarubber, and pressure between rollers. By the present method, this troublesome work is avoided, Mr. J. R. Johnson having found out how to overcome the difficulty.

The process at present used by the Autotype Company is as follows:—The pigment without any bichromate is made as already described, a little sugar, however, being added to make the tissue more pliable when dried. A little blue or red colouring matter is also added, to improve the tone of the colour of the Indian ink. A large vessel is filled with the gelatine pigment, and kept steadily at a temperature just high enough to prevent it from solidifying. A great length of paper is then joined at its two ends, so as to form an endless band, which travels loosely and slowly round and round upon rollers. At its centre this band dips into the gelatine pigment, which partially dries upon the paper before it passes into the liquid pigment again. In this way the paper band receives successive thin coatings of the pigment, until the desired thickness is attained. It is then dried and cut up into sheets, which as yet are insensitive to the action of light, because they contain no bichromate salts.

The paper is sensitized a few hours before it is wanted for use by floating it for two minutes upon a solution containing 22 grains of bichromate of potash to each fluid ounce of water. This must, of course, be done by yellow, orange, or red light. The tissue is then dried in the dark, after which it is exposed under the negative. The eye is no guide to printing by the carbon process, so the right time of exposure for every separate negative is ascertained by means of a few experimental trials and a photometer; this point is the worst and most troublesome portion of the carbon process, as it stands at present. Next the exposed surface is wetted, and without any cementing substance it will adhere to any surface which is impermeable to water. The gelatine, not being saturated, rapidly absorbs the superfluous moisture after it is thus placed in contact with its support. The whole is then dipped in warm water, where the superfluous pigment dissolves away and the picture shows as a transparency, supposing the support chosen be a sheet of glass. When paper is used it is necessary that it should be impermeable to water, and this is effected by means of albumen coagulated by alcohol.

To make an opalotype the exposed tissue

is immersed in water for a few minutes, and then raised from the liquid by means of a plate of opal glass placed beneath. Next, a pad of blotting paper is laid upon the tissue, and all air bubbles between the tissue and the glass are carefully pressed out. After the lapse of some little time, to permit partial drying, the development is effected at a temperature of about 100deg. Fah. and the picture is finished. When it is desired to transfer such pictures from glass to paper the glass is rubbed over, in the first instance, with a solution of stearine in weak methylated alcohol, which is then polished off again, but it leaves an imperceptible film behind, which prevents the pigment from adhering too firmly to the glass. After the development is finished a sheet of paper coated with transparent gelatine is wetted and pressed into contact with the glass, care being taken to exclude air bubbles; then the whole is allowed to dry, after which the paper may be peeled from the glass, bringing the picture with it entire and uninjured. Sometimes the exposed carbon tissue is mounted directly upon paper which has been rendered impermeable to water by some process not yet made public; it is then developed, and the picture is finished. The paper is probably treated with a solution of some resinous substance in weak methylated spirit.

Such is the carbon process, as it stands at present, and it exhibits many simplifications not to be found in the original process, which we published several years ago. Considering the large number of pictures of English scenes and English celebrities which are taken by photography every year, it is a pity that records of so much historical value should not be printed in a permanent manner. Negatives were taken of the site of Holborn Viaduct before its erection and this instance alone shows the desirability of permanently printing a scene from "Old" London which mortal eye will never see again, except upon paper. Silver prints from these negatives were on view at the recent exhibition of the London Photographic Society in Conduit-street. As for silver pictures upon albumenised paper, they fade rapidly away, so it may be more truly said of photographers than other people—"They die, and their works do follow them."

THE SMITHFIELD CLUB SHOW.

IN resuming our notice of the Smithfield Club Show, we will first look at the stand of Messrs. Richard Garrett and Sons, of the Leiston Works, Suffolk. This firm exhibited a great variety of seed drills, horse hoes, manure distributors, field rollers, and a number of useful implements of their usual excellent make. But we would call special attention to their self-moving agricultural engines, which were designed by this enterprising firm to meet a want which had often been much felt. This want was a light self-moving engine capable of being easily transported from farm to farm. The advantages of Messrs. Garrett's self-moving engine are that it will draw a thrashing machine and straw elevator with ease, and pass over soft land and places where it would be exceedingly difficult to take machinery by horses. This engine is but a few hundredweights heavier than a portable engine of the same power. This firm also exhibited Hayes' straw elevator, and a very well-arranged continuous iron framed stone grinding mill, with 48-inch French Burr stones. These mills are so arranged that any number can be put down at different times and driven by the same motive power.

Messrs. Richard Hornsby and Sons, of the Spittlegate Iron Works, Grantham, had a very good portable engine and a combined thrashing, shaking, and finishing machine. But their chief strength was shown in their reapers, which were there in all their useful varieties. The "paragon" machines of this class differ from all others in having a really direct action for the knife. The cutter bar is directly jointed to the crank shaft, so that it will work freely at any angle. This firm have also introduced a grinding and sharpening machine, which supplies a want which has long been felt by users of reaping and mowing machines, in which so much depends upon the knives being kept properly sharp. The machine is a small bevelled sharpening roller which is actuated by a treadle, the operator sitting in front of the machine. The angle given to the sharpener is exactly adapted to the contour of the knives, and the work of sharpening is rapid and easy.

The Beverley Iron and Waggon Company, Beverley, Yorkshire, made their usual display of carts and waggons, for which they have been so long and so justly famed. Amongst this class of exhibits we particularly noticed their liquid manure or water cart, which is well-arranged and put together. This cart is fitted with the Beverley Company's patent iron wheels, and is admirably adapted for distributing liquid manure or water by means of a spread-board 6ft. long, which is suspended from the back of the cart and can be adjusted to the true level when working along the side of a hill. We also noticed a well-designed one-horse manual delivery reaper, which is fitted with Norfolk's patent self-acting tipping platform, and which has done some good work, and was a new exhibit with the Beverley Company. Whilst on the subject of reapers, we must not omit to notice this company's self-acting swathe-delivery reaper, which certainly embodies all the features that a true reaper should. This machine will pass complete through almost any gateway, commence cutting as it enters the field (being quite independent of scythemen), and deliver on either side, which enables it to work both up and down the same side of, or all round the crop, as circumstances may require. It is a noteworthy fact that the Royal Agricultural Society paid the Beverley Iron and Waggon Company twenty-five guineas for the use of one of these reapers in opening out the fields and dividing the lots of rye so as to enable the machines of other exhibitors to commence work without employing scythemen to clear the way for them, being a larger sum than was awarded to any other reaper in any class at Manchester. At this stand we also found a new turnip cutter, which struck us as being the handiest and most perfect out. Pickers are attached inside the front plate, and these clean the knives directly a cut is made. This ensures greater regularity in the size of the pieces cut, and a complete separation from dirt with less waste and labour. It thus has at all times empty knives to effect a clean and easy cut, it cuts the last piece irrespective of thickness, and it delivers the cut turnips direct into the scuttle perfectly clean, instead of taking them round in the barrel until forced out by the next pieces. The Beverley Company have also improved their linseed cake breaker by making the hopper for feeding variable, so that it can readily be fed with broken cake. Of course the company were as strong as usual in clod crushers and field rollers.

The special feature at the stand of Messrs. Amies and Barford, of the Queen-street Ironworks, Peterborough, was Campain's patent anchor, which is used in the roundabout or stationary system of steam cultivation. By the use of this anchor, which is self-moving and self-acting, the two anchormen as now employed are saved, the repeated digging up of the headlands is avoided, the annoyance and loss of time caused by the ordinary anchors drawing out is unknown, 40 per cent. of the daily expenses in wages is saved, and 10 per cent. more work can be accomplished. Indeed, the roundabout system can now be worked with the same number of hands as the direct system, while the items of coal and water carting are of course considerably less. Two anchors are employed occupying a position opposite to each othe on the headlands, and proceeding at righ angles with the plough or cultivator as it proceeds in its work. This firm also exhibited their combined straw, hay, and corn elevator, which is constructed both to carry straw from the steam thrashing machine, and hay, as well as sheaved or loose corn, during the hay and harvest seasons, with this additional advantage, that the machine is self-contained, and requires no separate horse works, and is consequently removed from stack to stack in much less time, while the machine is stronger and lifts to a great height. This is accomplished by Messrs. Amies and Barford's new plan of raising the body of the machine, by means of racks and pinions, to such a height that a horse can work underneath it, and the produce is then delivered to an elevation of 30ft., and the most severe part of the hitherto laborious manual operation is saved—a light nag horse being equal to the work. When harvest is over, the machine is let down to the ordinary height, and is then suitable for being driven in the usual manner from any steam thrashing machine. Another feature at this stand was Messrs. Amies' adjustable water ballast roller, which was described in the MECHANICS' MAGAZINE last year. In this roller, the cylinder is made of the best boiler plate, and is perfectly watertight, so that it can be loaded with water to any required extent. One of these useful implements has just been supplied by the makers to the town of Berwick-on-Tweed. It was 6ft. 6in. in diameter, 5ft. 6in. long, was made of 1in. plates, and weighed 12 tons.

Conspicuous, as usual, for steam cultivating machinery was the stand of Messrs. John Fowler and Co., of Leeds. They exhibited a new cultivator of strong and simple construction and 15ft. wide, in which the harrows are upon the principle adopted in this class of implement by this firm. They also exhibited a 14-horse power steam ploughing engine, and a single cylinder 10-horse power ploughing engine. The winding drum is worked by outside gear instead of inside as formerly, which enables the power to be obtained direct from the crank shaft. The pumps, cylinder, taps, &c., are all within the driver's reach, and in all respects these engines show careful design and sound workmanship. Messrs. Fowler have perfected five distinct systems of steam cultivation which are adapted to the various requirements of agriculturists.

Messrs. Kinsey, Norton, Hill, and Co., of the Robin Hood Works, Nottingham, are now making their combined vertical engines and boilers upon a principle which they were the first to introduce. This consists in fitting the engines to an independent frame or standard, which is attached to the boiler at the top by an expansion joint. The frame and base—which serves as a tank—are cast in one piece, and although apparently heavy the frame is very light, being cast hollow. The combined steam engine and steam pumper of this firm can be altered to either purpose in a few minutes by simply removing or replacing a cotter which connects the pump. Messrs. Kinsey and Co.'s horizontal engines present no new feature, except, perhaps, Mr. Kinsey's quick speed governor, with which all the engines turned out by this firm are now fitted. At this stand we were also shown some sections of a new wrought-iron tubular boiler, which is about to be introduced by Messrs. Kinsey. It is now in course of being perfected, and when completed we shall place full particulars before our readers. In the meantime, we may state that it appears well calculated for safety, economy, and rapid steam generation.

Messrs. Aveling and Porter, of Rochester, had two engines which well represented their special class of manufacture. There were a 12-horse winding engine for steam ploughing on the direct two-engine system, and an 8-horse agricultural locomotive engine.

The 12-horse engine was the embodiment of simplicity, carrying very little gearing, a great recommendation in any engine, especially those of this class. Messrs. Aveling and Porter's novelty, which is their road roller, was not admitted, on the ground that it was not purely agricultural. However, the Islington Vestry have arranged to hire, with a view to purchase, one of these excellent machines, so that it may, at any rate, be seen in the neighbourhood of the Show. For the sake of human nerves and horseflesh, we trust other vestries will follow the sensible example set by that of Islington.

The portable engines of Messrs. Allchin and Son, of the Globe Engine and Boiler Works, Northampton, are improved in various details since the last Show. They have steam jacketed cylinders; a precautionary measure now generally adopted by makers of these engines. The boilers of the engines made by this firm are made of Messrs. Shorbridge and Howell's mild steel, a metal which is specially adapted for this purpose. Messrs. Allchin's engines are fitted with every modern appliance, the working parts being accessible and well arranged.

Haymaking machines, horse rakes, chaff cutters, and other small implements were to be found in abundance at the stand of Messrs. Ashby, Jeffery, and Luke, of Stamford. This firm has brought out a new series of chaff cutters, which are alike notable for their excellence and their cheapness. Their No. E chaff cutter is specially worthy of a few words. It is a very strong machine, adapted for hand, horse, or steam power; it is mounted on a strong wrought-iron frame, strong wrought angle-iron legs; has three bearings to the main spindles; the cog wheels are all covered, and it is fitted on the near side with a safety lever for instantly stopping the feed rollers and for regulating the length of cut; width of mouth, 9⅝in. It can be easily worked by one man if required. It cuts ¼in. and ⅜in. chaff. Messrs. Ashby also had a very good high-pressure vertical engine and boiler, in which all superfluity is avoided.

The novelty at the stand of Messrs. Wallis and Stevens, of Basingstoke, is their new pattern elevator for ricking hay, straw, and other produce by horse power. This invention which effects a great saving in manual labour, has been tested during the season of 1869 in all localities and with all sorts of crops, with the most complete success. It has the great advantage that the chains cannot slip, however heavy the load. It will therefore take up a much larger quantity, and as it does not require to be driven at such a high speed it does not knock the crop about, as is the case with some of the quick-speed elevators. A small and light 1-horse gear has been designed specially for driving these elevators, which loads up on the frame of the elevator, and can be put down ready for work in a few minutes. The other exhibits of this firm consisted of a substantial 8-horse portable engine, thrashing and winnowing machines, ploughs, and harrows.

Messrs. Woods, Cocksedge, and Warner, of the Suffolk Iron Works, Stowmarket, have also a very well arranged vertical engine and boiler. The main shaft is arranged so that the fly-wheel may be placed on either side of the engine; thus two machines can be driven at once direct from the engine, one from each end of the crank shaft. The governor is on an entirely new principle; it is simple but very sensitive, and can be regulated so as to keep the engine at any speed desired. The feed pump is fitted with gun metal ball valves, and an extra valve is placed between the pump and the boiler, and close to the latter, so that the valves of the pump can be looked at or even removed without stopping the engine. The fireboxes are adapted for burning wood, coal, or coke. The crown of the firebox being kept low, there is always a great depth of water above it, which lessens the chances of the boiler being injured by shortness of water. The oil cake breakers exhibited by this firm are good; their No. 6 is a strong machine suitable for hand, horse, or steam power. It is fitted with double sets of rollers for drilling ordinary cake into fourteen distinct sizes. Messrs. Woods and Co. had a very good cart with a fixed sideboard and a movable frame, and which can be readily converted into a covered cart.

The "Clipper" 2-horse mowing machine has undergone one or two improvements since we last saw it at the stand of the Reading Ironworks Company. Our readers are familiar through our pages with the constructive details of this very successful machine. We need therefore only now point out that it combines strength and lightness in a pre-eminent degree. The recent improvements consist in the addition of a dividing shoe; a hollow wrought-iron connecting rod; a new and improved section of finger, the fingers being bolted instead of riveted; and an inner shoe of a flat instead of a sharp curve as has hitherto been used. The Reading Ironworks Company have attached a straw shaker to their horse thrashing machines, which meets a want that has often been felt and is now adequately provided for.

In the matter of carts and waggons we can refer with confidence to the stand of Messrs. William Crosskill and Sons, of Beverley. As far as the limited space allotted would permit, this firm made an excellent show of their speciality. Their 1-horse cart is fast superseding the old-fashioned 2-horse cart or heavy waggon. Their York pattern cart will be found admirably suited to light horses and ponies. The pair-horse waggon of this firm looks light, but a second glance serves to show that it is strong enough for any load that can be put in it for two horses. Their iron liquid manure or water cart is fitted with a simple valve arrangement, which can be opened and shut by the attendant as he walks by the side of the horse. This firm have brought out a new pig trough, which consists of a long iron trough with upright ends. By means of a moving shutter the pigs can be fed on either side of a wall. Messrs. Crosskill's clod-crushers continue to give every satisfaction, and the demand for them naturally increases every season.

We have now taken our readers through the body of the Agricultural Hall, which was appropriated to the exhibition of the heavy machines and the beasts, some of which were particularly heavy machines. Before leaving this part of the building, however, we may refer to the efficient arrangements which were made to guard against the spread of fire should an outbreak occur. There were three fire engines disposed at separate points of the building. Of these two were furnished by Messrs. Shand, Mason, and Co., of Blackfriars, and the third by Messrs. Merryweather and Sons, of Long Acre. These engines may also be considered in the light of exhibits by their respective manufacturers, and as such do them credit. Messrs. Shand sent a vertical single cylinder steam fire engine of the pattern supplied by them to the Metropolitan Fire Brigade. They also sent a manual brigade engine, which they have just completed for Beckenham. This suburb being beyond the limits of the metropolitan district, is required to have an engine of its own. Accordingly, a manual engine of the most recent pattern was ordered of and supplied by the above firm. The third engine was exhibited by Messrs. Merryweather, and was a steam fire engine, which they have just completed for the city of Trieste. It is one of their single cylinder class, and has a horizontal steam cylinder 6¼in. diameter, and a direct and double-acting pump 5¼in. diameter, with 18in. stroke of steam and water pistons. This engine is, we are informed, similar to the steam fire engine "Le Prince Imperial," one of the engines for which this firm gained the gold medal at the Paris Exhibition of 1867.

Proceeding again to the galleries, we will resume the notice we commenced last week by referring first to the stand of Messrs. Powis, James, and Co., of the Victoria Works, Vine-street, Lambeth. This firm exhibited their endless band saw machine, which is adapted for every variety of work. This machine is fitted with a swinging table, which can be adjusted to any angle, and has this great advantage over the circular saw, that it does not require one-tenth of the power to drive it. The new spring arrangement of this firm prevents the saws breaking, and gives the machine an important advantage. The upper saw wheel rides upon an adjusting spring, which allows it to yield freely to any sudden strain to which the saw may be subjected. In sawing sharp curves the saw is liable to expand, and in this case the spring acts mechanically in lifting up the slack without having to screw up a second time. In other machines it frequently happens, if the workman neglects to ease the saw, the instant the machine starts again the saw breaks.

Mr. John Davey, of Crofthole, near Devonport, sent one of his far-famed "excelsior" turnwrest ploughs, with swing furrow wheel. This implement is suitable for either level or hill-side land, and is admirably adapted for ploughing land for reaping or mowing by machinery, as it leaves no open furrows. By a simple contrivance all the moving parts are turned at once—one breast being placed in proper position, while the other is raised clear on the beam. This plough has done some very good work in the west of England. During the present year it has taken, in Cornwall alone, one prize—excelsior plough—two silver cups, eight champion prizes, twelve all-England, and numerous other prizes.

Messrs. Tangye, Brothers, and Holman, of Laurence Pountney-lane, London, had a variety of exhibits, their special steam pump, of course, forming a special feature. At this stand we noticed a very neatly designed and well-made horizontal expansive high-pressure engine, of simple arrangement and strong construction. The bed-plate, inner cylinder, cover, guides, and main journal are formed of one piece of metal, which, in form and proportions, is very perfect, and affords a strength and rigidity that cannot possibly be attained with the best fitted engines of the ordinary horizontal type. It is fitted with Tangye's high-speed regulating safety governor, which is of special description, and combines in the small space usually occupied by the ordinary steam stop valve, a governor, throttle valve, and stop valve complete. It is exceedingly simple and compact, and being driven at a high speed it is very sensitive, and the working of the engine rendered uniform under varying pressures of steam or sudden differences of load. A regulating arrangement is also combined for speeding the engine, that is, for determining the number of revolutions per minute at which the governor shall begin to operate. One important feature in this governor is its ability to shut off steam the instant the running off or breaking of the driving band takes place. In such a case the gravitating action of the governor balls immediately cuts off the steam, and prevents the engine over-running or causing any damage to the machinery driven by it. The throttle valve has one disc only, which is steam balanced, and by a peculiar arrangement of the steam ports the action of the engine is similarly controlled, both at the greatest rise and the greatest fall of the valve.

Mr. J. L. Norton, of 38, Belle Sauvage-yard, London, was well represented by his Abyssinian tube wells, which were there in various sizes. Mr. Norton also exhibited Mortlock's patent millstone dressing and levelling machine. This apparatus is exceedingly simple in construction and effectual in working. It dresses stones rapidly and

economically; one man can dress a stone in about an hour. It can be worked with one hand, no gearing or motive power of any kind being required.

Lever oil feeders and lubricators were well represented by two firms—by Messrs. B. Brown and Co., of 39, Charlotte-street, Blackfriars-road (who claim to be the original inventors of these feeders), and Messrs J. White and Co., of 15, Trinity-street, Borough. The former firm have an excellent oil feeder with a flat spring, and the latter firm have an equally excellent feeder with a spiral spring. Messrs. White also had a new lubricator—the "skylight" lubricator—which is an adaptation of Lieuvain's well-known needle principle to a small brass cup having a circular glass inserted in its top or cover; inside the cap is fixed a leather washer, making a joint which, when screwed down in its place, effectually excludes the air; the state of the oil in the lubricator will be always visible through the skylight in the top.

Not far from this stand we found a model of a house covered with Harding's flexible roofing, which is now so extensively used by the Admiralty, Metropolitan Board of Works, railway companies, &c. The price of this roofing has very recently been reduced to that of the common asphalte. At the late Amsterdam Exhibition a silver medal was awarded to Mr. Harding for this roofing, for its superiority and cheapness, although the price was then 50 per cent. above that of asphalte. Nothing more can be required on our part to recommend Harding's flexible roofing, seeing that it is patronised by the English and foreign governments. Before quitting the galleries we ought to notice the atmospheric churn, in which some improvements have recently been made. The Atmospheric Churn Company, whose offices are 119, New Bond-street, have effected a new arrangement for the admission of air. Formerly, it found its way in at the top of the tube, but now it is admitted by holes in the side of the tube, which is found to be a marked improvement. At this stand, too, we found Yeatman's yeast powder, which has only been before the public about six months. It is, however, a success, and from trials we have made of it we can speak to its efficiency and economy.

In the bazaar, which—as we stated last week—was devoted to a miscellaneous exhibition, we found several matters of interest to our readers. For instance, we there found Mr. Marsden, of 224, Kingsland-road, London, who had a good show of his metallic flexible tube joints in several varieties. This joint, which will be found described and illustrated at page 279 of our last volume, is a most important invention to sanitary engineers, as it prevents leakage when a settlement in the ground occurs. For ships this joint is invaluable for steam pipes, pumps, or other purposes, as it will give to the strain of the vessel without causing any leakage. For connecting locomotive steam engines to tenders it is an important improvement and advantage; in fact, this joint is for a number of purposes of great importance, for the ball and socket can be used as from the castings without grinding in.

In this part of the show we also found a very good rotary engine and pump, which was exhibited by the Rotary Engine Company, of 25, Old Jewry. This pump is the patented invention of Mr. Bennison, and was described and illustrated in the Mechanics' Magazine for July 23 last. Our high opinion of the valve of the pump at that time, which was based upon a careful investigation of its working, has by no means altered. Worked by hand at the Smithfield Club Show it came well up to the mark. The engine, as a motive power, is unequalled for economy, the small space it occupies, and from its capability of being reversed, stopped, and set in motion instantaneously from any point of the cylinder. It can also be used as a pump, and if it should choke, is immediately cleared by being reversed. A pump of 2½in. area, worked by hand, will discharge 20 to 25 gallons a minute, and by steam power 70 to 80 gallons. It also forms a most perfect air pump, blowing engine, or gas exhauster.

At another stand, not many yards from the last, we found the "Denmark" revolving pump, which was exhibited by Messrs. J. C. Wilson and Co., of 26, Martin's-lane, Cannon-street. This pump is constructed on the revolving principle. The method of forming the vacuum and of propelling the water, or lifting it, is the same as in ordinary pumps, viz., by means of a travelling piston. The difference, however, is that in this pump the motion is made continuous. This fact dispenses with the use of valves, which are only necessary to retain the water during the down stroke of a reciprocating motion. The advantages of this pump are those common to its class, and which are daily becoming better known and appreciated.

Mr. Jas. Smyth and Co., of 21, Little Trinity-lane, Cannon-street, had a display of their ingenious Panteles umbrella, which we noticed this time last year as one of the soundest practical improvements in these useful articles that has yet been adopted. The whole arrangement is thoroughly mechanical, and has stood the test of time so well that we cannot wonder at its success.

And thus we once more come to a close. We have taken our readers through what was this day last week a busy and crowded Show, and which has proved a great success. Now the great hall is deserted; the hum of the busy and inquiring throng is no longer heard, the bleating of sheep and the lowing of kine are silenced, the glories of the Smithfield Club Show of 1869 are matters of history. *Sic transit omnes gloria.*

THE FOOT BRIDGE AT PRAGUE.

OUR readers will doubtless remember that in June, last year, a new bridge was completed and opened at Prague. This bridge—the Franz Joseph—was designed and constructed by Mr. R. M. Ordish, of Westminster, upon his rigid suspension principle, which has been described in our columns. The success of this principle led to the construction of another bridge upon the same system and across the same river—the Moldan. This second bridge is for foot passengers only, and has the peculiarity of having one central tower and two abutment piers, thus forming two half spans. The special feature was necessary, in consequence of the character of the river bed and other local considerations. This bridge has a platform width of 11ft., and each span is 305ft. 6in. in the clear. The works of the bridge having been completed, it was tested on the 22nd and 23rd of last month by a commission appointed by the municipality, under the superintendence of the resident engineer, Mr. Max am Ende. The test load consisted of 42,500 bricks, equivalent to a load of 457,640lb., equal to a distributed load of about 64lb. per square foot. This load remained upon the platform for one hour. During that time observations were made at each span; the maximum deflection was 6¼in. and 6¾in. respectively; the anchorage chains extended over 1-12th and 1-8th of an inch. The estimated deflection was 7½in. On the 24th, the bridge was cleared of its load, when the permanent set was found to be half an inch, the anchorage chains having returned within 1-24th of an inch to their original position. The bridge is found to be exceedingly steady under uneven loading, and it has been exposed to heavy gales with like results. The success of these two bridges ought to lead to the carrying out of the long-talked-of bridge on the same principle over the Thames at Chelsea, and which is now represented by several dreary groups of piles.

NOTICES OF BOOKS.

THE name of Henry Booth has for many years past been known and honoured in the railway world. As one of the pioneers in the development of our railway system, he laboured diligently and indefatigably, first in connection with the Liverpool and Manchester Railway, and afterwards in the management of the London and North-Western system. Mr. Booth closed an active, useful, and eventful life on the 28th of March last, in the 81st year of his age. A brief notice of this sad event appeared in our columns at the time in common with our contemporaries. Since then a series of articles have appeared in the "Railway News," in which Mr. Booth's life and works were graphically portrayed. The information contained in these articles has served as the basis of a very interesting memoir,* by Mr. Robert Smiles. And we are very glad to find such a record of a man who for thirty-five years filled positions of the highest responsibility in the railway world. The volume before us is both interesting and instructive. It is interesting, inasmuch as it takes us back to the early days of railway development and carries us down the stream of time so that we note their progress as we go—matters which become dim and faded as memory adds year to year in its span. It is instructive as teaching lessons of patience and perseverance, and showing the never-failing results of the application of energy in a right direction. It also teaches us how a man apparently immersed in wearing and wearying pursuits can still find time for those of an elevating and more genial character. Mr. Smiles gives an insight into the early days of Mr. Booth, and touches upon the leading features of his life. His public career in connection with the railway interests is then placed before us, and, lastly, Mr. Booth's writings in the various positions he occupied in life are detailed and commented upon. Mr. Smiles modestly observes that he has only endeavoured to collect a number of facts and to string them together. That he has performed his task well and creditably is evidenced by the volume before us, whilst he has produced a memento which every railway man will desire as being that of their old and well-tried friend, Henry Booth.

Mr. Henry Dircks, C.E., has added another to the series of papers he has recently contributed on the subject of patent law. At the Social Science Congress, at Bristol, in September last, Mr. Dircks read a paper "on the policy of a patent law," which, with the discussion that followed, has been published in pamphlet form, by Messrs. Spon, 48, Charing Cross. This paper is a critical notice of the arguments employed by Mr. Macfie, M.P., in support of the abolition of patents, and with which our readers are familiar. Mr. Dirck's paper is a refutation of the absurd and untenable positions advanced by the honourable member for Leith. After Mr. Dircks' paper, we have the interesting discussion, which shows Mr. Macfie to have been wholly unsupported—a result scarcely to be wondered at. The only matter for wonder is how Mr. Macfie can find heart to reiterate statements and propound views which are exactly opposite to those entertained by every other member of society except Mr. Macfie himself.

"England at Home" is the name of another little brochure, published by Messrs. Cassell, Peter, and Galpin, of La Belle Sauvage-yard, London. It is written by Mr. W. E. Littlewood, M.A., and is a familiar description of the principal physical, social, commercial, and topographical features of England and Wales. These are important points of view from which to teach children the specialities

* "Memoir of the late Henry Booth, of the Liverpool and Manchester and afterwards of the London and North-Western Railway." By Robert Smiles. London: Wyman and Sons, 75, Great Queen-street, Lincoln's Inn-fields. 1869.

of their own countries. Here, youngsters are taught the geological character of England and Wales to begin with; they are then made acquainted with our rivers, our railways, our people, and our animals, in a plain and concise manner.

A few more annuals have reached us. The first of these is "Gutch's Literary and Scientific Register and Almanack" for 1870 (Stevens, 421, Strand). This is the twenty-ninth year of publication of this useful pocket companion, which contains as usual the pith and marrow of all branches of science. It is a compilation of special value to those whose dealings with science are general, for here the main facts of every branch are collected and presented in a condensed form. It bears evidence of great painstaking on the part of its editor, and the result is a collection of useful matter and reliable scientific data nowhere else to be found in so small and handy a compass.

The diaries of Messrs. Letts and Co., of New Cross, of which we have received several specimens for 1870, continue to constitute perfect marvels of cheapness and usefulness. Nothing but the extensive patronage these books have could enable these manufacturers to give the public such rare value for their money. Letts' broad shilling diary is especially useful; it gives an entire week in the opening of two pages, and is ruled with double cash columns. At the end are pages devoted to each month for special monthly entries, and one for the reception of "Addresses, quotations, and other matters of interest." The sixpenny diary gives a whole page to each week, and is the handiest and most complete book for the price we have ever seen. The medical diary is adapted especially to the ordinary requirements of the medical profession, and is well suited for the purpose intended. It gives an opening of two pages to each week, the left hand being divided into the days of the week, the right arranged for lists of patients. All these diaries are replete with general and special information conveniently arranged for ready reference. To complete the list we may mention the appointment diary, which forms a very handy pocket book. It provides an hourly arrangement for the punctual keeping of engagements from 9 a.m. to 6 p.m. for every working day, besides giving space for casual memoranda to each. All of these productions well sustain the reputation Messrs. Letts have acquired in this direction.

TELEGRAPHIC NOTES.

WE have more than once called attention to the circumstance that it was intended to lay a submarine telegraph in China, in order to complete the communications with the East already in progress by the Falmouth, Gibraltar, and Malta, the Anglo-Mediterranean, the British Indian Submarine, and British Indian Extension Telegraph Companies. Pursuant to this intention a prospectus has been issued of the China Submarine Telegraph Company, in connection with the foregoing companies. The capital proposed is £525,000, and the first operation will be to lay a cable of 1,640 miles from the Straits of Malacca to Hong Kong (with an intermediate station at the French settlement of Saigon, in Cochin China), which is to be manufactured by the Telegraph Construction and Maintenance Company for £508,000. This cable will be shipped hence in the coming year and be completely laid by June, 1871. Subsequently a section will be laid from Hong Kong to Shanghai. Lines ultimately to Japan are likewise contemplated. All the companies with which the present extension is to be connected have agreed to make an allowance on all through messages forwarded over their cables from and to China, and, looking at the present enormous trade of China, not only with Europe but with America, and the prospects of its rapid increase, no doubt is entertained as to the paying capacities of the route, under a judiciously regulated tariff. The Board of Direction comprises the respective chairmen of the Falmouth, British Indian, Anglo-Mediterranean, and British Indian Extension Companies, the late Director-General of Telegraphs of India, the late Commissioner of Imperial Chinese Customs, and other persons of Eastern experience.

Last Friday a special general meeting of the shareholders in the United Kingdom Electric Telegraph Company was held, at which it was resolved *nem. con.* that the sum of £5,000 should be awarded to the directors for division among themselves; that the sum of £1,000 be awarded to Mr. Andrews, the secretary and manager of the company, and that £2,000 be equitably divided among the other officers of the company. The chairman (Mr. Crow) announced that the board expected to receive £24,000, which would be available for division among the ordinary shareholders; £7 15s. per share would absorb £21,000 of that sum, and the balance would be available for certain necessary expenses connected with the closing of the business. The preference claims and shares would be fully paid off by the close of this month, and by the end of January next he was of opinion the Government would have finally absorbed the company.

The United States' war sloop "Yantick" has been appointed by the American Government to make the soundings for the West Indian submarine cables from Jamaica to Porto Rico, St. Thomas, and Barbadoes. The British Admiralty have also ordered a vessel to continue the soundings from Barbadoes to Trinidad and Demerara. The "Yantick" is being fitted with sounding gear at the Navy Yard, Brooklyn, and will sail on January 1, under the command of Captain Irwin, United States' Navy, by whom the soundings between Jamaica and Panama have been already made in the "Gettysburg." The cables of the West India and Panama Telegraph Company, to connect Cuba, Jamaica, and Porto Rico, have been completed at the Silvertown Works, and the whole of the line will be shipped by March 15. An additional subsidy of £800 per annum has been devoted by Antigua to establish a station in that island.

The conflicting rumours which were rife last week respecting the transfer of the telegraph companies have been succeeded by a general conviction that the Government will take over the telegraph system on January 31, and that the payment of the £5,715,048 compensation money to the companies will be made some time between January 28 and February 5.

The cable from Land's-end to Scilly has been overhauled for about a mile from the Land's-end, and a kink has been found and buoyed. If splicing apparatus can be obtained in the neighbourhood, the kink will be cut out and the cable spliced immediately, weather permitting, and then it is hoped that messages will be passed. It will be remembered that the weather was exceedingly rough and the sea high when the cable was laid.

The arrangements for the commencement of telegraphic business at the Norwich Post Office have now made good progress. There will be five instruments in operation; messages will be written on the ground floor, and will then vanish to the second floor by means of a hoist. The Crowland office has been fitted up with desks; it is not expected to be opened for some weeks, as the route to be taken by the wires has not yet been decided on. Telegraph wires have within the last few days been extended to the new office in Guildhall-street, Lincoln.

It is stated that a company has been incorporated, under the title of the International South Transatlantic Telegraph Company, and will be shortly introduced to the public, for the purpose of establishing telegraphic communication between Europe and the continent of South America, under the concessions obtained by Mr. P. A. Balestrini from the French, Italian, Portuguese, Danish, and Brazilian Governments, and that the cable has been already contracted for by the firm of Aubert, Gerard, and Co., of Paris, London, and Harburg.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

THE RELATION BETWEEN THE INTENSITY OF LIGHT AND THE CONSUMPTION OF GAS—EVAPORATING POWER OF PETROLEUM—TINNING IN THE WET WAY—NEW LIGHT FOR PHOTOGRAPHERS.

A VERY important observation in relation to the illuminating power of gas has been made by Professor Silliman, of New York. Hitherto it has always been supposed, and nothing would appear more reasonable, that the amount of light obtained from the combustion of gas is simply in proportion to the quantity of gas consumed. From a series of experiments, however, made by himself and others, Professor Silliman has arrived at the conclusion that the intensity of gas flames, that is the illuminating power, varies—at all events, within the ordinary limits of consumption—as the square of the volume of gas consumed. The truth of this theorem was proved in the following simple way. Two gas flames, one at each end of an ordinary 100in. photometer bar, were made to give the same amount of illumination, which was accomplished by placing the Bunsen's disc midway, and regulating the flames until the consumption and the illumination were equal. The disc was then moved on the bar to a point just four times as far from one flame as from the other, that is, the bar being 100in., the disc stood at 80, or 1 to 4. The distant flame was then increased until equality of illumination was again obtained, and the consumption in the two flames was noted. The nearer flame was found to consume 3·66ft., and the distant one 7·32ft., or exactly double. Now, if the old rule of correction had been followed, a double consumption of gas would have been calculated to produce only twice the amount of illumination; but the actual increase observed was as 4 to 1. The importance of this observation, when the illuminating power of an observed consumption is calculated to a standard consumption, becomes very great. As an example, Professor Silliman supposes a gas consumed at the rate of 3½ft. to give an observed effect of 20 candles. By calculating this to a standard consumption of 5ft. on the old rule, the result would be only 28·57 candles, but calculated on the theorem above stated, the result becomes 40 candles, or 40 per cent. higher. Supposing the theorem to be true, and sufficient truth of it is promised, the practical inferences are worthy of all attention. The observation shows that the maximum economical effect is obtained from the consumption of gas in burners of ample flow. When an equal diffusion of light over a large space is required, numerous small jets may be used with the most advantage, but when the maximum intensity from a given volume is desired, intensity burners of large consumption, Professor Silliman says, are plainly indicated. Considered in relation to the legal examination of gas these observations are of the utmost importance, and it is to be hoped that the matter will receive the serious attention of all interested in the matter.

When speaking of the use of petroleum in locomotives a short time ago we neglected to give our readers the comparative evaporating power of petroleum and other fuels. So far as "patent fuel" is concerned—and we rather think that of the Aberdare Company is used—the results were as follows:—Weight of water evaporated by 1 kilo. of oil, 10·9 kilos.; by 1 kilo. of patent fuel, 7·9 kilos.

In addition to the information which we gave some time ago relative to tinning in the wet way—a process which is claimed by others besides Dr. Hiller, from whom we quoted—we may give the following particulars. When articles tinned by the galvanic process are heated to the melting point of tin, they assume the appearance and acquire the solidity of articles tinned in the usual way. In some cases, however, the galvanic process is especially advantageous. Thus it becomes possible by means of it to tin copper gauze, and when gauze so tinned is heated great additional strength is given by the wires becoming soldered together by the melted tin. By raising the temperature sufficiently high to effect a slight fusion of the underlying metal a surface of alloy is obtained, tinned copper, for example, assuming the appearance and properties of bronze. In the same way copper coated with zinc by a similar process acquires, when heated, the appearance of brass. It is mentioned also that zinc coated with tin by the galvanic process is more malleable when heated than zinc alone and solders well; and it is supposed that the alloy formed may be capable of useful applications.

We may mention here that Dr. Monckhoven has come to London to exhibit a new artificial light especially applicable to photography. It is procured, we believe, by rendering cylinders composed of magnesia and titanic acid incandescent by the oxyhydrogen flame. Our photographic notes will soon give our readers full particulars of this light.

ANGLO-FRENCH COMMUNICATION.*

By Mr. Zerah Colburn.

(Concluded from page 421.)

While it is fairly open to doubt whether any of us will ever live to see a practicable railway tube laid across the Channel—open to doubt, too, whether such a tube is even required at all—there is still a sort of bewitching interest in speculating upon the mere possibility of such a thing; and it is thus that this meeting may be supposed to have resolved itself into a committee of inquiry upon this very point. Can the tube be made at all? Can it be made before those now unmarried shall have lived to see their grandchildren? If it can be done, and done off hand, so much the better, always provided that the tube is what is wanted. Here, as with Mr. Midshipman Easy, there is no help for it but to "argue the point." Assuming, then, for the sake of argument, that the particular tube now under consideration can be made, and safely laid, can it be done as its proposers estimate, within a period of three years and a half, or only within from six to ten times that space? The tube is to be made of something like half a million tons of cast iron, and to believe that it can be made at the rate of 100ft. forward a day, as estimated, is to believe that nearly 500 tons of castings, all ready, or rather, supposed to be ready, to go exactly together, each casting weighing about eight tons, can be loaded on horse trucks, or hand trucks, and carried through the tube itself for an average distance of ten miles, unloaded, placed in position, the thousand or more connecting bolts, for which the holes have been previously drilled, secured in their places, the joints made good with lead, and a great deal of other work carried on, all within a confined space within which, partly from the machinery to be employed, hardly more than a dozen men, if as many, will have room to work at all. The British Association was lately occupied with a most able and most interesting description of this plan, and the Society of Arts may therefore be inclined to examine this, the very important point which, at the recent meeting of the Association at Exeter, appears to have escaped all examination whatever. The "point" might be "argued" still further, but let argument be dropped now for individual consideration of the subject.

Another plan of making and laying the tube has been proposed—a plan based, like the others, upon a general estimation of what is possible and probable. It is to construct the tube, in long lengths, within a dry dock in shore, and to float out these lengths, successively joined together, until the opposite coast is reached. The tube would be floated, not, certainly, upon the surface, but by means of buoys, just clear of the bottom, the tube being again grounded as soon as it had been advanced a length.

Few propositions, perhaps, connected with engineering upon which the writer has ever reflected, have, at the first view, presented more apparent impracticabilities than this one. But the more he has examined it, the more have the means by which these difficulties may be overcome disclosed themselves. It was enough to know, from the first, that the plan was not in contravention of any law of nature, and therefore was not impossible. Like each of the other plans already noticed, its execution would necessarily be in the face of tremendous difficulties—difficulties which, perhaps, not one of the various projectors of Channel tubes have fully estimated, and which it, is beyond doubt, they have not, because they cannot have fully provided for. But the whole progress of engineering has shown that what were once seeming impossibilities have long since become useful and familiar facts. The difficulties supposed to be once overcome, it is plain that a plan whereby (say) a thousand feet or more of the tube could be put together in a single day, in the open air, as many men being employed upon it at once as could find room to work with advantage upon that length, would have a manifest superiority over any other in which each length of a few feet (say ten), must be wholly completed before another length could be begun and especially in which the whole work of making up the tube is to be carried on within the tube itself, the parts being brought to the front in trucks drawn by horses to a distance successively increasing to 20 miles.

In no way could the segments of a tube be so rapidly got into place and secured together as in a dry dock, the semicircular bottom of which, of cast iron, would conform exactly to the tube itself. The segments would be lowered into place, those for the lower half of the tube centering themselves, while those for the upper half would be temporarily supported upon centres so made as to be readily taken down when the key segment was got in and secured. The seaward end of the tube, of great strength, would, of course, be closed, and it would be provided with suitable fittings for attaching the powerful hauling-out tackle to be used when the successive lengths were floated. The dock gates would close around the tube so as to form a water-tight joint. The tube would be of such dimensions and thickness that, previous to putting in the brick lining, its own weight would be as nearly as possible exactly the same as that of the sea water displaced, so that, of itself, it would, so to speak, neither sink nor swim. Approximately, a 14ft. tube would displace about $4\frac{1}{2}$ tons of water for each foot of its length, and it would of itself weigh about $4\frac{1}{2}$ tons for each foot of its length when its thickness, allowing for all flanges and bolts, was 5in. or say $4\frac{1}{2}$in. between flanges, and this would be the proper thickness for strength, irrespective of any consideration of displacement. The weight of the tube would require to be very accurately adjusted, since a difference of thickness of 1in. would cause a difference of weight of 900 tons in a 1,000ft. length, hence a difference of but one-thousandth of 1in. would represent very nearly 1 ton in weight. Each length would require to be brought to the exact limit of flotation by means of adjustable weights. As the tube would require to be adapted to the irregularities of the bed of the Channel, each length of a thousand or more feet, would have a ball and socket joint, and it would be here, and here only, that the sinking weight would be applied, and the holdfasts for the lifting and sinking tackle attached. Probably 100 tons might be necessary to prevent any movement of the tube, especially in shore, from the force of the sea, for at a depth of a few fathoms the force of storms would not be felt at all. The tube being made in segments, the construction of ball and socket joints would be attended with no difficulty. They would require to be made of great strength, not merely to provide sinking weight, for they would receive the whole strain of the hauling-out tackle when the tube was advanced seaward. A thickness, for the ball and socket, of 8in., this thickness being continued a little more than 10ft. each way, would give 100 tons of sinking weight. The motion at these joints would be but slight, yet this slight amount of motion is none the less necessary to enable the tube to adapt itself to varying gradients. It is at least remarkable that any strictly rigid tube should ever have been proposed, as more than one has been, for a line having gradients varying from nearly level to 1 in 100.

When a length of tube had been completed and was ready for launching, its in-shore end would be closed watertight, the buoys made fast in place, the dock gates opened, and the sea admitted, upon which the tube would be drawn up well clear of the bottom by means of the adjustable tackle connected with the buoys, and the whole of the tube, of whatever number of connected lengths of 1,000ft., would be drawn out to sea for a distance corresponding to the length last added. It would then be lowered again upon the bottom, the in-shore end of the tube being left well within the dock gates, which would then be closed, and the water in the dock pumped out.

In buoying and advancing the tube, especially when extended nearly 20 miles, it contained nearly half a million tons of cast iron, the chief resistance, in starting, would be, occasioned by not its weight, for except at the ball joints it would have no preponderating weight in the water, nor by its skin friction, for this at a rate of motion of 1,000ft. only in an hour would be comparatively trifling—but the real resistance would be from inertia. It might be supposed that as much effect would be produced by the hauling-out tackle, if made fast to the rock of Gibraltar, as if to a great iron sea-serpent, 20 miles long, and weighing half a million tons. But let us see what this enormous resistance would be. Let the rate of onward motion of the tube be 3in. per second, a rate at which 1,000ft. would be gained in 400 seconds, or one hour, six minutes, and forty seconds; not so very long a time after all. To give this rate of motion would require the same force as would be necessary to lift the whole weight to a height of the 1-85th part of an inch, a distance almost too insignificant to deserve consideration until it is understood that 500,000 tons are to be lifted to that height. It is then that the 1-85th part of an inch begins to look respectable, the work done being equal to that in lifting 1 ton to a height of nearly 500ft. or, in other words, 500 foot-tons, which is about the energy contained in a 32lb. cannon ball when it leaves the gun fired with a full service charge. But these 500 foot-tons do not need to be exerted within one, two, or three minutes, and if a quarter of an hour be taken to get the sea serpent under weigh, the mean rate of progress during that time being $1\frac{1}{2}$in. only per second, the tube will have progressed $112\frac{1}{2}$ft. before it is in full swing, and thus the pull will average less than 4 tons during that time, after which all further resistance from inertia ceases. Now 4 tons is a little more than the breaking strength of the little Atlantic cable of 1858, and is well within the working strength of the steel wire ropes employed to haul Fowler's steam ploughs. Next comes the resistance of skin friction. The surface of the tube, supposing it to be 14ft. in diameter and 20 miles long, and having no outer flanges, would be nearly 107 acres, whereas a ship like the "Hercules" has but little more than three-quarters of an acre of immersed surface when ready for sea. But the "Hercules" has run nearly 15 knots an hour with a net thrust upon her screw shaft of about 50 tons, the resistance being nearly all skin friction only. Skin friction is believed to increase as the square of the velocity, so that the 1,000ft. an hour of the sea serpent are to be compared to the 90,000ft. an hour of the "Hercules," not in the proportion of 1 to 90, but in that of the square of 1 to the square of 90, or as 1 to 8,100. Thus the "Hercules," weighing 8,600 tons, requires 50 tons pressure at the stern to drive her at her full pace, while the serpent, with a skin nearly 150 times more expansive, and a weight nearly 60 times greater, would nevertheless, upon the law of the square, require a pull of less than one ton to tow it by the nose, if serpents have noses, all the way across the Channel, its inertia having been already overcome. And yet this mass of iron, if thrown into the form of a cube, would measure about 136ft. on a side.

That the tube would follow its nose in a straight line, and not in the zig-zag outline of a Vandyke border, known in America as the Virginia fence pattern, may be safely concluded, not only from a consideration of the reasons which would compel it of necessity to follow a straight course, but from the analogy afforded by Mr. Macsweeny's jointed steamboat, the "Connector," which plied a few years ago between Newcastle and London, and by Mr. John Bourne's trains of connected boats on the Indus. Although neither of these systems proved commercially successful, both demonstrated that a long train of boats connected together will follow as true a course upon water as will a long train of waggons on a railway.

The tube would be hauled forward, as each fresh length was added, by tackle worked from a vessel steered well ahead, on the true course, and there moored fore and aft, to prevent swinging out of her position, although the whole work of advancing the tube would or should be performed at slack high water. In such a great work, so important to the commercial interests of the whole world, it is not unreasonable to suppose that a convention would be entered into by all, or nearly all, commercial nations sanctioning the authority of a marine police to guard the hauling chain from dragging anchors.

But now come, perhaps, the principal questions of all. The maximum tidal current, at spring tides, in that part of the Channel where the various proposed tubes are intended to be laid, is, by Burwood's tables, 3·3 knots an hour, or 5·57ft. per second. This is, however, the surface velocity, in mid-channel. The velocity at the bottom, in the deeper portions, is probably *nil*. In a communication recently made public by Mr. Cromwell Varley, the eminent telegraph engineer and electrician, occurs the following interesting and even amusing passage:—

"It is well known to all nautical men that the action of the waves decreases very rapidly in descending. I believe I am correct in stating, in proof of this, that a diver, engaged upon the wreck of the 'Royal George,' accidentally left his spectacles on the wreck off Spithead. The depth of water was about 16 fathoms. A violent storm prevented him from resuming operations for about nine days, and, on again descending, he found his spectacles in the place where he left them.

"It is also well known to all nautical men that currents extend, as a rule, to only a small depth; and it is a common practice to moor a boat in deep water by tying a kettle or some heavy object to a line, and dropping it overboard into the comparatively still water. This mode of anchoring has

* Read before the Society of Arts.

been frequently used by the surveyors in the Atlantic.

"As a further proof of the complete stillness at the bottom, I may mention the cable that was laid from Varna to Balaclava. This plain gutta-percha covered wire was wholly uninjured by those terrific storms which destroyed so many English vessels."

With 100 tons of anchoring weight at the shore end, and with the same weight at distances of every 1,000ft., and with the immense inertia of a tube weighing 4,500 tons between each pair of sinking weights, there would appear to be but little danger from the action of storms—a conclusion borne out by the fact that iron sewer pipes are often extended well out to sea, as at Brighton, and remain there without disturbance. The waves come end on with the tube, and are harmlessly divided, whereas, did they strike it athwart, they would lift it upon the beach. Experiment, during a single winter, would determine whether even so much as 100 tons sinking weight would be required at each 1,000ft. It might turn out that 50 or even 25 tons would suffice, in which case the work of lifting and grounding the tube, as about to be described, would be very greatly lessened. The most critical point in the whole scheme is probably that of lifting and lowering the tube at each advance. Before going into this, it will be as well to see what is to be done at each sinking weight or ball joint in deep water, say 33 fathoms at high tide. There are 100 tons of dead weight to be lifted, besides the inertia of 1,000ft. of tube to be overcome, and there is also the weight of the lifting chain itself and its supporting buoy. Taking the weight and inertia to be overcome as 150 tons, and supposing the lifting chain never to be strained beyond 3 tons per square inch, the sectional area of the chain would be 50 square inches, so that each 15ft. of its length would weigh a ton. As the chain would commence two fathoms and a half from the bottom, we will allow that for slack, and its own weight would thus be between 13 and 14 tons. This it would be necessary to buoy with the utmost care, for, once lost, the chain could never be recovered in water of greater depth at most than 15 fathoms. The buoy, weighing probably 5 tons of itself, should have at least 20 tons of additional supporting power, and would thus require to be of a capacity of 875 cubic feet, corresponding to a cylinder 8ft. in diameter and 18ft. long. Were it not that the buoys must be kept out of the way when the lifting tackle is attached, they would be best secured by passing the chain through them in a central pipe with secure stoppers, top and bottom. As they would, in any case, continue to float, this might, after all, be the best way of attaching them, when the stoppers were taken off at each lifting and lowering.

In getting into deeper water the chains would require to be lengthened, in 10ft. lengths, at every few advances, and in shoaling they would also have to be shortened in proportion. The lifting and lowering would be performed from a vessel alongside, and the lifting itself be effected by steam, acting directly upon the lifting chain, that is to say, a strong steam cylinder 5ft. in diameter, and permitting of a stroke of piston of 20ft., would be supplied with steam from a small boiler worked at from 125lb. to 150lb. per square inch, giving a lifting force of from 150 to nearly 200 tons. It is only by a direct steam lift that the effects of pitching and scending in the lifting vessel, and the varying level of the sea as the tide ebbs or flows, can be provided against, and that the elasticity of strain necessary for the preservation of the chain, and thus of the tube itself, could be secured. There are many details which would require to be carefully worked out before such an undertaking could be safely begun, but, without entering at greater length upon them here, it may be said that the principles upon which safety at each step would be reasonably assured have been considered with some care, and that there are no difficulties in the way which appear really insurmountable. It is not to be forgotten that a lifting vessel would be required at each 1,000ft. length, making no less than 110 in a length of 21 miles. There would be no difficulty in chartering the number, and the cost of the requisite fittings would not, in comparison with the whole cost of the work, be excessive.

The practicability of this making and laying a tube could be approximately ascertained by making two 500ft. lengths of tube half size, or 7ft. diameter and 2¼in. thick, closing their ends, and sinking and lifting them by means of three tug boats in different parts of the Channel. These lengths would weigh, including sinking weights, about 925 tons. If the experiment succeeded perfectly, as it should, in calm weather and at slack high water, it might be continued in rough weather and under the influence of the tidal current. The exposure of one or both these lengths, for a single winter, lying end-on to the shore, would afford very valuable experience. It is always to be borne in mind that after the tube is once laid, the brickwork lining and permanent way which will then be added will more than double its weight.

The tube, when laid for its whole length, would be bolted together at the ball joints by means of inner flanges, the whole then lined with brickwork and an inner iron casing, a permanent way laid, and would then be worked upon the atmospheric system.

The cost of the whole may be roughly estimated as follows:—

	£
500,000 tons of castings fitted ready for placing at £6	3,000,000
Brickwork lining	250,000
Dry dock, fixed plant, &c.	500,000
Floating establishment	1,000,000
2,500 workmen for two years at £100 per annum	500,000
Interest, during construction	500,000
Engineering and contingencies	250,000
Total, exclusive of approaches	£6,000,000

The plan suggested can claim no other advantages than these—viz., its practicability being assumed, it could be carried out in two or three years, including all the time expended in preparatory works. Almost any number of workmen might be effectively employed at the same time, and that in the open air, in full daylight, and out of the way of danger in case of accident. The tube would furthermore possess a flexibility which would ensure its following the irregularities, both vertical and lateral, which, with a careful survey in advance of the work, would naturally be found even on the comparatively smooth bed of the Channel.

It forms no part of the objects of the present paper, however, to put forward claims in favour of submerged railways. It is admitted, on all sides, that they cannot be made at a less cost than from £300,000 to £500,000 per mile. It is by no means certain that, even for the saving of half an hour and an immunity from sea-sickness, the majority of passengers would prefer a submarine journey of three-quarters of an hour, with the knowledge that but a few inches of iron were interposed between them and a second deluge. The fact that almost countless fleets of shipping were crossing 50 or 60 yards overhead, that a single ship, foundering then and there, and making its fatal plunge upon the tube, might work even greater destruction than its own; the reflection that scoundrels in the pursuit of mischief, or villains in the service of the devil, could at any time, and with almost perfect impunity, dispose of the tube for ever—all this would be anything but reassuring to the timid, and it would have its due weight with the strong.

In respect of economy merely, the interest upon a cost of £6,000,000, supposing the work to be carried out for that sum, and the money raised upon the guarantee of the English and French Governments at 4 per cent., would be £665 per day, or £231 per mile per week. It is not, perhaps, necessary, however, to assume that the work is to be undertaken as an immediately paying speculation, since other considerations of importance are involved in the question.

It is not to be lost sight of, however remote the bearing of the question upon the present subject may appear to be, that a sudden demand, within a couple of years, for half a million tons of cast iron, not for export, and not for immediately productive employment at home, would most certainly inflate the iron trade, and, indirectly, affect nearly every branch of our industry. If the price of pig iron advanced, as it not unlikely might, to the extent of 20s. a ton, this means 25s. or 28s. on rails, 30s. to 35s. on bars, and from £2 to £3, or even £4 on the higher qualities and lighter sections of iron. The very home demand—whereby we would be literally throwing our iron, and with it our money, into the sea, to no immediate profit, would give to other nations an advantage of which they would not be slow to avail themselves. Half a million tons of pig iron, when converted into rails, bars, or plates, and allowing for loss in conversion, would suffice for 2,000 miles of double line railway, or it would construct 75 miles of heavy iron bridges, weighing a ton per foot, or it would serve the shipbuilder for 250 hulls, such as, when fitted, would register their 3,000 tons each. The sudden abstraction of such a quantity for a single work, having no immediate prospect of success, might be attended with consequences which the whole country would long have occasion to deplore.

It has been mainly the object of the present paper, however, to examine into the engineering merits of the various schemes proposed for crossing the Channel, and the writer cannot close without expressing the belief that the balance of certainty, economy, and, all things considered, the safety and even the comfort of the travelling public, remains with a large and suitably organised Channel ferry service.

MANUFACTURE OF WHITE LEAD.

WHITE lead is generally manufactured in England by placing the metal over earthenware pots containing an acid, piling them up in layers, and covering them over with spent tan. An improvement upon this somewhat slow process has been patented by Mr. Joseph Major, of Swallow-street, Middlesex, in conjunction with Mr. W. Wright and Mr. G. H. Jones. The invention consists in the manufacture of white lead in closed chambers, heated artificially, and without the employment of spent tan or earthenware pots. The necessary vapours and gases are fed into the chambers containing the compounds to be converted into white lead. The invention further relates to the use of the vapours and gases under pressure in a closed chamber, although the white lead can be produced by this invention without the gases and vapours being submitted to pressure, but more time is necessary.

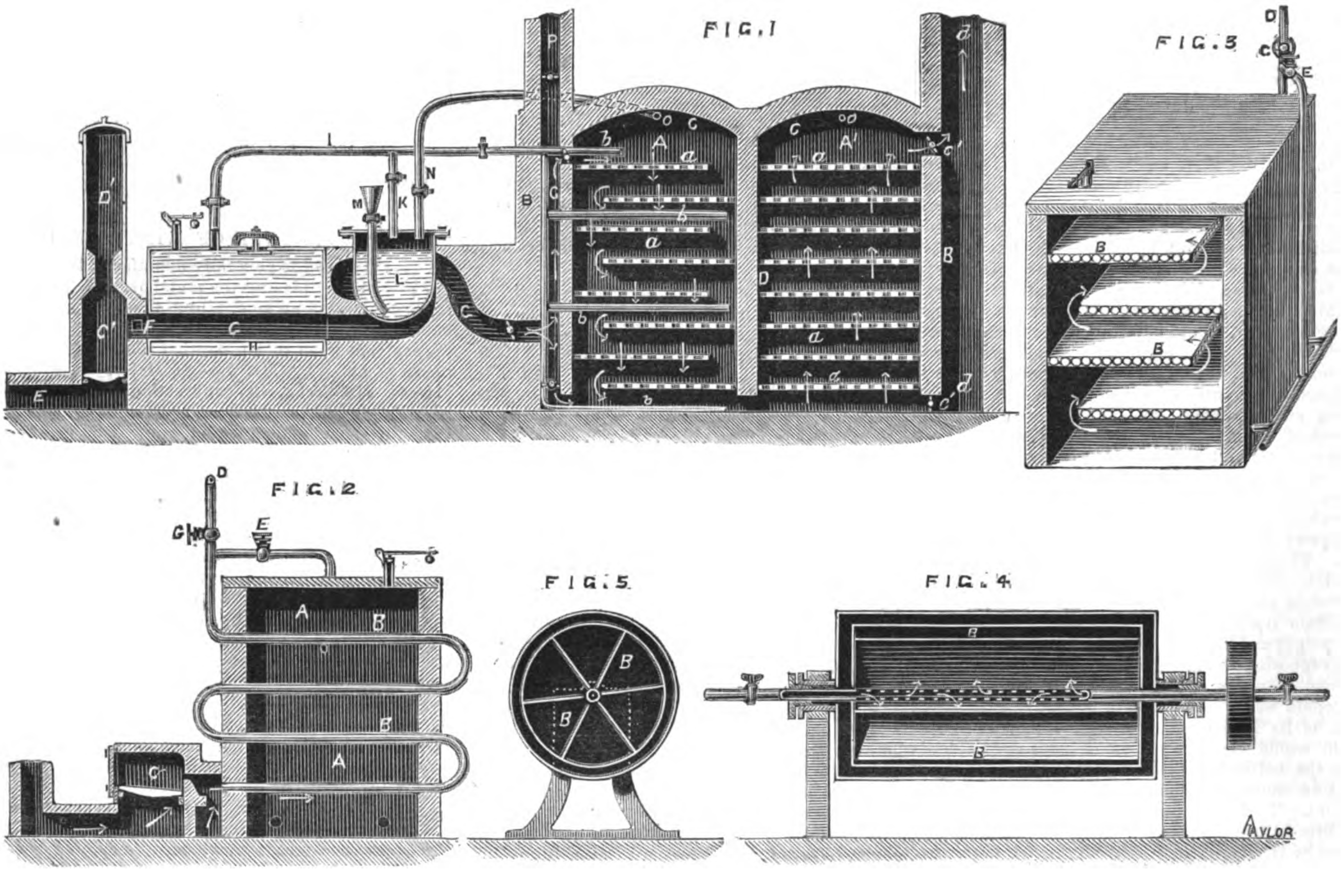
The apparatus employed in the manufacture embraces independent apparatus for feeding the vapours and gases and for regulating their supply, and for keeping the lead in continuous circulation through the closed chambers. This is accomplished by revolving surfaces inside a chamber actuated by machinery, upon which surface the lead is placed. The invention further consists in a method of treating the white lead, when produced, so as to decompose and remove any remaining acetic compound, and replace the necessity of washing the material. This is accomplished by currents of heated vapour or gases and air brought in contact with the material in the closed chambers, and circulating through them in contact with the materials, so as to deprive them of any superfluous compounds. They can, however, be washed and finished in the ordinary way. The article thus manufactured is completed by any of the well-known methods.

In our engraving fig. 1 represents chambers constructed for carrying out the first part of this invention. A A¹ represent the chambers; B B the wall; C C the roof; and D the separating wall. These chambers are shown with different arrangements of the shelves, for causing the gases to circulate perfectly and to permeate in a complete manner the lead under process of conversion into white lead. The chamber A has shelves *a a* made of any suitable material so disposed as to cause the vapours and gases to circulate in the direction shown by the arrows, as well as to permeate directly through from the top to the bottom, or *vice versa*. The second chamber A¹ shows an arrangement by which the circulation is effected longitudinally. Steam is supplied to these chambers both for heating and for furnishing moisture by the pipes *b b* shown in the chamber A. *c c* are the flues, so contrived as to cause the heated gases circulating through them to pass through several chambers or through one only or to the chimney *d*, without passing upwards through the chambers, the course of the currents of heated gases being regulated by the dampers shown in the flues *c c*. The lead is placed upon the shelves *a a*. The vapour of water and ammonia and acids and gases generated from carbonaceous materials for furnishing carbonic acid are fed into the chambers A A¹.

The mode of providing the necessary carbonic gases to the chambers is as follows:—C¹ is a charcoal or fuel burner and furnace, made so as to be self-feeding by the upper box D¹ D¹, and provided with a supply pipe E, by which the combustion may be sustained by pressure from a fan. F is an oxidising valve, which regulates the air admitted for effecting the combustion of the fuel. The products of this combustion pass under and through the boiler H by the internal flue G. The products after passing through the boiler pass under the vessels for generating the gases. One of these generators is shown at L. M is a pouring pipe; N is an exit pipe; K, a steam pipe adapted to the generator. By the generator gases can be made

APPARATUS FOR THE MANUFACTURE OF WHITE LEAD.

BY MESSRS. MAJOR, WRIGHT, AND JONES.



and sent to the chambers A A[1] by the pipe N. P represents an auxiliary exit or chimney used as a bye pass when necessary, as when the combustion is needed in the furnace C[1] and the products are not wanted to circulate through the chambers A A[1]; *d* is the working chimney, which receives the products from the chambers by either of the valves *c*[1] *c*[1] for sealing the chambers when required; I is the main steam pipe.

The mode of operating is as follows:—The lead, which is prepared so as to expose a large amount of surface, is placed on the shelves in the chambers; the chambers are then closed, and heated to a temperature of about 120deg. to 140deg. Fah. Steam is then directed into the chambers so as to convert a portion of the metal into hydrated oxide or oxide; this is continued for from ten to twenty hours. The chambers being raised to a temperature of about 120deg. to 140deg. Fah., the next step is to generate vapours in the generator L. These vapours are conducted by the pipe N to the upper part of the chambers at O. In these operations a sub-salt of lead is produced upon the lead in the chamber. The next step is to treat the lead with carbonic acid. This gas is prepared in the fuel burner C[1], and is fed into the chambers and caused to circulate regularly in contact with the materials so as to convert the sub-salts into carbonate of lead. During the conversion of the lead in these stages of the operation the temperature of the chamber is preserved at about 140deg. Fah., and the successive steps of the operation are repeated, care being exercised to regulate the supply of steam so as not to wash the lead nor to have it in too dry a state for treatment until the whole is converted into white lead.

Fig. 2 shows the arrangement of a pressure chamber A, fitted with valves E E for the purpose of regulating the pressure within. B B are pipes for circulating steam from a boiler, or hot air and gases from the fuel burner C, and forming also the shelves or supports for the lead. These pipes communicate with the chimney at D, which is provided with a stop valve G, so that the products of combustion, after passing through the pipes of he chamber and heating it, can be forced into the interior of the chamber and brought in contact with the lead, and thus after being employed as a means of heating the chamber when the same is heated by the gases from the fuel burner C, these gases are utilised in the decomposition of the sub-salts and in the formation of white lead; the heated gases, however, may be employed for heating purposes alone, and carbonic acid supplied to the chamber from some independent source in a heated condition or not. Fig. 3 shows the arrangement of the shelves in the chambers so as to cause circulation of the gases within it, the course of these currents being at right angles to those within the hollow shelves or pipes through which the heating current passes, and on which the lead or its compound is placed. The mode of operating is the same in the pressure chambers as that already described.

When circulating chambers are employed, in which the metal is kept in motion, the inventors have two cylinders, as shown in figs. 4 and 5; the inner one, which contains the lead, is made to rotate. It is a cylindrical vessel B with a number of radial shelves or gratings on which the lead is placed. These chambers are all fitted in a similar manner to those we have already described, and are fed with gases or vapours in a similar manner. The whole of the chambers have air-tight doors or openings for charging and discharging materials in manufacture.

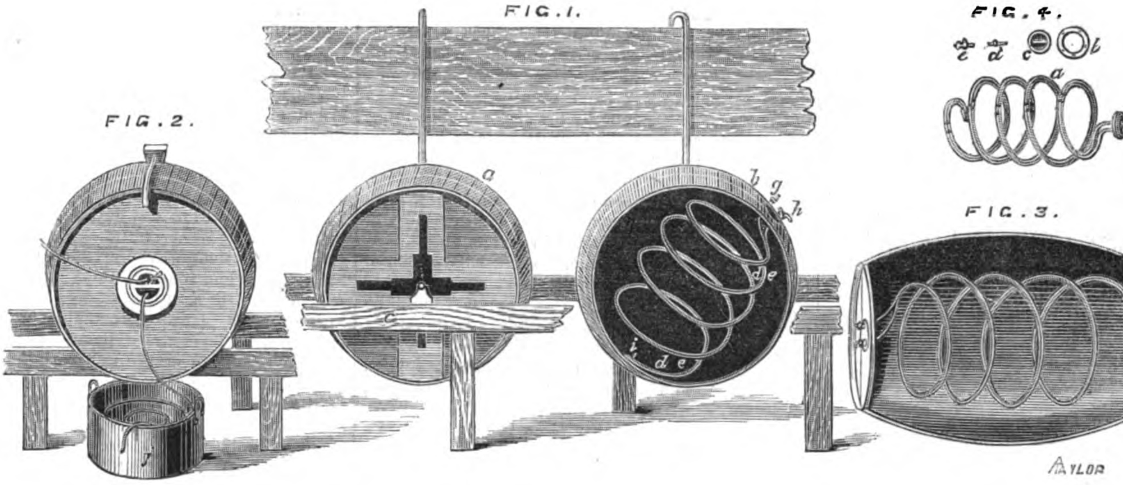
White lead so manufactured can be finished in the usual manner by washing, grinding, &c., but the inventors treat their products in a novel manner and on a new principle. They decompose any salts of lead remaining other than those proper to white lead, and this they accomplish as follows:—They pass into the chambers when containing the lead compounds produced in manufacture, ammoniacal compounds, and so decompose any remaining salts of lead other than those proper to white lead. After this treatment they raise the temperature of the chamber and its contents so as to remove the ammoniacal compound so formed, and thus avoid the necessity of washing. The lead is afterwards finished and prepared for general uses in the customary manner. White lead manufactured according to this invention is said to be free from all contamination, and is pure white lead. The process relieves the operation from its present dangerous tendencies, the workmen are never exposed to any dangerous or deadly fumes, nor is there any chance of loss of material in the process of manufacture. Time is also economised, the usual period required being about three months, whereas the inventors state that they can fully operate upon lead so as to convert it into white lead in from fourteen to twenty-eight days, according to the substance of the material operated upon, and in a pressure chamber they can produce it in even less time.

Professor E. V. Gardner, of Berners College, Oxford-street, has practically carried out this patent in all its bearings, and his exhaustive report is now before us. Upon all points the Professor obtained the most satisfactory results, as will be seen by the following extracts from his report:—"I do not hesitate to state, from my experience in these experiments, which I would observe are not laboratory experiments but practical operations (the chamber fully worked out being 4ft. by 2ft. 6in. by 2ft. 6in., and containing 3cwt. of lead), that white lead could be made by Major's process in twenty-eight days—*i.e.*, if the process were well conducted day and night unceasingly, and no time lost in raising the heat of the chambers day by day, as has been unavoidably the case in these experiments. I am also of opinion that the conduct of this process on an extensive scale, say of 500 or 1,000 tons, would show even more favourable results, and afford means of large and economical reductions in the cost of manufacture." Concerning the finishing process, the Professor writes:—"According to the plan at present pursued in making and finishing white lead, the material from the converting vessels being washed and ground, the cost is about £7 per ton. By this process (according to Major's patent) the converted material is treated with vapour of ammonia, so that any remaining acetate is decomposed; the salts of ammonia thus formed are then removed by currents of heated air, or by superheated steam. This newly improved finishing process, it is to be observed, is completed without removing the converted material from the chambers in which it has been treated."

OWNERS of runs in Australia continue to expend large sums of money in order to prevent the increase of the wild rabbits, which in some districts appear to have become a formidable nuisance. Mr. Robertson's run at Colac, for instance, says the "Melbourne Argus," is enclosed with stone walling, and a man with a pack of dogs is engaged in keeping the rabbits outside the boundary, while the run has been already cleared by the work of the rabbiters, at an expenditure up to the present date of £9,000. Dr. Stodart has four miles of walling completed, and has expended £1,300 in endeavouring to get rid of the bunnies. Mr. A. Murray has also expended some thousands of pounds in a like manner.

ATTEMPERATOR FOR UNION CASKS.

BY MR. J. A. BINDLEY.



ATTEMPERATOR FOR UNION CASKS.

THE defective construction of the tubes usually employed in breweries for attemperating by means of water has been carefully considered by Mr. J. A. Bindley, of Burton-on-Trent. He has, therefore, patented, through Messrs. Robertson, Brooman, and Co., patent agents, of 166, Fleet-street, the invention we are about to describe, and which is illustrated in the accompanying engraving. Mr. Bindley's improvement consists in employing, instead of the ordinary attemperator or pipe and casing, a pair of tubes laid side by side and coiled together into a large tapered spiral, roughly approximating in form to that of the cask in which they are to be employed, but of smaller diameter than the interior of the cask. One of these pipes is connected with the inlet nozzle and the other with the outlet nozzle usually employed with the ordinary attemperators, and the extremities of the pipes themselves are connected at the termination of the spiral, so that the course of the water is along one and back by the other throughout the entire spiral. This duplex spiral pipe being fixed by its inlet and outlet nozzles to the ordinary screw bung or closure of the cask, the spiral form given to the pipes enables them to be introduced through the ordinary aperture of the cask till the screw closure comes up to its flange and is secured. Mr. Bindley thus accomplishes the introduction into the cask of an attemperator of much greater surface area than that which is ordinarily in use, and, what is much more important, capable of uniformly regulating the temperature throughout the cask.

In the case of those attemperators which are fixed horizontally in the cask, projections or props are either attached to points on the spiral or are free to move thereon, or a ledge is made at the end of the cask for the point of the spiral to rest upon in employing any of these expedients, for the purpose of supporting the spiral when its axis is in a horizontal position. In the accompanying engraving we have represented the manner in which Mr. Bindley carries his invention into effect. Fig. 1 is a view showing two casks *a b* lodged upon a frame *c*. One of these casks is represented with the head removed, to show the coils of pipes *d e* forming the attemperator arranged in a spiral manner in the inside. The coils of pipes *d e* have been introduced into the cask through the bung hole, which is fitted with a screw collar for receiving a plate *f* on the end of the pipes, which plate has connected to it two taps *g h*, one to act as a nozzle and lead the water into the coil *d*, while the other tap *h* acts as the outlet to admit of the water which has returned through the coil *e* leaving the cask after having thrown off its cooling properties and reduced the temperature of the beer. The ends of the coils are connected so that a free passage for the water is established between one coil and the other. To prevent the ends of the coils being injured by coming into contact with the inside of the cask while they are being turned on inserting them, a projection is made on the ends of the same to act as a guide. Fig. 2 is an end view of a cask showing the face of the plate *f* and the arrangement of the inlet and outlet nozzles or taps *g h* fitted in the head or end of the cask instead of in the bunghole as in fig. 1. After the coils are screwed in, flexible tubes are attached to the nozzles, one of the tubes being in connection with the water supply, and the other in connection with the waste pipe or drain. The tub *j* is placed under the head of the cask for receiving the yeast thrown off. In fig. 3, we have shown a double coil of pipes fitted in a cask in a similar manner to that represented in fig. 2, and in fig. 4 we have illustrated the coils detached.

This apparatus has been at work for some time at the brewery of Messrs. Worthington and Co., where it gives every satisfaction; in fact, we are informed that its working has exceeded the inventor's anticipations. There is no projection or space left inside the cask which can harbour any sediment. The boss is constructed large enough to admit of a man's arm, so that the cask can at any time (when not in work) be brushed out without taking the head out. This attemperator has so many advantages which the practical brewer will at once recognise that it cannot fail to prove a success.

OPERATING TILT HAMMERS.

MR. T. T. PROSSER, of Chicago, has invented the method of communicating power to tilt hammers shown in the accompanying cut. His invention also relates to the arrangement for hanging, operating, and controlling the hammer, and the changing of the hammer dies both in the hammer head and in the anvil. The invention has recently been patented in England. Our engraving shows a vertical longitudinal section of the apparatus.

A A are two sills which form the base of the machine frame; B B are two posts inserted in the sills to receive the balance of the timbers composing the frame. Bolted on each side of the posts B are two longitudinal pieces C forming the side timbers. The rear post is longer than the front one so as to receive the cap or cross piece D on its upper end. By thus arranging the frame all parts are in position to receive the working parts of the machine and form a durable and perfect arrangement. On the upper end of the front post is the anvil block F containing the die E, which is made adjustable and is easily removed. Upon the upper and lower side of each end of the cross piece D are fulcrum or pivot boxes G to receive the pivots H passing through the vibrating arms I and I[1], which are connected together and held in position by the springs J and bolts K. The arms I I[1] are in pairs, and the lower pair of arms is shorter than the upper pair; and the arms are in each pair much further apart at the rear end than at the other or front end; the rear ends of each pair are not connected, whilst the front ends are. The lower pair of arms is connected at the front end by a pin *l* and the bolts *m*. In the middle of the pin *l* is a box *n*, to which are attached the eccentric rods that vibrate the arms I[1] and I by means of the eccentric O on the shaft P, which is connected to the short arm of the levers *q*, which are pivoted at R, and, as the eccentric is driven by the friction wheels S, it will be evident that as the foot is placed on the footboard T the shaft P will vibrate and bring the wheels in contact with those driven by the belt *u*. As the pressure of the foot causes an increase of friction the vibrations correspond therewith. As the hammer is moved up and down by these vibrations the faster the vibrations are the harder the hammer will strike, and the slower they are the lighter blow the hammer will strike. As these motions are under the control of the operator by means of the footboard T and lever *q* the machine can be made to strike just such a blow as the operator may desire.

The upper pair of arms is longer than the lower arms, and their front ends are permanently attached together by means of two plates *w*, through which the hammer shank passes, and to which it is attached by the nut V on the upper end of the hammer shank. The hammer shank near the hammer W is square, and the hole in the plate on the under side of the arms through which it passes is made to correspond therewith, whilst the hole in the upper plate is round. The object of making the hole and hammer shank square is to keep the hammer from turning. By connecting the lower arms to the upper by means of the springs the inertia of the hammer when at rest and the recoil when at work are overcome in such a manner as to relieve the machine from those violent shocks incidental to the common tilt hammer and to convert them into useful effect, for as the hammer is thrown up by its momentum to a greater distance than the movement of the eccentric an increased amount of tension is imparted to the forward springs, and when the hammer descends the increased tension causes it to descend with an increased velocity and additional force, thus being enabled to strike a much quicker and harder blow than can be done by the machines now in use. As the springs admit of a ready adjustment by means of the bolts and nuts it can be readily adjusted to a rapid or slow motion as desired, and as the shock consequent upon a vibrating motion caused by a reverse movement is all taken up by the springs its motions are all easy and it cannot fail to be durable, the importance of which advantages must be evident to all who are acquainted with the vast amount of labour performed by this class of machines.

THE public will be glad to hear that "Seely's Pigs," which gave occasion to so long and fierce a controversy, have at last been sold to Mr. Dixon, of Laurence Pountney-hill.

DR. LIVINGSTONE.

SOME further intelligence of Dr. Livingstone has been received, in the form of a very interesting letter from the veteran explorer himself. The letter, which we append, was received at Zanzibar on the 2nd of October last, by Dr. Kirk, who, in forwarding it to the secretary to the government at Bombay, wrote as follows :—

"Zanzibar, October 2, 1869.

"Sir,—I have the honour to enclose herewith, for the information of the Right Hon. the Governor in Council, the copy of a letter from Dr. Livingstone, dated the 30th May, 1869, and received at Zanzibar this day. The requests made by Dr. Livingstone in a previous communication that reached on the 7th ult., having been already complied with, I shall lose no time in supplying the things herein demanded. There will, however, be some difficulty in getting faithful men, as the Arabs of Unyanyembe, being of the El Hoathi tribe, are by no means loyal subjects of Seyd Majid, and, as Dr. Livingstone tells us, still engaged in the slave trade.—I have, &c.

"JOHN KIRK."

The following is Dr. Livingstone's letter :—

"Ujiji, May 30, 1869.

"My dear Dr. Kirk,—This note goes by Musa Kamaals, who was employed by Koarji to drive the buffaloes hither; but, by overdriving them unmercifully in the sun, and tying them up to save trouble in herding, they all died before he got to Unyanyembe. He witnessed the plundering of my goods and got a share of them, and I have given him beads and cloth sufficient to buy provisions for himself on the way back to Zanzibar. He has done nothing here. He neither went near the goods here nor tried to prevent their being stolen in any way. I suppose that pay for four months in coming, other four of rest, and four in going back would be ample, but I leave this to your decision. I could not employ him to carry my mail back, nor can I say anything to him, for he at once goes to the Ujijians and gives his own version of all he hears. He is untruthful and ill-conditioned, and would hand off the mail to any one who wished to destroy it. The people here are like the Kilwa traders—haters of the English. Those Zanzibar men whom I met between this and Nyassa were gentlemen and traded with honour. Here, as in the haunts of the Kilwa hordes, slaving is a series of forays, and they dread exposure by my letters. No one will take charge of them. I have got Thani bin Suellim to take a mail privately for transmission to Unyanyembe. It contains a cheque on Ritche, Steuart, and Co., of Bombay, for Rs. 2,000 and some forty letters, written during my slow recovery. I fear it may never reach you. A party was sent to the coast two months ago. One man volunteered to take a letter secretly, but his master warned them all not to do so, because I might write something he did not like. He went out with the party and gave orders to the head man to destroy any letter he might detect on the way. Thus, though I am good friends outwardly with them all, I can get no assistance in procuring carriers, and as you will see if the mail comes to hand I sent to Zanzibar for fifteen good boatmen to act as carriers if required, 80 pieces of moritrano, 40 pieces of kinitra, 12 farasales of the beds called jamsain, shoes, &c., and I have written to Seyd Majid begging two of his guards to see to the safety of the goods here into Thani bin Suellim's hands or into those of Mohammed bin Sahib.

"As to the work to be done by me it is only to connect the sources which I have discovered from 500 to 700 miles south of Speke and Baker's with their Nile. The volume of water which flows north from lat. 120 S. is so large, I suspect that I have been working at the sources of the Cango as well as those of the Nile. I have to go down the eastern line of drainage to Baker's turning point. Tanganyika, Nyige Chowambe (Baker's ?) are one water, and the head of it is 300 miles south of this. The western and central lines of drainage converge into an unvisited lake west or south-west of this. The outflow of this, whether to Congo or Nile, I have to ascertain. The people of this, called Manyema, are cannibals, if Arabs speak truly. I may have to go there first, and down Tanganyika, if I come out uneaten, and find my new squad from Zanzibar. I earnestly hope that you will do what you can to help me with the goods and men; £400 to be sent by Mr. Young must surely have come to you through Fleming and Co.—I am, &c.

"DAVID LIVINGSTONE.

"A long box paid for to Nijiji was left at Unyanyembe and so with other boxes."

At the last meeting of the Royal Geographical Society, Sir Roderick Murchison made the following observations upon the above letter. He observed,—Much as I regret to find by this letter that the intrepid traveller had recently to contend with difficulties owing to the conduct of certain Arabs, it is for us to admire still more the indomitable resolution with which he was preparing to conclude his labours. The very words preceding his last paragraphs express so entirely what I surmised would be my absent friend's final endeavour, that I cannot forbear from quoting them :—"As to the work to be done by me (says Livingstone) it is only to connect the sources which I have discovered from 500 to 700 miles south of Speke's and Baker's with their Nile." Let us, therefore, hope that this intended effort has before now been crowned with success, and that no long period will elapse before we are rejoiced in welcoming him at home. At the same time, we must be prepared for the possible but not probable contingency that the waters of the Lake Tanganyika should be found not to flow northwards into the Lake Albert Nyanza, but to be deflected to the west. In that case, if Livingstone should be adequately supplied with carriers and provisions, he will, I doubt not, follow these waters, and thus being led on, perhaps, to the Congo, we may once more be subjected to a long and anxious period of suspense.

ROYAL POLYTECHNIC INSTITUTION.

THE annual distribution of certificates and prizes to the successful candidates of the evening classes connected with the above institution took place last Friday, in the large theatre of the institution. Dr. Brewer, M.P., occupied the chair, and was supported by the Rev. J. B. Owen, chairman of the Polytechnic, the Rev. Prebendary Mackenzie, M.A., hon. manager of the educational department, Professor Pepper, and Mr. T. W. Tobin, the secretary. In opening the business, the Chairman referred to the great success which attended the candidates sent by the institution to the various examinations; it was a circumstance of which they might well be proud, that the late Prince Consort's prize had been carried off a second time by a member of the Polytechnic Institution, the fortunate winner this year being Mr. W. J. Wilson, who was very successful in various branches of study and had received a large number of prizes. The Rev. Mr. Mackenzie said that her Majesty the Queen, on learning that the Polytechnic had carried off the Prince Consort's prize for two successive years, had graciously forwarded for the use of the library a copy of her works with an autograph inscription. Dr. Brewer then handed the prizes to those winners who were present to receive them, and the proceedings closed by a hearty vote of thanks to the chairman, moved by the Rev. J. B. Owen, seconded by Professor Pepper.

ROGERS' LIFE-SAVING APPARATUS.

OUR readers will be glad to learn that the development of Mr. Rogers' apparatus for saving life at sea is progressing satisfactorily, as, indeed, such a valuable and practical invention deserves to progress. An interesting series of preliminary experiments with this apparatus were made under the superintendence of the inventor and the officers of H.M. gunnery ship "Excellent," at Whaley Island, last week, with the most useful size, viz., a 3½-inch mortar. The practice showed the accuracy of aim with which the projectile could be thrown, and the distance was very great for the quantity of powder used. A projectile weighing 12lb., with double line, the weight of which was 10lb., was thrown a distance of 198 yards with the incredibly small quantity of 1¼oz. of powder. The whole of the experiments were carried out to the entire satisfaction of all who witnessed them. We have before fully described and commented upon this meritorious invention, which has so impressed the Government with its utility that Mr. Rogers has been instructed to have the full size appliance made in her Majesty's Dockyard at Portsmouth, under his personal superintendence. We trust the inventor will reap that reward he so richly deserves for the time and thought he has devoted to this means of rendering aid to our seamen and ships in distress.

WE understand that it has been decided to make no re-appointment to the office of Master of the Mint. The present Deputy-master, Mr. Freemantle, will preside over the establishment, which will be attached to the Treasury.

HYDRAULIC MACHINERY FOR WAREHOUSING GRAIN.*

By MR. PERCY G. B. WESTMACOTT.

THE subject of the paper of which the following is an abstract was a description of the hydraulic machinery for warehousing grain at the Liverpool Docks. Blocks of warehouses have been erected by the Mersey Dock and Harbour Board, ably designed and executed under the supervision of Mr. Lyster, the dock engineer, for the stowing and conditioning of grain and bread stuffs. The dock upon which they are situated is 570ft. wide by 230ft. broad at one end and 180ft. at the other, with a depth at high water spring tides of 34ft. over the sill of the gate. The blocks on the east and west sides of the dock are 650ft. long, and that on the north end 185ft., the whole range being 70ft. wide. The buildings contain five stories. Above the fifth or upper storage floor, and partly in the roof, is placed the machinery floor, and below the quay level are wells and arched subways for the reception of the underground machinery. The total storage capacity of the floors, exclusive of the quay floor (at 4qrs. to the square yard) amounts to 196,000qrs. of grain. The ends of the east and west blocks are constructed to receive iron chambers for conditioning grain on the Deveraux system in order to prepare it for the market by drying. The steam engine, the prime mover of the whole plant of machinery, was of 370-horse power, and that, in addition to driving the machinery in the warehouse, supplied power working for the lock machinery and the bridge over the entrance, consisting of two 60ft. and one 50ft. bridges, twelve sluices, ten powerful ship capstans, and twenty-four machines for opening and closing the lock gates. From returns taken of the importation into Liverpool of the different descriptions of breadstuffs for the years 1858—63, it was estimated that the warehouses should be constructed capable of working 250,000 tons per annum, irrespective of other ordinary merchandise.

Having described the principal processes required to be performed by the machinery, and the best means likely to secure the requisite power, and especially the kind of power, and the most convenient, practical, and least costly method of applying and distributing that power, the writer stated that it was found after experiment that no system of motive power or combination of systems could be found to meet those requirements in the aggregate with so much effect, convenience, and economy as the hydraulic system. Having noticed the facility with which this power had been conveyed for long distances at the Birkenhead docks, and also the advantages or otherwise of propelling grain horizontally by means of screws, the author stated the results of the latter system. At sixty revolutions per minute (the maximum effective speed) grain could be discharged by a screw in use at a certain brewery at the rate of 6¾ tons per hour, being at the rate of 1-25th-horse power for every foot run. With a screw subsequently put into operation of 12in. diameter, and driven at the rate of seventy revolutions per minute (the most effective speed), thirty-four tons of grain per hour were discharged. The effect upon the grain in the latter case was marked, it being rubbed and polished, and thereby improved in marketable condition. But the long distance through which the grain had to be conveyed horizontally, amounting collectively to 7,000ft., and the power required to perform the operation, even with the best form of screw, rendered it expedient to seek some other method less absorbent of power, and recourse was had to endless travelling bands.

Experiments were made with a 12in. band, constructed of canvas and india-rubber. It was found that a speed of 9ft. per second could be attained with heavy grain, and still more with peas. The amount of grain discharged by the 12in. band at the speed of 8ft. per second, was at the rate of about thirty-five tons per hour. Further trials were carried on with an 18in. band, made of two plies of stout canvas, covered with vulcanised india-rubber. To meet the requirements of passing grain from off the straight bands to either side at certain points along the travel, several contrivances with air blast, and brushes driven from the band itself, were tried, but with indifferent success. Both methods were objectionable on account of raising dust, and the friction of the brush proved in time injurious to the band. The idea then occurred of diverting the line of the current of grain by means of an upward deflection of the band, thus casting the grain clear from the band

* Institution of Mechanical Engineers.

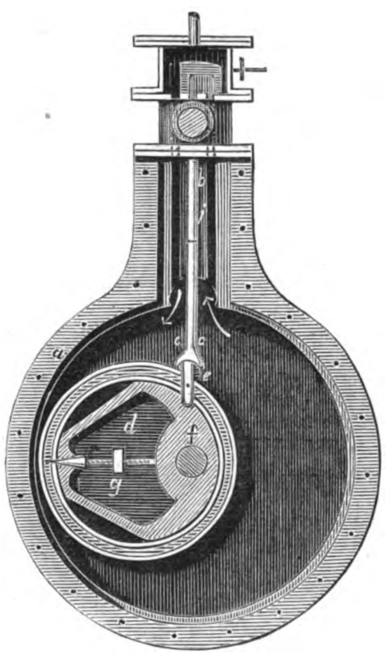
into the air for a short distance; it could then be received upon a band travelling in any other direction, and, if necessary, could be passed round the warehouse from one side to the other, or even make a circuit of three sides of the block, according to the method in which it was intended to dispose of it, or the place in which it was to be deposited. There were fifty-six spouts, 8½in. square, from the upper to the various other floors. No difficulty was experienced in keeping the grain on the band, but it was found necessary to glide the grain on to it from the feeding hopper through a spout rather less than half the breadth of the band, at an inclination of 42½ deg., which would impart a velocity to it on falling approximating to that of the band. The maximum amount of heavy grain conveyed by the 18in. band was at the rate of seventy tons per hour; the power required for driving the band when fully loaded was ascertained to be equal to about 1-70th-horse power effective per foot run.

The paper then described the boiler and engine, &c., and also other apparatus with which the warehouses are furnished, including the cranes and the two accumulators, each of which latter is weighted with a load of seventy tons, acting on a ram 17in. diameter, and the auxiliary accumulator with a load of 100 tons, acting on a 20in. ram. The form of tub in which grain is lifted from the holds of ships, and the hoppers through which it is passed for various purposes, having been minutely described, the author detailed the construction and capacity of the elevator, which consists of a wrought-iron bucket, capable of containing about 21 cwt. of grain. It was slung in an arrangement of bars and levers, provided with guiding rollers, which enabled the bucket to run in special grooves to the top, for the discharge of the grain into the upper hopper, which communicates with the same cross bands that convey the grain from the hopper under the crane. Casks, bags, and other merchandise might be raised or lowered by two classes of machines—one by means of the hydraulic cradle hoists, of which there were twelve; the other by means of twenty jiggers. Twelve double-acting 10 cwt. jiggers had also been added to the plant in the central block, to lift and lower goods to and from railway waggons. The paper lastly directed attention to one of the great advantages which the hydraulic system possessed in so eminent a degree, namely, the facility afforded for the extension of power to any point where the demand for additional contrivances to save time and hand labour was felt.

ROTARY ENGINE.

MESSRS. JOHNSON and GILL, of Unstone, Derby, have lately patented some improvements in rotary engines and pumps. In their invention a direct rotary motion is given to the shaft of the engine, the moving parts working perfectly steam-tight with a small amount of friction. When motion is given from an external source to the shaft, the piston will act as a pump for raising or forcing water. The engine consists of a cylinder, secured on a foundation, and having a central shaft working in bearings at each end. On this shaft is mounted a circular piston, revolving eccentrically around and within the cylinder, at the top of which the inlet and exhaust pipes are applied. Between the ports a slot is cut, in which a slide has a reciprocating motion, and which, therefore, separates the exhaust from the feed, the slide also working in grooves cut within each end of the cylinder, and being attached to the piston by a saddle and knuckle joint in connection with a belt surrounding the piston but not rotating with it. By this arrangement the eccentric motion of the piston causes the slide to ascend and descend at each revolution of the shaft, always maintaining a perfect steam stop. The piston is made in two parts, so as to ensure its being steam-tight. The interior contains a spring adjusted to any pressure by a screw to bind or thrust its periphery against the surface of the cylinder, and the outer ring is divided into two parts, so that it can be sprung to the face of the side. The end also of the outer ring contains a groove, wherein the ring attached to the strap works, which connects the slide to the revolving piston. The strap works through the end of the slide, and is connected also to a spring at the top of the slide to keep it to its work. When used as a pump the chest and feed valve is not required; the feed and exhaust ports serve equally for the inlet and discharge of the water, the engine working in exactly the same manner as when steam is applied.

We show a vertical section of the engine, in which *a* is the end plate or cover of the engine, with the groove *b* cut in it for the reception of the sliding top *c*, attached to the cylindrical piston *d* by means of the jointed strap *e* and loose ring in the centre of the piston; *f* is the shaft to which the piston is fixed, and *g* is the screw rod which forces the piston against the interior of the cylinder; *h* is the feed pipe, and *i* the exhaust port, the arrows showing the direction of the steam or water and the consequent course of the piston. The slide

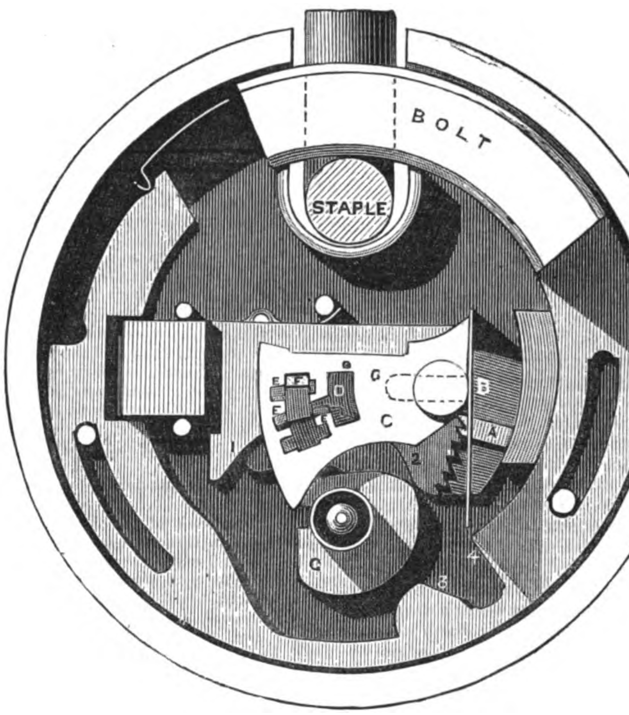


rises and falls within the groove and within the slot *j* in the upper part of the engine above the main cylinder, being always attached to the ring enclosing the cylindrical piston, so as to acquire a reciprocating vertical motion caused by the eccentric movement of the piston. The engine will be found applicable to driving screw propellers where direct rotary motion is desirable, as it occupies a very small space in comparison with that necessary for a reciprocating engine.

A FIR tree, 139ft. high, and 71in. in diameter, has recently been felled in the woods belonging to the family of Zichy, at Arwa, in Hungary. It has been taken to Hamburgh to be formed into a mast.

THE "CITADEL" WEDGED BOLT ORBICULAR PADLOCK.

BY MR. HODGSON.



THE "CITADEL" ORBICULAR PADLOCK.

IN our number for July 23 last will be found an illustrated description of Mr. Hodgson's patent wedged bolt lock, which marks a material advance in the locksmith's art, and puts as material a check upon fraud and violence. We now illustrate herewith the same principle applied to a padlock, which we have just examined. This padlock, from its perfectly round shape, combines security with elegance and convenience, and altogether with the entirely new internal action, affords the greatest security possible in a padlock. It has no ears or shackle, the orbicular bolt turned by the key forming the shackle, and being secured internally by a single and simple action of the bolt of a complete "citadel" lock. Referring to our engraving the action of the padlock in opening is as follows:—The key, on being inserted and turned, first elevates the levers or tumblers C to their proper height for the stamp F on the secondary bolt to pass forward into the true gatings E. It then shoots the bolt sufficiently far forward to disengage the teeth of the wedge A from those of the bolt. This additional outward movement of the bolt is effected by the action of the key upon the outer incline in the secondary bolt before it has entered sufficiently far into the talon D of the bolt to move it backwards. The key, continuing its rotation, then elevates the wedge lever A sufficiently to bring the block or wedge A opposite to the slot B in the bolt, and then withdraws the secondary bolt in the usual way; and when it meets the talon of the orbicular bolt rotates it until it arrives at the keyhole.

In locking this padlock, the key on its entrance first acts on the talon of the orbicular bolt 3, 4, and shoots it sufficiently far round as may be convenient; and then, by reason of the eccentricity of the drill pin, *i.e.*, the pin on which the key rotates, it arranges the levers and shoots the secondary bolt 1 into the orbicular one, and that in the usual manner. But so soon as the rear end of the slot B in the bolt has cleared the block or wedge A the latter is forced downwards by its spring bringing the wedge A opposite the solid portion of the rear end of the bolt and effectually preventing it from being forced back. In order that the inclined teeth on the rear end of the bolt may become engaged or interlocked with those in the wedge or block A, it is necessary that the bolt should be moved back slightly before the key is withdrawn. This backward motion is accomplished by means of a projection on the curtain G revolving with the key, the projection coming in contact with the inner incline on the bolt before the key arrives at the position for enabling it to be withdrawn from the lock. In our engraving the projection or collar

on the curtain G has just left the incline and completed the action of locking. The bolt and wedge are thus interlocked together, and no lifting of the wedge can be effected until the bolt has been disengaged from it or moved outwards slightly, as previously described. We thus see that the exposure of the shackle and the weak points of the ears and rivets—inherent defects in the ordinary padlock—are here perfectly remedied. These special advantages, together with the very perfect mechanism of the interior, enable us to recommend it as a safe and reliable fastening. We should add that the manufacturer of and agent for the orbicular padlock is Mr. James Hodges, 114, Chancery-lane, London, who has favoured us with these particulars.

A NEW DIGGING MACHINE.

We recently witnessed the working of a new rotary digging machine, which is on view to those interested in such matters in the Ashburnham Grounds, Chelsea. This machine is the invention of M. Florent J. Vandenvinne, who has successfully shown what can be done in grubbing up land. The apparatus is worked by steam, and is self-contained and self-propelling. It consists of a boiler and engine, which works a couple of vertical shafts in front of the machine, and which are armed with a series of horizontal picks. As the earth is brought down by the picks it is mechanically filled into a set of buckets on an endless band. These buckets deliver the soil into a revolving platform carried over the machine, and which delivers it out behind over a shoot. The propulsion is obtained by means of an endless platform working over pulleys, and which forms a way for the machine to travel on, and which it lays as it proceeds. This machine is exceedingly ingenious, and can be regulated to work in a direct line or in an upward or downward direction. We shall place an illustrated description of the apparatus before our readers next week.

STREET TRAMWAYS.

A vigorous commencement has been made this week with the first of the tramways authorised last session for the metropolitan district. The London Street Tramway Company have commenced the construction of their double line from Whitechapel to Bow, and the men, of whom a larger number will be employed next week, are making rapid progress. The rails are 4in. broad, and have a groove on the face for the flange of the wheel. They are spiked upon longitudinal sleepers of Baltic timber, 6in. by 4in. The sleepers are bedded in cast-iron chains, and kept in gauge by cross ties of iron, dovetailed at the ends into the chains, and abutting upon the sides of the sleepers. The roadway is of the best description, having a considerable depth of concrete under the paving stones. The sleepers will be packed with Portland cement, which will furnish a firm and durable bearing. The contractors for the line, which is about 2¾ miles in length, are Messrs. Fisher and Parrish, who, so far as can be judged at present, seem determined to make a thoroughly sound and durable road whereon the great experiment of street tramways is to be first tried in the metropolis.

THE AMERICAN NAVY.

It is stated that the Secretary of the Navy, in his forthcoming report, will recommend a total reorganisation of the United States navy, the sale of all the old and worthless vessels of the "Isherwood" class, and the construction of some new and more serviceable ships. The force of the navy now amounts to about 200 vessels. The Secretary will suggest that the peace footing be fixed at about 180 vessels. He is also in favour of subsidising lines of ocean steamers, and alludes to the advantages which the country would have derived in the late war from the possession of a steam flotilla, such as the British Government has at its disposal in the event of hostilities. The tonnage of England, France, and the United States is contrasted, with, as may be judged, results by no means favourable to the United States. On the subject of docks and navy yards the Secretary has some recommendations to make. He considers the Brooklyn yard too small, and will advise that ground be purchased on the North River for a more commodious establishment. The foreign squadrons, he thinks, should be increased and strengthened. All this can be accomplished on the same amount of money as was appropriated last year.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular December 16.)

Since our last circular of the 9th, the transactions reported in the chemical trade may be considered a fair average; a slight lull in the alkali trade was experienced in the early part of last week, but towards the close some considerable shipping orders were given out. For home consumption there has not been such a perceptible falling off in orders as is usual at this time of the year; consequently, prices are very firm, with every prospect of an appreciable increase at the turn of the year. In minerals, no sales of importance; the deliveries have been chiefly on account of contracts. Since the advance in iron, a proportionate increase in the value of the ores has not been realised, many of the ironmasters having contracted for five years' supply, based on the late low prices of iron. In metals, the Scotch pig iron market has been very excited during the week, and prices are now higher than they have been for a considerable time. The market closes with prices still tending upwards. Copper is in quiet demand; the standard advanced 10s. per ton at the last sale of Cornish ores. Tin is fluctuating in value, but stocks of English are low. Lead in moderate demand, and selling freely at our quotations. Spelter quiet, and prices unaltered. Soda: Soda ash for contracts is still being placed at the old rates of £7 on 48; and of caustic at £13 on 60. The demand for soda crystals has somewhat abated, prices remaining at £3 17s. 6d. Salt cake, not pressing, and firm, at 57s.; bicarbonate, dull, at £9 5s. Nitrate of soda has fallen again, though it is still, at £15, considerably above its value. Potash: muriate very firm, and in inadequate supply, prices tending upwards, from £7 7s. 6d. to £7 12s. Saltpetre: a somewhat more active market, prices ruling from 22s. to 23s. 6d. foreign; and 26s. 6d. English refined. Alum: though heavily contracted forward, is sold at the old rates of £6 5s. for loose lump; and £7 for export in barrels; and £7 for ground. Ammonia: sulphate in tolerable request, at £15 10s. for 20, to £17 for fine white; muriate sells at £22 to £23. Copperas: green and rusty, at £2 10s., in ordinary demand; dry, very active, at 50s. Pyrites: the market is now somewhat more regularly supplied, prices ruling as before. Lime: in phosphate there is less doing, at 52s. 6d. for 65; bleaching powder firm, at £8 for 35, with considerable quantities still to place; disinfectants, at £5 5s. per ton for best kinds, selling freely. Manganese: in slow requirement, at 90s. for 70. Iron ores: hematite sells at 15s. to 18s.; oolitic is finding new consumers, at 6s. to 8s., in Staffordshire. Guano: best Peruvian obtains still £13 7s. 6d. to £13 10s.; seconds in slower demand.

Metals.—Iron: Scotch pigs steady at 56s. 11d. to 57s. Cleveland, very firm, at 47s. for forge, to 51s. 6d. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire bars, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: quiet; English tough, £71 to £73; Chili slab, £67 to £68. Tin: fluctuating; English ingots, £118 to £120; Straits, nominally from £112 to £114. Lead: steady; P. G. best English soft pig lead, £19. Spelter: inactive. English, £20 10s.; Silesian, special brands, £19 10s. to £19 15s.; hard spelter, for export, £16 10s.

Obituary.

We have to record the death of Mr. George Smith, C.E., Belfast harbour engineer, which occurred on the 3rd inst. The deceased gentleman was in his 77th year, and had been for twenty-four years the resident engineer of the Belfast harbour. During that period Mr. Smith carried out a very large amount of work. Under his superintendence the new cut at the Queen's Island and the channel between the Twin Islands were formed, the contractor being the late Mr. Dargan. The Queen's Quay, Clarendon Dock, and all the timber wharfs on the Down and Antrim sides of the river were also constructed under his superintendence. The filling up of the old docks—Limekiln Dock running into Waring-street, Ritchie's Dock up to Great George-street, and Town Dock up High-street to where the Albert Memorial now stands, and all the extensive improvements in connection therewith, were executed by him. He was the architect of the new Harbour Office, and designed the lighthouse on Holywood Bank. Under his superintendence the Patent slip was constructed; he carried out all the reclamation improvements on the County Down side of the river; and the extensive ranges of sheds along the quays were all planned and executed by Mr. Smith. Indeed, all the great improvements in the harbour of Belfast completed during the past thirty years were carried out under his management.

Legal Intelligence.

VICE-CHANCELLORS' COURT.

December 15.

(Before Vice-Chancellor Sir W. M. James.)

ELMSLIE v. BOURSIER.

This was a suit for the purpose of restraining an infringement of a patent for improvements in machinery or apparatus for the manufacture of sheet tin by the importation from France of tin-foil manufactured according to the patented process.

The patent in question was taken out in March, 1859, by Mr. J. H. Johnson, as a communication from abroad by Jean Baptiste Ferdinand Masson, of Paris. In May, 1851, the letters patent were assigned by Johnson (by the direction of Masson) and Masson to the plaintiffs, upon the distinct understanding, as alleged in the bill, that the plaintiffs should have the exclusive right of selling in England tin-foil according to the invention, and should be free from the competition of any persons manufacturing tin-foil in any foreign country according to the invention, under any patent or *brevet d'invention* then or thereafter to be granted to Masson. In 1865 the defendant Boursier purchased from Masson his manufactory and business, and all his patents or *brevets d'invention* for France, with notice, as alleged in the bill, of the understanding between the plaintiffs and Masson. This agreement, which was in the French language, contained, among other provisions, the following:—"A l'egard de tous autres pays, l'Angleterre exceptee, pour laquelle M. Masson a deja pris un brevet, qui a ete vendu par lui, et dont il est bien entendu qu'il conserve le prix integral, M. Boursier pourra prendre a son profit, s'il le juge a propos, et si la legislation de ce pays le permet, les brevets d'invention et d'importation." The defendant Boursier had imported into this country from Paris tin-foil, which was manufactured according to the process patented in England, and now vested in plaintiffs by assignment. The question argued was whether the importation and sale of articles manufactured abroad according to the patented process was an infringement of the patent, it being contended on behalf of the defendant that there had been no infringement, as the subject protected by the letters patent was the particular improvements in the machinery for rolling tin, and not the metal itself or any new combination of metal.

Mr. Grove, Q.C., and Mr. W. N. Lawson appeared for the plaintiffs, and were stopped; Mr. Willcock, Q.C., and Mr. Locock Webb appeared on behalf of the defendant.

The Vice-Chancellor was of opinion that there had been a clear violation on the part of the defendant of the rights and exclusive privileges granted by the Crown to the patentee, and now vested in the plaintiffs. It was conceded that no one could use the plaintiff's process in England, and if it could not be done in this country it would be a very strange thing if a man, after parting with his rights over the patent in England, were to be allowed to sell the process in France, and enable it to be brought over here, so as to destroy all benefit of the grant of the letters patent. Being, therefore, of opinion that this obtaining from abroad and selling manufactured in this country tin-foil according to the plaintiffs' process was an infringement of the patent, the plaintiffs were entitled to an injunction according to the prayer of their bill.

Correspondence.

RAISING THE TEMPERATURE OF SOLUTIONS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Allow me to correct a rather important error in the resumé of my paper "on raising a higher temperature in certain solutions by steam of 212deg. Fah.," in your number of December 3. The mistake lies in the part of the following sentence which I have put in italics:—"The discovery was of immense practical value to Mr. Spence, and will be to every manufacturer who has *to boil down large quantities of saline solutions*, or to digest materials with high boiling points for a long time, since it shows that a naked fire may be entirely dispensed with." I feel more the necessity of explanation, as a large firm of salt manufacturers have to-day applied to me for details as to its applicability to evaporating brine. Now no boiling down can in fact take place at all, as the excess of temperature is afforded by the condensation of part of the steam, the water uniting with the salt, and the latent heat being developed into heat of temperature. You are perfectly correct as to its applicability to all cases of digesting saline or acid solutions where a continued high temperature is required

Hoping you will find room for this in your valuable journal,—I am, Sir, yours, &c.,

PETER SPENCE.

Pendleton Alum Works, Manchester,
December 14.

[We are much obliged to Mr. Spence for this correction. It would appear at first sight improbable that the steam condensed could compensate for the evaporation at the elevated temperature, but such is no doubt the case; and on reflection the reason appears clear.—ED. M.M.]

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the MECHANICS' MAGAZINE. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, MECHANICS' MAGAZINE Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. ED. M. M.

Advertisements are inserted in the MECHANICS' MAGAZINE, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

RECEIVED.—S. C.—J. C. B.—C. R.—R. W.—E. T.—W. G.—L. and P. S.—J. W. T.—H. and M.—S. G. E.—T. W. T.—W. H.—E. B. J.—F. G.—A. H.—T. P.—J. W. P.—J. D.—P.O.—S. K. M.—J. E. L.—R. B.—J. M.—E. F.—J. R.—P. S.—J. C. E.—H. E. D.—V. P.—G. W. H.—F. B. and Co.—S.—E. T. B.—P. A. W.—H. C.—G. R.—J. M.—W. F. E.—R. and S.—C. and W.—W. T. F.—J. N.—J. J. and Son.

Meetings for the Week.

MON.—Society of Engineers.—Adjourned discussion on "Apparatus for Measuring the Velocity of Ships," by Mr. Vaughan Pendred, at 7.30 p.m.

TUES.—Institution of Civil Engineers.—Annual General Meeting, at 8 p.m.

Naval, Military, and Gunnery Items.

AN iron vessel called the "Haddock," loaded with guano, sunk in Galway Bay some three months since, was on Saturday last raised and brought into dock by Captain John Brennan, of City Quay, Dublin, a professional diver.

IT is said that a Russian line of steamers from the Black Sea to Bombay, *via* the Suez Canal, is about to be established, with contracts already made by one house at Moscow to ship 4,000 bales of cotton per week.

AT the usual monthly meeting of Clyde Trustees, held in Glasgow on Tuesday, the Lord Provost presiding, it was intimated that the revenue for November last amounted to £14,310 11s. 8d., as compared with £12,537 1s. 6d. for the corresponding period of last year, showing an increase last month of £1,773 10s. 2d. The increase for the past five months was £7,710 8s. 2d.

WE understand that about thirty of the new bronze guns were last week cast at Woolwich Arsenal. The analysis of the Indian bronze guns was only completed at the beginning of the week, when it was found that the composition consisted of from 8 to 10 per cent. of tin, the remainder being copper. The quantity of tin varied on account of its volatility and the difference in the length of time the alloy was being fused.

THE Inman steamer "City of Brussels," Captain Kennedy, has recently arrived in the Mersey, after a splendid run from New York. She discharged her pilot at 9.30 p.m. on the 4th inst., and anchored in the Mersey at 4.45 a.m. on the 13th. Allowing for difference in time and detention at Queenstown, the passage occupied the unprecedentedly short period of 7 days 23 hours 25 minutes. On the 9th with a south-west wind, she steamed 371 nautical miles, and on the following day she logged 365 miles.

IT will be remembered that in the fearful hurricane at St. Thomas on October 29, 1867, two of the Royal Mail Company's steamships were totally wrecked. The "Rhone" was lost on Peter Island, with 108 of her officers and crew, and the "Wye" on Buck Island, with 41 of her officers and crew, making a total of 149 lifes sacrificed in the two vessels. A very handsome memorial to Captain Frederick Woolley and the others who lost their lives on that occasion has just been completed in the Southampton Cemetery, and was recently unveiled and presented to the town by Alderman J. R. Stebbing, who was Mayor of the borough during the municipal year which immediately followed the hurricane.

A FURTHER reduction in the number of workmen employed in the shot and shell foundry and factory of the Laboratory Department in the Royal Arsenal at Woolwich, has been made this week by the discharge of 50 more skilled workmen. These continued discharges from this branch of the department are causing great surprise, as it is well known that there is a very inadequate store of common and shrapnel shells for the many hundreds of wrought-iron and converted cast-iron 64-pounder rifled muzzle-loading guns, and a still greater paucity of Palliser common and shrapnel shells, and Palliser shot for the large number of 7, 8, 9, 10, and 12-inch muzzle-loading rifled guns which have been manufactured.

A COMMENCEMENT has been made in Chatham Dockyard in building the "Rupert," iron-clad ram, 3 guns, 3,159 tons, 700-horse power. While fitted to act as a ram, this ship will carry a turret, and her armour will be heavier than any which has been used on any vessel. She will be supplied with the newly-invented double-balance rudder. She will be constructed in No. 2 dock; but as that dock is at present occupied by the "Sultan," in order to hasten the work the keel of the "Rupert" is being laid down, as a temporary measure, under No. 4 slip, and when the "Sultan" is completed the keel will be taken to pieces and removed to No. 2 dock, and the work of building the new ship will then be pushed forward. No. 2 dock will not long be occupied by the "Sultan," for the Admiralty have issued strict orders that she is to be so far completed as to be fit for floating out at the end of February or the commencement of March next.

Miscellanea.

THE number of visitors to the Patent Office Museum, South Kensington, for the week ending December 11, was 2,076. Total number since the opening of the Museum, free daily (May 12, 1858), 1,686,741.

FROM a statement of the business done by the New York Post Office with Europe for the month of October last, it appears that the total number of letters received and forwarded were 786,491, and the postage collected on the same amounted to 97,750 dollars 99 cents.

IT is announced that a great industrial and artistic exhibition is to be held at Turin in the year 1872, on the occasion of the completion of the tunnelling of Mont Cenis, but it is not stated whether it will be international, or confined to Italian productions only.

A COMPANY has been formed under the title of the East African Cotton Company, the object of which is the acquirement of land and cultivation of cotton in Zanzibar. The climate is stated to be specially suited for the cultivation of the superior qualities of cotton. The soil is rich, and labour is said to be plentiful.

IT has been definitively arranged that the eighteenth anniversary dinner of the members and friends of the London Association of Foremen Engineers shall take place in the City of London on Saturday, February 20 next, and that the arrangements and appointments in connection with it shall be similar to those which have proved so eminently satisfactory on former occasions.

IT is calculated that in the six months ended on the 25th of March last, copper, tin, lead, and other minerals were raised in Cornwall and Devon of the value of £637,028, and in the six months ended the 29th of September, £715,292. In the corresponding periods of 1868, the values were £553,652 and £581,200. The increase shown in the half-year ended September last is in the returns of tin and lead, the production of copper showing a serious decline.

YESTERDAY week there was an explosion of gunpowder at the Roslin powder-mills, Scotland, belonging to Messrs. Merricks and Co. The explosion occurred in a drying-room, which contained about 18cwt. of loose powder. The building was blown to pieces, and the roofs of several of the adjacent houses connected with the mills were much damaged. The report of the explosion was heard a distance of several miles. One man was slightly injured.

THE number of visitors to the South Kensington Museum during the week ending December 11, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 9,748; Meyrick and other galleries, 1,132; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,843; Meyrick and other galleries, 68; total, 12,791. Average of corresponding week in former years, 8,427. Total from opening of Museum, 8,993,807.

A CORRESPONDENT of the "Inverness Courier" writes:—Kildonan gold is all the rage this year, but we have good reason to believe that Abernethy gold will be in equal request next year. That some trace of the precious metal has been found very recently within the limits of this parish is beyond a doubt. The exact locality is not as yet given out by the discoverer, but we have every confidence in the party who made this discovery as one capable of judging of the possibility of gold being found.

THE fine collection of the late M. Lacaze has just become the property of the French nation, and now another well-known collector, M. Duclos, is about to present to the famous gallery one hundred of the best pictures in his collection. Already the whole of the new rooms of the Louvre are occupied, and great changes have to be made to afford space for the Lacaze Gallery; but the completion of the great gallery, and the removal of the Salle des Etats will soon furnish more space, which, however, will soon be filled.

THE following is a return of the quantity of coal exported from Grimsby during November, 1869:—To Belgium, 717 tons; Denmark, 342; Egypt, 918; France, 6,006; Hanseatic towns, 1,290; Holland, 547; India—British possessions, 686; Danish West India Islands, 186; Mecklenburg, 511; Norway, 1,594; Italy, 1,793; Prussia, 877; Spain, 761; Sweden, 2,259; Russia, 124; Turkey, 442; total, 19,053; coastwise, 3,179; total, 22,232 tons. Corresponding period, 1868, 20,049; coastwise, 3,502; total, 23,551. Decrease, 1,319 tons.

YESTERDAY week, at Stonehaven, on the Caledonian Railway, the boiler of a pilot engine attached to a goods train burst. The engine was blown to fragments, volumes of scalding water were thrown in every direction to a considerable distance; a large part of the line on which the engine had stood was blown away, and a hole of considerable depth made. One of the driving wheels was carried to a green about 50 yards from Stonehaven, while the sand box was thrown into a field about 100 yards off. The driver escaped with slight injury.

THE Lemberg-Czernowitz-Jassy Railway Company have notified the opening of another portion of the line from Suczawa to Roman, the first section to Moldavia, thus shortening the approach to the Black Sea by 108 kilometres, without taking into account the Paskain-Jassy line, which the company expect likewise to complete by the end of this year simultaneously with the Russian works from Tiraspol (Bender) to Kischeneff. The approaches to the ports of the Black Sea (Odessa) will then, it is stated, be from Jassy to the Pruth 17, and thence to Kischeneff 107, total 124 kilometres, thereby connecting the Black Sea with the Baltic in one direct route, *via* the Lemberg-Czernowitz-Jassy line.

ACCORDING to official statistics, 858 accidents occurred on Prussian railways in 1867. The train ran off the rails 206 times, there were 68 collisions, 432 times the carriages or engine were injured, nine persons travelling on the train were killed, and 21 in other ways, while 68 were more or less seriously injured. The causes of the accidents were as follows:—124 arose from the state of the atmosphere (snow, fog, wind, &c.), 25 from accidental obstacles on the line, 4 from obstacles intentionally placed there, 11 from the carelessness of officials, 60 from the mistakes of engine-drivers, and 41 from the bad state of the line. The rest were the results of faults in the locomotives, carriages, &c., or of undiscovered causes.

AT a meeting of the Royal Botanic Society, held at the Gardens last Saturday, Mr. James Heywood in the chair, a letter was read from H.S.H. the Prince of Teck, president of the Society, nominating the following members of the council to be vice-presidents during the ensuing year:—The Duke of Buckingham and Chandos, K.G., Marquis of Bristol, Lord Calthorpe, Lord Chesham, Lord Tredegar, Lord Alfred Hervey, Bishop of Oxford, Sir W. Stirling, Bart., the Right Hon. Sir William Hutt, K.C.B., Charles Robert Turner, Esq. Seven new fellows were added to the Society, and the chairman read a list of dates as fixed for the exhibitions and fetes, promenades, lectures, and other meetings for the next season.

THE often-sought-for site of the Roman city of Trajanopolis has recently, it is said, been discovered. The remains have been found in an extensive marshy district near Enos, a league and a half from Dymes, at the mouth of the Hebrus. To the unhealthy nature of this region is attributed the fact that the ruins of such a large city have remained so long undiscovered, few travellers caring to incur the risk of catching a fever or ague by traversing it. That these are really the ruins of Trajanopolis is supposed to be proved by an inscription found on a stone built into a monument erected by the Romans, and on their situation being in exact accordance with the position assigned to the city in ancient books of travel.

THE value of our exports to the Australasian group of colonies has experienced a considerable increase this year, having been £8,649,983 for the eight months ending August 31, as compared with £7,294,843 in the corresponding period of 1868, and £5,850,875 in the corresponding period of 1867. Every one of the seven Australasian colonies has been a larger consumer of our goods and products this

year—a very gratifying circumstance. Annexed is the value of the exports made to each of the seven colonies to August 31 this year:—Western Australia, £81,046; South Australia, £946,120; Victoria, £4,002,835; New South Wales, £2,147,419; Queensland, £263,306; Tasmania, £179,862; and New Zealand, £1,029,395.

THE following is a method given by M. Weiszkopf of producing upon iron a durable black shining varnish:—Take oil of turpentine, add to it, drop by drop and while stirring, strong sulphuric acid until a syrupy precipitate is quite formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed with water, every time refreshed after a good stirring, until the water does not exhibit any more acid reaction on being tested with blue litmus paper. The precipitate is next brought upon a cloth filter, and, after all the water has run off, the syrupy mass is fit for use. This thickish magma is painted over the iron with a brush; if it happens to be too stiff, it is previously diluted with some oil of turpentine. Immediately after the iron has been so painted, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed over with a piece of woollen stuff dipped in and moistened with linseed oil. According to the author, this varnish is not a simple covering of the surface, but it is chemically combined with the metal, and does not, therefore, wear off or peel off, as other paints and varnishes do, from iron.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1628, 1646

BUILDINGS AND BUILDING MATERIALS—1588, 1603, 1612, 1622, 1623, 1636

CHEMISTRY AND PHOTOGRAPHY—1638

CULTIVATION OF THE SOIL, including agricultural implements and machines—1575, 1634

ELECTRICAL APPARATUS—1600, 1627

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1580, 1591, 1635, 1644

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.

FURNITURE AND APPAREL, including household utensils time-keepers, jewellery, musical instruments, &c.—1571, 1574, 1583, 1597, 1610, 1619

GENERAL MACHINERY—1594, 1602, 1604, 1609, 1615, 1616, 1647

LIGHTING, HEATING, AND VENTILATING—1572

METALS, including apparatus for their manufacture—1573, 1575, 1577, 1582, 1586, 1593, 1626, 1641

MISCELLANEOUS.—1576, 1579, 1585, 1589, 1592, 1595, 1599, 1605, 1611, 1620, 1629, 1630, 1631, 1632, 1637, 1642

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1581, 1584, 1590, 1601, 1607, 1608, 1618, 1625, 1639, 1640, 1643, 1649, 1650

SHIPS AND BOATS, including their fittings—1587, 1624, 1648

STEAM ENGINES—1596, 1598, 1606, 1614, 1621, 1645

WARFARE—1613, 1633

1571 E. H. PULBROOK, Tooting. *Organs.* Dated May 21, 1869.

Hitherto in organs where the keys are placed at some distance from the instrument motion has been communicated to the pallets from the keys by means of levers or rods, known as trackers, or by electricity. Now, according to this invention, the inventor connects the pneumatic apparatus at or near the keys with the pneumatic apparatus in the instrument and in connection with the pallets by means of a tube or tubes.—Patent completed.

1572 W. H. DUPRE, Jersey. *Light and ventilation.* Dated May, 21 1869.

This consists, first, in simplifying the form and construction of roof lights, having for its object a more effectual method of inserting the glass within the valve frame, through the medium of a rabbet or slider fitted with a hinged beading in which the glass is enclosed, and protected on all sides in conjunction with square or round corners forming the base or bottom plate to the roof lights. Second, in the employment and mode of opening and closing pane ventilators by means of sash weights and cords applied thereto, by which it is opened and shut as required, and fitted with wire gauze at the top of same for the exclusion of dust, insects, or otherwise.—Patent completed.

1573 A. MUNRO, Arbroath, and W. B. ADAMSON, Glasgow. *Treating metallic substances.* Dated May 21, 1869.

This consists in casting the metals or their alloys or articles composed thereof into chills of the required shape and dimensions. The metals or their alloys, or articles composed thereof, are by the chill rendered very dense, hard, and brittle, and the present invention consists in placing the substances or articles composed thereof in open or closed vessels or boxes containing carbonaceous matter, the vessels or boxes so filled being submitted for a variable length of time to heat in a closed or open furnace, retort, kiln, or oven, or in place of using carbonaceous matter alone, other substances, such as calcareous matter, may be admixed with it.—Patent completed.

1574 J. PLATT, Birmingham. *Brooms and brushes.* Dated May 21, 1869.

In preparing the knots or bunches of the brushing material for securing into the stocks or backs of brooms or brushes, the inventor cuts the brushing material into suitable lengths, and ties such lengths in the middle; the lengths so held are then doubled or bent up. The inventor takes a stock, back, or board, whether flat, bevelled, round, oval, or other required outline, and formed of wood, metal, ivory bone, shell, composition, or other suitable material, and drills or bores to a requisite depth upon the brush surface a number of round or other shaped holes in the ordinary manner. These may be arranged in straight rows at angles to each other, or in a suitable pattern for receiving the knots or bunches of the material to form the broom or brush.—Patent completed.

1575 C. W. SIEMENS, Great George-street, Westminster. *Calcining and smelting ores.* Dated May 21, 1869.

This consists chiefly in effecting the calcination of metallic ores, and also the burning of such substances as cement, lime, or plaster of Paris, on a drum or cylinder of iron, lined with hollow firebrick, forming longitudinal channels, which is mounted upon rollers and is made to rotate round its horizontal axis.—Patent completed.

1576 A. M. CLARK, Chancery-lane. *Opening eggs.* (A communication.) Dated May 21, 1869.

This apparatus consists essentially of a cutter having a circular motion which embraces and makes a circular incision round the end of the egg which is required to be removed.—Patent abandoned.

1577 W. R. LAKE, Southampton-buildings. *Shearing and punching metal.* (A communication.) Dated May 21, 1869.

This relates mainly to a peculiar combination of levers, which are adapted to effect the operations of shearing, punching, and bending iron and other metals, shrinking and stretching tyres, and "gumming" or cutting between the teeth of saws. In this machine the levers are arranged in combination with a cam, and all of the parts are mounted upon a strong frame.—Patent completed.

1578 C. J. FOSTER, Maldon. *Reaping and mowing machines.* Dated May 21, 1869.

In order to produce the reciprocating motion of the cutter bar the internal periphery of the motor wheel is provided with a flange consisting of a continuous zigzag with curvilinear bearing surfaces. This flange is to be cast in one with the rim and spokes, and, consequently, the wheel is immensely strengthened, and rendered capable of sustaining sudden strains without risk of fracture.—Patent completed.

1579 N. LAWRENCE, Great Prescott-street, Goodman's-fields. *Lighting cigars.* Dated May 21, 1869.

The lighting end of a cigar is to be dipped into a fusee composition, specially prepared of gum arabic, 20 parts; chlorate of potash, 10 parts; nitric, 40 parts; charcoal, 20 parts; and cascarita, 16 parts. When dry, the inventor dips the cigar a second time into a safety composition, consisting of gum or glue, 3 parts; chlorate of potash, 10 parts; powdered glass, 1 part; and antimony, 1 part. Safety friction is composed of gum, 1 part; and amorphous phosphorus, 2 parts; which is placed on a paper or label, and wrapped round the cigar. The label is easily removed by slipping it off, and by bringing the friction, which is placed on the label, in contact with the dipped end of the cigar, the latter is ignited.—Patent abandoned.

1580 J. HUDSON and C. CATLOW, Burnley. *Looms.* Dated May 21, 1869.

The inventors place on the shaft of the emery roller a boss having two arms extending therefrom. Supported by the arm nearest the sley is a tension bar or roller; to the other arm is attached a link or spring extending to the shaft of the cloth roller and resting on the ordinary weight lever. The cloth passes over the breast beam, over the emery roller, and over the extension bar or roller to the cloth beam. The cloth passing over or from the emery roller to and over the tension bar or roller (placed nearest the sley as described) has a tendency to bind the emery and cloth rollers together, stretching the cloth and winding the cloth hard or tight on the beam.—Patent completed.

1581 W. MORRIS, South Hackney. *Connecting railway rails.* Dated May 21, 1869.

The inventor connects and secures the ends of rails together, simply by fitting to the sides of such rails at the end parts thereof fishes, or securing pieces formed so that they shall fit into the web of the rail, that is, between the enlarged parts, such fishes or securing pieces having grooves formed in them for the purpose of fitting into corresponding dovetail projections on the sides or web of the rail at the end part thereof, and when this fitting is effected on both sides of the rail, the same will be thereby secured without the aid of screw bolts and nuts.—Patent completed.

1582 H. R. LUMLEY, Marlborough-place, N.W. *Treating crude iron.* Dated May 22, 1869.

When melted, the inventor causes iron to be run into a converting vessel, so prepared that the molten metal may fall through suitable apertures, and from a sufficient height, in the form of a shower of minutely subdivided streams or particles, through an upward current of cold or heated air. The iron is then taken from the vessel suitably prepared to receive it, and is hammered or otherwise treated according to the ordinary methods used in preparing malleable iron and steel.—Patent abandoned.

1583 R. ORLEY, Axminster. *Invalid bedsteads.* Dated May 22, 1869.

This consists in fitting and supporting a false sacking or bottom, or the frame in which the sacking or bottom is connected, by means of cords to the four posts of the bedstead. The cords pass over pulleys, and lead to a transverse shaft or roller placed under the bedstead. This shaft or roller is actuated by a bevel or a worm and pinion arrangement, worked by a crank handle or otherwise at the foot, head, or side of the bedstead. A catch or other appliance may be fitted to hold the false sacking at any required height. By detaching the cords at the head or at the foot, any inclination can be given to the false bottom.—Patent completed.

1584 J. LOCKWOOD, Leeds. *Railway couplings.* Dated May 22, 1869.

This consists in applying to the draw bar, or in constructing them with, catches or hooks capable of taking into each other in a lateral or sidewise direction, the slot holes in the framework of the engine, carriage, or waggon being made so as to allow for lateral deflection or motion of the draw bar. These catches or hooks are made of sufficient breadth or depth to provide for the difference in height of the draw bars of different carriages from the rails.—Patent abandoned.

1585 E. T. HUGHES, Chancery-lane. *Horseshoe nails* (A communication.) Dated May 22, 1869.

A bar of iron, the size of the nail head, is passed through a pair of rollers which reduce it at certain places to form a blank of the proper size for the subsequent operations of making the nails.—Patent completed.

1586 G. T. BOUSFIELD, Brixton. *Casting iron.* (A communication.) Dated May 22, 1869.

This consists in the combination of a spout for delivering the molten iron with a series of removable box moulds, by means of a traversing mechanism, consisting of a revolving table or chain, or some equivalent or substitute therefor, which operates to traverse the series of box moulds in succession beneath the spout, so that each box mould in succession can receive a portion of the molten iron. When the box moulds are filled, each may be removed separately and successively by a crane and reversed, so as to drop out its contents, and may then be immediately replaced by the crane in its position upon the traversing mechanism.—Patent completed.

1587 J. H. DAVIS, Cape Town. *Ships' compasses.* Dated May 22, 1869.

The compass bowl is made of an oval form, and is mounted on gimbals; in the bowl two floats are placed. They are floated on water or other liquid, and are kept in their places by central pivots, or the pivots may form the entire support. The two floats are geared together by means of teeth or otherwise, in such manner that they turn simultaneously but in opposite directions. On one of the floats a number of magnetic bars are fixed parallel the one to the other.—Patent abandoned.

1588 M. TILDESLEY, Willenhall. *Sash pulleys.* Dated May 22, 1869.

The inventor casts the pulley frame for receiving the bowl in two counterparts or halves, that is to say, one of the side cheeks and half of the width of the face plate to each casting. Upon one of these castings are formed the pins or rivets for securing the two parts together, and in the other casting are formed the pin or rivet holes, while in the cheeks are cast the bosses, countersinkings, or holes for the axle of the pulley bowl to work in.—Patent abandoned.

1589 S. THOMAS, jun., Redditch. *Needle wrappers.* Dated May 22, 1869.

The inventor cuts or stamps out of paper or other suitable material the form shown in the drawings annexed to the specification filed. The flap part of this is then folded up; the needles which are to be wrapped up in the envelope, having been stuck in the usual manner upon cloth or other suitable material, are placed upon the part, and the flap or tail piece folded down over the loose end of the cloth upon which the needles are stuck, so as to prevent their displacement, and to keep them in one position in the wrapper: the part having in it the slit is then folded down upon the needles, and a second part folded down upon a third, the tongue or tuck being inserted in the slit.—Patent completed.

1590 W. H. BLISS, Bayswater. *Velocipedes.* Dated May 22, 1869.

Three wheels are employed in combination with curved or other suitably formed springs, which are mounted upon the axle of the two hind wheels, such spring or springs being combined with a central spring attached to the longitudinal beam or body of the velocipede in front.—Patent abandoned.

1591 L. J. CROSSLEY and R. HANSON, of Halifax. *Steaming yarns.* Dated May 22, 1869.

In order to prevent the various colours applied to the yarns from spreading or running into each other, by reason of the water or moisture arising from the condensed steam settling upon the yarns, the latter are placed in a chamber to which steam is admitted, and which is surrounded by a jacket containing steam of a somewhat higher pressure and consequently hotter. Another important advantage of the jacketed chamber is that the steam used in the setting process is greatly economised, as the inventors are able to reduce the size of the chamber by dispensing with the sloping or angular roofs heretofore used in steam chambers, and which were designed to prevent the condensed steam which gathered within on the under side of the roofs from dropping on to the yarns.—Patent completed.

1592 W. FURNESS, New-street, E.C. *Fastening for belts* Dated May 24, 1869.

The clip or fastening consists of two metal jaws hinged together in any suitable manner, each jaw being provided on its internal or biting edge with a series of serrated teeth or other gripping edges. The opposite side of each jaw is curved or otherwise bevelled off to suit the curvilinear line of the belt or strap on which it is intended to bear.—Patent completed.

1593 W. MITCHELL, Manchester. *Grinding metallic articles.* Dated May 24, 1869.

This consists in applying to the periphery of a revolving disc made of metal, wood, or other suitable material, a continuous stream of sand and water, which is contained in a vessel or receptacle, from which it is caused to flow through an opening or valve during the time the disc is revolving, the valve being closed and the flow of sand and water cut off during the time the disc is not in motion.—Patent completed.

1594 B. F. WEATHERDON, Chancery-lane, *Reacting turbine wheel.* (A communication.) Dated May 24, 1869.

This consists in employing (in connection with the Scotch system of turbines) an outer wheel or case mounted upon the same axis, so as to receive the repellent action of the water issuing from the discharging orifices thereof, and cause the same to turn in a contrary direction to the turbine, and communicate motion and power thereto through the medium of a tooth and pinion and shifting slide-valve gear.—Patent completed.

1595 W. A. GILBEE, South-street, Finsbury. *Ice houses.* (A communication.) Dated May 24, 1869.

The inventor constructs an ice house with a close ice chamber, from which the external atmosphere is excluded. The devices he employs for abstracting and removing the sensible heat and moisture of the internal atmosphere of a close ice chamber mechanically consist of a corrugated sheet metal ceiling and wooden gutters suspended under it, constructed with discharge pipes.—Patent completed.

1596 M. H. DE GOESBRIAND, Paris. *Steam motors.* Dated May 24, 1869.

This machine may be compared to a turbine moved by steam in lieu of water, the motor being enclosed within the condenser. Two pumps serve for injection and extraction, the extraction pump is worked by the same crank as the injection pump, and like it is a suction and force pump. It sends the condensed steam directly into the boiler.—Patent completed.

1597 E. T. HUGHES, Chancery-lane. *Manufacture of brushes.* (A communication.) Dated May 24, 1869.

First, the table of the machine is arranged upon a universal joint on the spindle or bracket so as to be adjusted to present the brush back to the bit or tufting apparatus. Second, the holder of the machine is perforated or indented, according to the design of the brush to be produced, so as to be adjusted upon the point on the table.—Patent completed.

1598 G. SALT, Saltaire, York, and W. INGLIS, Bolten. *Steam engine governors.* Dated May 24, 1869.

A weight is applied by means of a bell crank lever directly to the rod, by which the action of the governor is transmitted to the lever of the cut off gear. The rod is connected by a coupling piece to the bell-crank lever of the governor. This coupling piece is fitted with a pair of clips, whilst the end of the rod is fitted with a disengaging toe, lever, or trigger, like the valve rods of a small kind of liberating valve gear. The trigger is connected by a link to a lever, which is adjustable by hand, the parts being shown in the positions in which they are when ready to act. Then should the rotation of the governor cease from any cause, the consequent descent of the balls will first cause the rod to be moved over towards the cylinder, which will be in the direction corresponding to an increased supply of steam, but this action will be only momentary, as on the rod being moved a certain distance, the trigger will effect the disengagement of the two parts of the rod, and the weighted lever will immediately move the part away from the cylinder, and thereby adjust the valve gear so as admit no steam.—Patent completed.

1599 A. BARCLAY, Kilmarnock. *Injecting and ejecting liquids.* Dated May 24, 1869.

This consists in using a more numerous series of nozzles than have hitherto been employed in injectors or ejector condensers, and in constituting them a compound nozzle. The invention also consists in placing a stopcock or valve in the passage connecting two of the branches or passages in the instruments or apparatus constituting the injectors, ejectors, or ejector-condensers, so that the branches may be put in communication with each other or their communication cut off.—Patent completed.

1600 J. BRITTAIN, Bowling Green-lane. *Telegraphic instruments.* Dated May 24, 1869.

The inventor inserts in an inking trough a wheel, the periphery of which, by preference, he notches that it may the better, while being rotated, lift the ink, and present to the pen or marker a continuous supply.—Patent completed.

1601 R. RICHARDSON, Great George-street. *Velocipedes.* Dated May 25, 1869.

The inventor places the wheels one behind the other, but not in the same plane, and arranges the seat or seats so that the load, instead of having to be balanced unstably upon the one line in which the wheels as at present arranged touch the ground, is supported upon and between the parallel lines in which the wheels run.—Patent abandoned.

1602 J. DICK, Coatbridge. *Rolls for rolling mills.* Dated May 25, 1869.

This consists in forming such rolls hollow, in place of solid as hitherto, so that the rolls may be kept cool by allowing water or other liquid or fluid to flow through them.—Patent completed.

1603 J. H. JOHNSON, Lincoln's Inn-fields. *Imitation of wood.* Dated May 25, 1869.

The inventors takes any kind of fibrous vegetable, animal, or even mineral matter, such for instance as flock paper, leather chips, or asbestos, and reduces the same to a very fine state, so that the particles can be intimately and thoroughly mixed with a pulverised cementing or agglutinizing substance. This cement he thorougly intermixes with the fibrous substance, both being in as dry a state as possible.—Patent abandoned.

1604 J. TROTMAN, Painswick. *Fastenings for driving bands.* Dated May 25, 1869.

This consists in uniting the ends of machine driving bands or straps by means of two plates of metal screwed together with the ends of the strap between them.—Patent abandoned.

1605 W. JONES and T. SHEFFIELD, Manchester. *Drawing instruments.* Dated May 25, 1869.

This consists in providing the straight edge or rule to be employed as a guide for the form of line required with a groove or channel running parallel to and near the straight or curvilinear edge of the rule or guiding piece.—Patent abandoned.

1606 F. T. BLAKE, Boulogne. *Motive power.* Dated May 25, 1869.

This consists in the combination with a series of gravitating weights sliding along arms or radial guides, in a rotary wheel or disc, mounted on a shaft of a stationary guiding surface, which acts upon the weights in such a manner as to move outwards from the centre of the revolving wheel or disc, a sufficient number of the sliding weights to overcome the counteracting gravity and leverage of the remaining weights, which latter are simultaneously moved inwards towards the centre again by another portion of the same guiding surface.—Patent abandoned.

1607 G. H. HOARE, Southampton-row, W.C. *Velocipedes.* Dated May 25, 1869.

Instead of placing the wheels of bicyles in a line one before the other, the inventor places one wheel at a little distance on one side and the other at a little distance on the other side of the central line, by which means a bicycle or velocipede is enabled to stand by itself without any other support. The two wheels are connected together by a light iron or steel bar or frame, having fixed thereto a spring seat, or saddle, as usual, and instead of driving by means of cranks or treadles fixed directly to the front wheel, the inventor mounts the cranks or treadles upon a grooved wheel, placed intermediate of the bearing wheels, motion being communicated to one of such wheels by a gut or band passing around the grooved wheel.—Patent abandoned.

1608 A. M'NEILE and J. SLATER, John-street, Pentonville. *Carriage wheels.* Dated May 25, 1869.

This relates more particularly to cast or wrought iron axle boxes or naves. One of the principal objects of the invention is to so construct the felloes of wheels that should a part of the felloe of one or more of the spokes become damaged, such damaged part or parts may be removed and repaired, or new parts substituted, with greater facility than can be done with wheels of the ordinary construction, and without the necessity of removing the whole or greater part of the felloe.—Patent completed.

1609 L. ROMAN, Paris. *Hydraulic motive power.* Dated May 25, 1869.

The apparatus consists in two or more endless chains provided with curved or straight paddles, which latter are kept perpendicular and parallel to each other at suitable distances apart, so as to form an endless chain of paddles, which is carried over two or more octagonal drums, wheels, or pulleys, the axes of which are situate parallel to the level of the water, and revolve in vertical standards provided in boats or suitable movable or fixed supports. The endless chain is laid in the direction of the current, and kept at such a height that the paddles of the lower portion of the chain are immersed perpendicularly in the water, whilst the remainder of them are out of this latter; the current in acting on the immersed paddles will carry them forward, and thus cause the revolution of the endless chain, and also the revolution of the wheels, drums, or pulleys, over which this latter is carried, which motion may further be transmitted by any suitable mechanical means to and serve as a motive power for driving machinery or other similar purposes requiring a cheap and efficient motive power.—Patent completed.

1610 R. WHEBLE, Cockspur-street. *Hats.* Dated May 25, 1869.

This consists in the application to the ordinary brim or border of the hat or to the hat body of a supplementary or movable brim of any size or form required, such brim being attached to the ordinary brim or to the body of the hat by any suitable fastenings capable of being adjusted and removed, according to the brim required to be applied and worn.—Patent completed.

1611 R. SCHOMBURG, Fleet-street. *Tobacco ash receiver.* Dated May 25, 1869.

This consists of an apparatus for receiving and discharging cigar and tobacco ashes in railway and other carriages, which consists of a trough turning upon centres in a suitable framework to be attached to the carriage. This framework is open on the top and on one side, the ends and back and the bottom forming the closed casing. The trough receives the ashes, and by turning a button or other contrivance at one end the trough discharges its contents on the outside, and after doing so resumes its former position.—Patent abandoned.

1612 M. BENSON, Southampton-buildings. *Glass cutting tools.* (A communication.) Dated May 26, 1869.

This consists of a tool composed of a disc and made to revolve on its axis as it is passed or drawn over the surface to be fractured or cut.—Patent completed.

1613 W. PALLISER, Pall Mall. *Vents and screw nuts for ordnance.* Dated May 26, 1869.

This consists in making the lower end of the vent separate from the upper part, and composed, by preference, either of platinum or of an alloy of platinum and iridium, which separate lower portion the inventor screws in from the inside of the gun, making it fit with a countersunk head into a corresponding recess in the gun; the upper end of this lower portion of the vent fits into the recessed end of the upper part of the vent, which is screwed in from the outside, and is formed either entirely of copper or of steel or iron with a lining of copper screwed in from the lower end. The improvements in screw nuts or collars for securing the tube or lining of the patentee's converted or compound guns consists in forming the bearing surfaces either of the screw thread or of the nut or collar with such an incline that, in being screwed up, they shall exercise a wedging action sufficient to prevent the nut or collar from unscrewing through the jarring effect produced by firing, and at the same time to produce an accurate and tight fit between the tube, the nut, and the casing, and thus neutralise the effect of vibration, which is apt to crack the tube if loose in the muzzle of the gun.—Patent completed.

1614 H. D. M'MASTER and A. DALE, Gilford, Ireland. *Engine governors.* Dated May 26, 1869.

This consists in the use of a force pump of any suitable construction in connection with a cylinder and ram for regulating the motion of steam engines.—Patent completed.

1615 T. VAUGHAN and E. WATTEEU, Middlesborough-on-Tees. *Nutting screw bolts.* Dated May 26, 1869.

The inventors arrange two vertical opposite discs a certain distance apart, but connected together in an adjustable manner so as to regulate their distance apart to the length of the bolts to be nutted, for which purpose a central cylinder in the one disc fits into a central recess in the other, which cylinder is capable of being made to slide in the recess by means of an adjusting screw. The disc having the recess is of considerable depth, and is made to revolve slowly in bearings formed in a fixed framing carrying with it the second disc, rotary motion being imparted by a spur pinion in gear with a spur rim fixed to the first disc, and receiving motion through speed reducing gearing from a driving shaft carrying a fast and loose pulley.—Patent completed.

1616 W. TATHAM, Rochdale. *Doffing the sliver from carding engines.* Dated May 26, 1869.

The inventor places a fan, revolving at a moderate velocity, directly over the doffer or other cylinder, of the width of the cylinder, and blows the material from it in a dispersed condition, and collects it either as and for the purpose stated in the provisional specification of a patent for which protection was granted to him on January 8, 1869 (No. 57), or he blows it against a travelling creeper, moving at such rate as to be thereby conveyed in sliver form to delivering rollers in the usual manner.—Patent abandoned.

1618 J. D. BRUNTON, Leighton-crescent, N.W. *Tunnelling.* Dated May 26, 1869.

The inventor substitutes for the revolving discs or for the sectors having bevelled cutting edges, a row or rows of cutting tools of a chisel form, and he acts upon these chisels by rollers or rotating discs, so as to cause them to chip pieces off the rock or stone. The chisels may be so placed or arranged side by side in a row or rows as that their edges shall form a circle either concave or convex, or so that their edges shall form a straight line or any other figure that may be desired.—Patent completed.

1619 C. F. CHEW, George-street, N.W. *Pianofortes.* Dated May 26, 1869.

This consists in the use of a pin formed with a collar. This pin passes through a hole in a metal plate, and has a screw formed on its lower part to receive a nut, between which and the metal plate the inventor places a washer of leather or other available material, as well as an iron washer, and when the string is drawn to the desired pitch by the turning round of the pin the nut is then screwed up, and thus keeps the pin from removing, and retains the tension on the string, whereby the instrument keeps in tune for a much longer time.—Patent completed.

1620 J. J. FIELD, Highgate. *Microscopic apparatus.* Dated May 26, 1869.

This consists in a frame (which fits below the object stage) and carries a Nichol's prism (or other polarizer) at the lower, and a certain number of thin plates or films of selenite at the upper part of the apparatus. The selenite films or plates are arranged in cells of different diameters, which cells admit of rotation, and are toothed around their circumference, and they gear into toothed wheels (also of variable size) fixed on an upright pillar near the side of the apparatus. The pillar wheels (which may be called the drivers) are so attached that they can only move in unison, and thus when the drivers are moved they cause the selenite frames to rotate with different velocities, but always in fixed ratios.—Patent abandoned.

1621 C. HANSON, Huddersfield, and J. BOTTOMLEY, Kirkgate. *Motive power.* Dated May 26, 1869.

The inventor fixes a driving wheel with faced sides on a shaft. On one side of this wheel they fit a solid ratchet and spur wheel, in the last of which they make a rack, toothed, to fit the wheel to work in a parallel motion. On the driving wheel they fix a click, which is kept to the ratchet wheel by means of a spring, this click fitting the ratchet wheel teeth.—Patent completed.

1622 J. CRANSTON, Birmingham. *Glass houses.* Dated May 26, 1869.

In erections of this description of the ordinary kind there must of necessity be a certain amount of waste room or shallow space near to the floor along the sides or ends which cannot be utilised. By this invention the inventor proposes to form these parts into forcing pits, opening from the outside of the building and divided off from the main structure by suitable means, such, for instance, as stepped, shelving, running around or along the sides of the main building to which the forcing pits so formed act as buttresses.—Patent completed.

1623 J. BRIDGES, Ludgate-hill, E.C. *Lever lock.* Dated May 26, 1869.

This is composed chiefly of three metal plates, one of them being the body or dome of the lock, which is raised by a die to a sufficient height to allow the locking or fastening action to slide freely underneath either horizontally or perpendicularly.—Patent abandoned.

1624 G. H. ELLIS, Gracechurch-street. *Boat cleaning machine.* Dated May 26, 1869.

The inventor provides a set of three circular brushes formed upon one stock, and disposes them at a convenient angle on a suitable base or pedestal. The brushes are, by preference, concave upon their surface, and at one end (the highest from the base) he places a sponge or other pad for blocking. At the other end the iron spindle upon which the brushes are mounted goes into and rotates within a socket formed upon the base or pedestal (at the requisite angle) so that the brushes can be drawn in and out at pleasure.—Patent completed.

1625 R. P. WILLIAMS, Great George-street, S.W. *Fishes for railways.* Dated May 26, 1869.

The inventor takes for this purpose a plate of iron or steel of the length of the fish, and he forms in it two longitudinal corrugations adapted to fit to the lower flanges of the rails, one on either side. The plate is then bent along its centre so as to bring the two longitudinal corrugations above mentioned nearly face to face, but allowing room for the bottom flanges of the rails to pass between them. Bolt holes are formed along the two sides of the fish plate beyond the corrugations, and when the fish has been passed over the bottom flanges of the rails as already mentioned, the bolts are inserted through the two sides of the fish, and the web of the rail between them and the bolts being screwed up, draw these parts closely together, and at the same time draw the corrugations together until they adapt themselves closely to the flanges of the rails, the central bend of the fish plate giving the elasticity necessary to allow them to do so.—Patent completed.

1626 F. H. LLOYD, Wednesbury. *Metal tubes.* Dated May 26, 1869.

The inventor first forms a hollow conical ingot by the process of casting, the casting being effected in a mould, the top and bottom of which are closed, with the exception of a hole in each situated axially, and of a size proper to receive a core of cast or wrought iron or steel. The core is a smooth conical bar having sufficient taper to allow of the requisite amount of contraction in the casting. The outside of the mould is made of a conical tube of cast iron, either in one, two, or more parts. The steel is cast through a " gate " or runner at or near the bottom of the mould, and in connection with a second mould or receptacle containing the molten steel from which the gate or runner is fed. After the mould is full the core is released by being driven downwards by a blow from a hammer or otherwise, thus leaving the hollow conical ingot free to contract as it cools. The outer part of the mould is removed from the ingot, and the ingot is reduced in diameter by rolling or forging with or without a mandrel. The hole in the ingot is contracted as the diameter of the ingot is reduced, and allowance is made for this contraction in the size of the core fixed in the axis of the mould. The rolled ingot is sawn into pieces of the required length, and these pieces are then bored.—Patent completed.

1627 E. G. BARTHOLOMEW, Chepstow Villas, Holloway. *Electrical apparatus.* Dated May 26, 1869.
This consists in making use of the tie bars technically called the "stretchers," or of the pieces which perform this function, as conductors of the electric current, and also as supports to which certain portions of the apparatus may be fixed.—Patent abandoned.

1628 L., W., and J. BEESLEY, Dalton-in-Furness, Lancashire. *Boilers.* Dated May 27, 1869.
The invention may be conveniently carried out by attaching or connecting the tapered box to the cross tube usually used in firebox boilers.—Patent abandoned.

1629 J. SNAPE, Aberdare. *Pumps.* Dated May 27, 1869.
This consists in fitting between the plunger or ram and the suction valve, a piston, the rod of which passes downwards through a stuffing box, and has connected to it another piston working in the branch of a bent pipe leading to the out flow and connected by a short connection or valve box to the suction pipe, so that the valves are kept in a state of equilibrium by resting upon columns of water.—Patent completed.

1630 A. EDLMANN, Palmerston-buildings, C.E. *Manufacture of peat.* Dated May 27, 1869.
In converting the peat into charcoal or fuel, the peat, when dug or raised, is placed in a vertical cylinder of suitable size, in which a shaft armed with knives or blades rotates, the cylinder being also provided with similar knives or blades placed laterally, and in passing between or through which the fibre of the peat is thoroughly broken. The bottom of the cylinder is a spiral incline of from 5deg. to 10deg. of pitch, having at the lowest point a porthole or opening through which, in a state of semipulp, the peat passes on to a pair of corrugated, fluted, or toothed rollers on the top of the machine.—Patent completed.

1631 F. S. ANGEL, Hatton Garden. *Advertising tablets.* (A communication.) Dated May 27, 1869.
A sheet of metal is painted or coloured for forming the ground for the design or lettering which may be required; the sheet thus prepared is then placed on lead with the coloured side downwards. It is then stamped or embossed with letters or designs (prepared in hard and suitable metal) which are put together and placed in a frame after the manner of type; the pressure may be produced by hydraulic press or other adequate means.—Patent abandoned.

1632 F. A. BARROW, Glasgow. *Bleaching oils.* Dated May 27, 1869.
This consists in exposing the oil in a shallow and slowly flowing layer or stream to the action of direct sunlight or of diffused daylight.—Patent completed.

1633 D. FOSTER, Sheffield. *Hollow shot.* Dated May 27, 1869.
The inventor so manufactures hollow shot or shell of cast iron that the nose, or that part which is intended to strike and penetrate an object, is chilled, and he so manufactures the other parts of the hollow shot or shell that such parts are not chilled, or are only partially chilled, and have therefore more tenacity and less liability to fracture.—Patent abandoned.

1634 P. WHITESIDE, Fox-street, Liverpool. *Mowing and reaping machines.* (A communication.) Dated May 27, 1869.
The body or main frame consists of a metal tube which extends from wheel to wheel with radial arms to support the gearing, which support prevents trembling and vibration when the machine is in motion. The drive wheels consist of wrought-iron spokes cast in the hub and rim of the wheels, by which means the wheels are lighter and yet stronger than if made all of cast iron.—Patent abandoned.

1635 H. M'E. WARD, Ballymaconaghy, Downshire. *Spinning flax.* Dated May 27, 1869.
The back top feed or retaining roller is divided into separate parts or bosses, one boss for each spindle end or thread. These bosses are mounted loosely on a common shaft so that they may rotate together or independently of each other, in order to allow of any one or more being stopped without affecting the other feeding bosses on the same shaft. Each feeding boss is fitted with a self-acting contrivance for disconnecting it from its shaft whenever the end breaks that it is supplying to the delivery or drawing rollers.—Patent abandoned.

1636 T. BRADFORD, Manchester. *Drying closets and houses.* Dated May 27, 1869.
The inventor constructs an enclosed drying closet of brickwork, sheet iron, or other suitable material, provided with a stove at one or both ends or sides, or underneath in the usual manner, also with a suitable door or doors, and ventilated in the ordinary way or in any other convenient manner. This closet may be made of any required dimensions and of various forms. In the centre or other convenient part thereof the inventor mounts an upright shaft supported by a suitable footstep beneath, and by a top bearing above so that it can revolve, and he attaches thereto either gearing or any other convenient appliance, by means of which it may be caused to revolve either by power or manual labour. To this upright shaft inside the closet he attaches a series of horizontal arms arranged radially one below the other in a spiral form from the top to near the bottom of the shaft in such a manner that when the clothes or other articles to be dried are hung thereon they shall hang clear of the rest.—Patent completed.

1637 O. PLUMB, Commercial-road. *Ratchet brace.* Dated May 28, 1869.
The inventor employs an ordinary handle or lever encircling at one extremity a cylindrical head or centre piece upon the exterior of which is cut a ratchet. Attached to the handle are two pawls taking on to the opposite sides of the said ratchet, and so arranged that by turning a cam either can be thrown out of or into gear with the ratchet, thus allowing the ratchet brace to be worked in either a forward or backward direction. The face of the cylindrical head is provided with an elongated recess for receiving plates or dies with apertures formed therein for the insertion of the butt end of the drill plates with, different sized apertures being used according to the size of the drill to be employed. These plates or dies are prevented from falling out of their places by means of a ring screwed over them on to the face of the cylindrical head or by other suitable means.—Patent abandoned.

1638 H. A. BONNEVILLE, Sackville-street, W. *Carte and portrait box.* (A communication.) Dated May 28, 1869.
This consists of a box with a lid divided into several compartments, of which the size may be increased or decreased by means of movable partitions sliding in grooves in the wall or surface of the sides which form the compartments.—Patent abandoned.

1639 B. T. NEWNHAM, Bath. *Carriages.* Dated May 28, 1869.
The object of the invention is that parts of the carriage may be readily changeable in order to render it capable of carrying a variable number of persons. Supposing the carriage to be a phaeton or four wheel dog cart with front and back seats arranged *dos-a-dos*, the front under part of the body or the "arms" or "body loops" rise high to admit of large fore wheels to turn under them. The front seat, with its back and side rests, and the part for the legs and feet of those who sit there, together with the "dash" leather, is connected to the body by cranked irons or lever arms, so that the part for the feet may at one time rest against and behind the "body loops," when the back of the seat may form also the back rest for those in the back seat. By raising and bringing forward the front seat with the parts attached thereto upon its cranks or lever arms it becomes a driving box raised over the front wheels and the parts which formed the back seat are attached to and fold against the back of the front or box seat.—Patent completed.

1640 J. WILSON, Royal Exchange-buildings. *Wooden railways.* (A communication.) Dated May 28, 1869.
This consists in forming the rail (for the transit of trains, &c.) of blocks of hard wood with the grain on end bolted and fixed by pins to longitudinal bearings in the manner shown in the drawing accompanying the specification. These blocks, when worn, can be replaced easily and quickly. Transverse sleepers are placed at intervals as on the ordinary railroad, and the longitudinals may be either set into these or bolted down on them as required. —Patent completed.

1641 J. WILSON, Royal Exchange-buildings. *Wrought iron.* (A communication.) Dated May 28, 1869.
This consists in making wrought iron from the melted ore as run from the blast furnace. Instead of running the metal into pigs in the ordinary way it is run into ingots, and at the same time a certain quantity of black oxide of sand ore (about 25 per cent.) in a dry state is poured in so that they mix well together.—Patent completed.

1642 J. BRONNER and H. GUTZKOW, Frankfort. *Obtaining anthracen.* Dated May 28, 1869.
In order to obtain anthracen and similar substances out of asphaltos, the inventors distil it in a fitting apparatus, or heat it in an apparatus for sublimation if required by the aid of steam. They convert the anthracen obtained by the above described method, or anthracen otherwise obtained, and those carburetted by hydrogens, which, in their properties, are similar to anthracen, into an oxydized product by means of nitric acid or of bichromate of potassa and acids, for instance, bichromate of potassa and sulphuric acid, or bichromate of potassa and acetic acid, or of acetic acid and nitric acid, or by chlorates; for instance, chlorate of potassa in combination with acics, muriatic acid, for example, or by other substances acting in a similar manner.—Patent completed.

1643 S. and J. PRESTWICH, Farnworth, Lancashire. *Velocipedes.* Dated May 28, 1869.
This consists in forming the wheels for velocipedes with brass, cast, malleable iron, or other metal naves, and with spokes of wood, the metal naves being formed with cavities or holes to receive the spokes, which holes on one side of the nave are arranged midway between the spaces for spokes on the other side, each wheel having two sets of spokes, one set opposite the spaces between the other set.—Patent abandoned.

1644 J. INGHAM and I. BUTTERFIELD, Bradford. *Dressing warps.* Dated May 28, 1869.
This consists in combining and arranging mechanism so that a brush, or a series of brushes, are caused to travel a certain distance upon a slide plate or bed to operate upon the warps, and then drop upon or be transferred to another bed, on which they are returned and again transferred to the first bed, and so on, continuing to travel forward on one bed and back on the other.—Patent completed.

1645 G. J. PEDLEY, Harborne, and H. GRABOWSKI Willenhall. *Motive power.* Dated May 28, 1869.
The object is to produce an improved motive power which may be usefully employed for propelling velocipedes and other such vehicles. It consists substantially in a coiled or helical spring, acted upon by hydraulic pressure, and what is claimed in the combination of the two forces for the purposes.—Patent abandoned.

1646 W. R. LAKE, Southampton-buildings. *Brushes for boiler tubes.* (A communication.) Dated May 28, 1869.
The invention comprises, first, a boiler flue brush, the flexible or brush portion of which is composed of strips or pieces of steel or other metal inserted in the hub. Second, the combination of a metallic-lined tubular hub or base with a steel or metallic brush. Third, the combination with a boiler flue brush of removable end pieces or heads, and a removable centre rod or handle. Fourth, the application to boiler flue brushes of a guard to guide the brush back into the flue after having been pushed through.—Patent completed.

1647 W. R. LAKE, Southampton-buildings. *Bolts and nuts.* (A communication.) Dated May 28, 1869.
The inventor claims in a machine for heading bolts the combination of the dies, acting simultaneously and moved in guides radially to a common centre by means of the levers and cams in combination with the holding dies and the upsetting die, all constructed and arranged to operate substantially in the manner as set forth.—Patent completed.

1648 G. F. GUY, Bury St. Edmunds. *Sheathing for ships.*
The inventor coats all that portion of the ship or vessel which is exposed to the action of the water with zinc amalgamated on its surface with mercury.—Patent abandoned.

1649 T. CLARKE, Ladyfield. *Velocipedes.* Dated May 28, 1869.
The chief feature of the invention consists in placing the weight as far forward as possible in advance of the central line of specific gravity of the driving wheels, at the same time endeavouring to secure a safe and steady balance in descending inclines or passing over inequalities of the ground. Second, the invention consists in the application of a variable reduplicating or multiplying power by means of wheels (either toothed or plain), drums, or pulleys, and a combination of foot and hand power (or foot or hand power separately), and substituting one power for the other at will, according to the nature of the ground travelled over, by which means either a much higher rate of speed than hitherto can be obtained, or an increased tractive power with a diminished speed may be substituted when required.—Patent completed.

1650 B. GARNER, Oldbury. *Axle bearings.* Dated May 28, 1866.
This consists, first, in making the bearings of lignum vitæ or other hard wood, fixed in grooves or depressions in the upper half of the axle box.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated December 7, 1868.

3529 D. Robertson, W. L. G. Wright, and J. More, Glasgow. A new or improved arrangement of apparatus for forcing and projecting liquids and fluids.
3530 S. Lewin, Poole, Dorsetshire. Improvements in elevators for raising and stacking straw, hay, and other similar substances.
3531 H. P. de Meyrignac, Paris, Boulevard de Strasbourg. A tubular apparatus for brushing and wet-rubbing hair.
3532 J. Swift, Ashton-in-the-Willows, near Wigan, Lancashire. Improvements in safety lamps to be used in coal mines, and for other purposes.
3533 G. Dowler, Birmingham, and W. Pursall, Aston, near Birmingham. Improvements in cartridges for breech-loading firearms.
3534 J. Jonas, Fenchurch-street, City. Improvements in means or apparatus for packing and consolidating tea and other substances.
3535 B. J. B. Mills, Southampton-buildings, Chancery-lane. Improvements in means for securing bales of fibrous and other substances.
3536 W. Scott, Hawick, Roxburghshire. Improvements in furnaces.
3537 J. Watson, Montrose, Forfarshire. Improvements in electric telegraph apparatus for continuous printing.
3538 C. Vavin, Boulevard St. Germain, Paris. An improved apparatus for separating metals and magnetic substances from other bodies.
3539 F. A. Harrison, Birmingham. An improved buckle or fastening for braces, belts, and other articles of wearing apparel.
3540 J. Childs, Victoria-street, Westminster. Improvements in the manufacture of bread and biscuits.
3541 J. H. Johnson, Lincoln's Inn-fields. Improvements in crucibles, melting pots, retorts, furnaces, and other articles subjected to an elevated temperature.
3542 C. Wyndham, Southover, near Lewes, Sussex. Improvements in apparatus connected with velocipedes.

Dated December 8, 1869.

3543 E. Edwards, Lincoln-terrace, Willesden-lane. Improvements in photo-mechanical printing, and the reproduction of designs.
3544 J. S. Robertson, Glasgow. Improvements in horse-shoes for frosty or snowy weather.
3545 M. Kolb, Robert-street, N.W. An improvement in screw propellers for the purpose of reducing the slip of the same.
3546 E. Weldon, Sheffield. Improvements in portable apparatus provided with means for carrying and cooking food, for containing and heating liquids, and with appliances for the toilet, and other like purposes.
3547 M. Stell, Hamerton Mill, Leeds-road, Bradford, Yorkshire. Improvements in the trap twisting frame or machinery for twisting or doubling worsted or other fibrous substances.
3548 G. Preston and J. Prestige, Deptford, Kent. Improvements in apparatus for regulating the supply of water to waterclosets and other similar places.
3549 B. F. Stevens, Henrietta-street, Covent-garden. Improvements in the working of glass, and in forming sheets and other articles therefrom.
3550 M. F. Anderson, Priory-row, Coventry, Warwickshire. Improvements in treating sewage, and in the manufacture of manure therefrom.
3551 A. L. Bricknell, Stratford-upon-Avon. Improvements in gates, and in the posts or supports for the same.
3552 A. M. Clark, Chancery-lane. A new or improved mode of ornamenting figured muslin and gauze fabrics.

Dated December 9, 1869.

3553 H. S. Rush, Brockley-terrace, New Cross, Kent. Improvements in railway chairs.
3554 E. Walker, Heckmondwike, Yorkshire. Improvements in gas burners.
3555 W. Johnson, Elms, Sketty, Glamorganshire. An improvement in machinery for pressing wool, cotton, hemp, and other materials.
3556 H. Byk, Leipsic, Saxony. Improvements to refine paraffin and render it white.
3557 W. Tranter, Birmingham. Improvements in firearms.
3558 J. Loader, Upper Clifton-street, Worship-square, and W. H. Child, Worship-street. Improvements in liquid meters.
3559 D. Clayton, Bradford, Yorkshire. Improvements in shuttles.
3560 C. Sipriot, Milan, Italy. An improved apparatus for exhibiting placards, posting bills, and other advertisements.
3561 J. Hamilton and R. Paterson, Glasgow. Improvements in collapsable casks or vessels for containing fermentable and aerated beverages.
3562 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in vices.
3563 J. F. Alexander, New York, U.S.A. Improvements in undulating propellers for steam ships and other vessels.
3564 R. A. Ballou, Massachusetts, U.S.A. Improvements in fire-resisting safes, steam boilers, pipes, or various other articles liable to exposure to heat.
3565 C. A. M'Calla, Northampton-street, Birmingham. Improvements in closing and stoppering bottles, tubes, and other such vessels, and in the means of regulating and measuring the flow of liquids from such vessels.
3566 J. Ballantyne, Tweed Vale Mills, Walkerburn, near Innerleithen, Peebles, North Britain. Improvements in the manufacture of yarns or threads, and in the mechanism employed therefor.

Dated December 10, 1869.

3567 H. Whittaker, Manchester, and W. Bradbury, Prestwich, Manchester. An improved method of connecting the ends of packing hoops or other metal hoops or bands, and for apparatus employed in connection therewith.

3568 H. Kershaw, Laister Dyke, near Bradford, Yorkshire. Improvements in means or apparatus employed when spinning worsted or other fibres.

3569 G. F. Logan, Glasgow. A new or improved means for utilising waste heat and for consuming smoke, which is also applicable for drawing off and consuming noxious gases or vapours.

3570 W. E. Gedge, Wellington-street, Strand. Improvements in velocipedes.

3571 J. Willis, Stockbridge Works, near Sheffield. Improvements in the manufacture of sunshades and umbrellas.

3572 T. S. Sarney, Catharine street, Sheffield. Improvements in the means of fishing or connecting railway rails.

3573 A. M. Clark, Chancery-lane. Improvements in the ornamentation of shell brooches and other articles of this material.

3574 W. Baines, Railway Plant Works, Soho, Smethwick, Staffordshire. Improvements in apparatus for actuating and controlling railway signals and switches, and for working railway turntables.

3575 R. J. Ransome, Ipswich, Suffolk, J. Deas, Glasgow, and R. C. Rapier, Westminster Chambers, Westminster. Improvements in tramways.

3576 W. Yeoman and J. Gilbert, East-street, Walworth. Improvements in shuttle sewing machines.

Dated December 11, 1869.

3577 W. Downing, Sheffield. An improved breech-loading cartridge with lubricating ball.

3578 J. Barnett, Lunar-street, Chelsea. Improvements in fuel for heating and warming, and in non-conducting material.

3579 G. White, Hemingford-road, Islington. Improvements in the apparatus used for steering, controlling, and propelling steam ships and other navigable vessels.

3580 T. Sagar, T. Richmond, and C. Catlow, Barnley, Lancashire. Improvements in looms and healds for weaving.

3581 A. A. Croll, Coleman-street, City. Improvements in the treatment of ammoniacal liquor of gasworks, to obtain therefrom salts of ammonia.

3582 W. E. Newton, Chancery-lane. Improved apparatus for folding printed sheets of paper, and for cutting and folding printed sheets of paper as they issue from the printing machine.

3583 J. T. Parlour, Trinity-terrace, Grosvenor-road, Pimlico. Improvements in machinery, and in the means employed in connection therewith, for raising sunken ships, and other submerged bodies, and for conducting other submarine operations.

3584 E. Simcoe, Harpenden, Wilts. An improved case or portfolio for filing music, and business and other papers.

3585 W. I. Hetherington, Rothesay, Bute, North Britain. Improvements in motive-power engines specially adapted for propelling ships, but which may be employed for other purposes.

3586 T. Moore, Aston, near Birmingham. Certain improvements in knobs for doors, bedsteads, and other purposes.

3587 W. A. Marshall, Canonbury. Improvements in the manufacture of electric telegraph cables, and in apparatus employed therein.

3588 H. and F. C. Cockey, Frome Selwood, Somersetshire. Improvements in steam boilers and in the setting thereof.

3589 W. C. Green, Duck-lane, Edward-street. Improvements in breech-loading firearms.

3590 H. Wilson, Stockton-on-Tees, Durham. Improvements in machinery for cutting timber into laths, strips, flooring, and other boards and pieces, also for cutting metals and other materials.

3591 W. Williams, Mitford-street, Liverpool. Improvements in subaqueous and tunnel communications, such, for instance, as submarine and other railway tunnels, and in generating tidal and hydraulic pneumatic power to be used for such communications and otherwise.

Dated December 13, 1869.

3592 T. Rawsthorne, Preston, Lancashire. Improvements in putting twist into sliver or yarn from the flyer eye to the front rollers of frames for cotton, woollen, or other fibrous substances.

3593 P. Koch, Manchester. Improved machinery for manufacturing untapped nuts intended for screw bolts.

3594 J. and J. Turner, Rochdale, Lancashire. Improved lubricators for steam engines.

3595 H. Watson, Steeton-in-Craven, Yorkshire. Improved means or machinery for smoothing, marking, and oiling bobbins.

3596 G., J., and M. Oldroyd, Spinkwell and Calder Mills, Dewsbury, Yorkshire. Improvements in means or apparatus employed in weaving.

3597 W. R. Lake, Southampton-buildings, Chancery-lane. An improved mode of, and means for, preserving dead human bodies and animal carcases.

3598 J. G. Tongue, Southampton-buildings, Chancery-lane. Improvements in machinery or apparatus for sewing or stitching together the numbers or separate parts of a volume in the operation of bookbinding.

3599 E. A. Cowper, Great George-street, Westminster. Improvements in rotary sieves.

3600 P. C. Evans, Brimscombe Mills, Gloucestershire, and H. J. H. King, Glasgow. Improvements in apparatus for feeding wool, cotton, or other fibrous materials to carding or other machines.

3601 A. Barr, Glasgow. Improvements in apparatus for blowing organs.

3602 W. Asquith, G. Booth, and G. Pickersgill, Halifax. Improvements in machinery to be employed for cutting and boring metals.

3603 H. E. Newton, Chancery-lane. Improvements in net machines.

3604 R. J. Carpenter, Old Broad-street, City. An improvement in the manufacture of iron and steel.

3605 J. Gardner, Bootle, Lancashire. An improved mode of cutting veneers.

3606 R. W. Bernard, Kildare, Ireland. Improvements in candle lamps or imitation candles.

3607 J. Livesey, Victoria Chambers, Westminster. Improvements in street tramways, light permanent way, and temporary railroads.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," December 14, 1869.

2314 J. Sharrocks
2316 W. Hosack
2319 J. Pinchbeck
2320 H. Turner
2334 G. Broadhurst
2340 A. Tylor
2347 E. Cocking
2348 E. Rihoux
2349 J. and A. Garde
2352 C. J. Chubb
2374 S. Osborn
2381 G. F. Ansell
2383 E. A. Curley
2393 J. Caddick
2394 F. Mazet
2401 A. B. Brown
2403 C. and T. Crossley and R. Whipp
2406 F. H. Needham
2408 A. M. Clark
2410 J. F. E. Martin and L. G. E. Guay
24[illegible]4 J. Mackenzie
24[illegible]7 W. S. Sutherland
25[illegible]5 H. A. Bonneville
25[illegible]9 W. R. Lake
25[illegible]9 R. C. Robinson
259[illegible] P. M'Gough
2596 S. H. Greaves
2993 W. Kloen
3126 J. W. More and J. Norman
3144 B. J. B. Mills
3181 J. P. Hawley and E. E. Hill
3224 A. C. Kirk
3234 J. Riley
3254 J. H. Johnson
3260 M. Benson
3270 S. W. Shaw
3284 J. Henderson
3331 S. Mendel
3357 A. B. Childs
3368 J. Bottomley and S. Emsley
3386 J. H. Johnson
3394 J. and B. Dunkerley
3405 J. Nichols
3420 S. Tatton
3421 S. Tatton
3426 A. C. Engert
3430 F. Preston
3458 J. Speight
3509 J. F. Kent
3527 W. R. Lake

LIST OF SEALED PATENTS.

Sealed December 10, 1869.

1810 J. H. Riddell
1816 E. G. Brewer
1818 J. Taylor
1819 W. S. Underhill and J. Smith
1821 J. Young
1834 J. Lindley
1840 J. T. Masbon
1854 E. Cardon
1864 W. M'Nabb
1872 J. G. Tongue
1920 A. M. Clark
2317 F. A. Yeo and H. Hanna
2441 J. Blyde
2539 A. Moncrieff
2813 F. Armstrong
2911 J. F. M. Pollock
2929 J. Frearson
2963 M. Andrew
3003 J. Mackie

Sealed December 14, 1869.

1842 H. Tylor
1849 W. R. Lake
1853 W. Woofe
1855 T. Routledge
1860 W. R. Lake
1866 J. H. Johnson
1867 C. and E. Brightman
1881 T. Silver
2037 W. Bray
2047 R. Mallet
2054 J. H. Johnson
2212 J. H. Johnson
2264 R. Hunt
2784 J. W. Morgan
2976 T. Parry and J. M'Hardy
2995 J. Taft and J. C. Edwards
3048 J. H. Johnson
3054 J. Scharr

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3228 W. Clark
3255 W. Hopkinson
3247 W. F. Smith and A. Coventry
3253 W. E. Newton
3262 R. B. Boyman
3265 S. Chatwood
3273 O. E. Brooman
3288 H. Brinsmead
3292 T. V. Morgan and E. Hyles
3299 G. Bertram
3328 W. R. Lake
3405 W. Clark
3432 G. Payne
3438 G. Shrewsbury
3449 C. F. Fisch

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3281 W. Palliser
3300 G. Jeffries
3384 J. Clayton

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

2733	3350	3415	3426	3437	3450	3460	3470
3016	3357	3417	3427	3438	3451	3461	3471
3197	3366	3418	3428	3439	3452	3462	3473
3247	3381	3419	3429	3440	3453	3463	3475
3275	3403	3420	3430	3443	3454	3464	3477
3291	3405	3421	3432	3444	3455	3465	3479
3302	3407	3422	3433	3447	3457	3466	3481
3321	3409	3423	3434	3448	3458	3467	3483
3335	3411	3424	3435	3449	3459	3468	3485
3348	3413	3425	3436				

LIST OF SPECIFICATIONS PUBLISHED

For the week ending December 11, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1238	1 0	1304	0 8	1337	0 10	1355	0 4	1376	0 4	1395	0 10
1245	1 6	1308	0 10	1342	0 4	1356	0 4	1378	0 4	1397	0 4
1248	0 6	1311	0 4	1343	0 6	1357	0 8	1379	0 4	1398	0 4
1261	0 6	1312	3 0	1344	1 0	1360	1 4	1381	0 4	1404	0 4
1270	0 8	1313	0 8	1346	0 4	1366	0 4	1383	0 4	1406	1 4
1273	1 2	1319	1 0	1347	0 4	1368	0 4	1387	0 4	1510	0 8
1280	0 8	1321	1 0	1348	0 8	1370	0 4	1389	0 4	1546	0 6
1286	0 8	1324	1 0	1349	1 0	1371	0 4	1390	0 4	1825	0 8
1289	0 10	1327	1 0	1350	0 8	1372	1 2	1391	0 4	1890	0 4
1293	1 2	1329	0 8	1354	0 10	1375	0 4	1393	0 4	2434	0 6
1296	0 10	1334	0 8								

NOTICE.—Having received communications from persons residing in the country to the effect that difficulties are occasionally experienced by them in obtaining copies of printed specification from the Patent Office, in consequence of the varying nature of the postage thereon, our readers are informed that upon receipt from them of particulars of the specifications they require, together with a remittance for the cost and approximate postage thereof, we shall be happy to procure and forward such specifications free of all further charge. Sums under Five Shillings may be remitted in postage stamps, for sums above that amount a Post Office Money Order should be sent, payable to ROBERTSON, BROOMAN, and CO., Patent Department. 166, Fleet-street, London, E.C., to whom all communications upon the subject should be addressed.

THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, DECEMBER 24, 1869.

THE CONDITION OF BARKING.

THERE are some people who, although they are continually making blunders and committing mistakes, yet never seem to meet with that punishment which their conduct unquestionably merits. Although constantly "coming to grief" they never appear a bit the worse for it. The fact is that these people have a happy knack, happy for themselves at least, of shifting the blame of their offences and misdemeanours on the shoulders of their neighbours. They can always find a scapegoat, and when found, the unfortunate animal pays dearly for the discovery. Undoubtedly, in this world the innocent suffer for the guilty, and their suffering is caused a great deal more frequently by design than by accident. It will be remembered that early in the autumn of the present year the inhabitants of Barking petitioned Government respecting certain nuisances existing in that neighbourhood. These nuisances the petitioners alleged were caused wholly and solely by the discharge of the sewage of the northern part of London into the Thames near the Creek of Barking. The party answerable for the discharge of the sewage is the Metropolitan Boards of Works, and, consequently, the real point arrived at, was to obtain an injunction against that body to restrain them from continuing their operations. It will be seen as we proceed whether or no the petitioners intended to make a scapegoat of that important corporate association. No sooner was the petition duly forwarded to the Secretary of State than the right honourable functionary promised an official inquiry into the matter, and shortly afterwards made his promise good by despatching the Government sanitary engineer, Mr. Rawlinson, C.B., to the scene of action. That gentleman held an open and impartial investigation into all the circumstances of the case, examined and listened to numerous witnesses, and fully tested the truth or falsehood of the various allegations advanced against the Metropolitan Board of Works. His report is now before us, and from its contents an accurate idea may be formed of the sanitary state of Barking, and the causes which led the petitioners to endeavour to shift the blame of such a scandalous condition of affairs from off their own shoulders to those of the Board of Works.

It is an admitted axiom in legal jurisprudence that a petitioner, whatever guise he may adopt, must come before the court with clean hands. How have the Barkingites fulfilled this maxim? We learn from the report of Mr. Rawlinson that "the town of Barking is without local governing powers, is unsewered, contains many cesspools, a sewage-tainted subsoil, and has a defective water supply." Yet, with all this self evidence against them, they petition for relief at the expense of other people. That they have no local government, is partly the fault of the sanitary legislature, but still more their own fault, as any town in which three-fourths of the inhabitants desire it can place itself under the provisions of the Local Health Act, and at once, by application to the Secretary of State, establish a local board and retain the services of the proper number of officers. The conclusion to be arrived at, therefore, is that, whether from parsimonious or other motives, the inhabitants of Barking did not elect to have a local government, but preferred to remain, like the swine in its wallowing, in the midst of their cesspools, refuse, and sewage abominations. Having once ascertained that the town is without an inspector of nuisances and other corporate officers, the rest of the picture given in the report might be readily anticipated. The fault of the sanitary department of the Government lies in the fact that any town, much less one so near the metropolis, should be permitted to remain in so filthy and infected a condition. As might be expected, the Commissioner admits that the Thames is polluted by the discharge of the London sewage combined with the road and street detritus, and the surface drainage generally, but reports that the main channel has not been reduced in depth by any deposits of this nature, as was alleged in the memorial. The allegation respecting the closing of the Barking Creek to vessels of 250 tons for want of water has not been proved to the satisfaction of Mr. Rawlinson. A very strong point in all cases where it is required to prove the pollution of any stream or watercourse, is the death of its finny inhabitants. Indeed, if that fact, together with the circumstance that cattle which once drank of the water refuse to do so any longer, can be "made out," the case is gained for the petitioners, and an injunction is sure to be granted. It was proved during the inquiry that fish had been destroyed by the empoisoned waters of the Creek, but it was an open question whether this was not due to the presence of chemical refuse in the stream, which could not have been the contribution of the Metropolitan Board of Works.

It will be admitted that, to use a common phrase, "it would be no joke" to engage in litigation with the Board of Works. A body that would think nothing of the expenditure of the thousands attending all lawsuits, and particularly one of this nature, would be a formidable adversary. The Commissioner appears to fight rather shy, in his report, of laying any onus upon that body. In one of the paragraphs, he observes, "That an accumulation of mud has taken place, both on the shore of the Thames and at the mouth of Barking Creek, but from what special cause has not been proved." This is neither more nor less than an evasion of the question. If this accumulation has taken place since the period in which the London sewage commenced to be discharged into the river, there can be no doubt in the mind of any reasonable man of the cause of it. While the people of Barking are deserving of the severest censure for the state in which the town is, yet the fact of their perpetrating a nuisance does not give another party the right to add their offensive contributions likewise. It signifies nothing how foul and polluted a stream or watercourse may be, but no one by law can add a single drop of additional contamination to it. The existing polluted condition of a river does not warrant anyone augmenting it. In other words, the culpability of A does not permit B with impunity to be equally culpable. It must be borne in mind that the Metropolitan Board of Works have universally recognised their obligation to purify their sewage before permitting the effluent water to enter the Thames. They assert that up to the present they have not been able to make arrangements for the purpose, but this is a very different affair from ignoring or denying their liability. In fact, without self-stultification, it would be impossible for them to act otherwise. They have objected in the strongest terms against the pollution of the Thames by the discharge of sewage from the towns situated higher up the stream, and it follows that they cannot well continue to pollute the river themselves at a point lower down. When only small towns have been compelled to provide for the purification and utilisation of their sewage, at least a year has been asked and granted to enable the local authorities to make the necessary arrangements. The Board of Works may reasonably, therefore, demand double or treble that time to perfect their plans for the utilisation of the sewage of the metropolis. That the sewage can be utilised, and profitably too, there is not a shadow of a doubt, and Mr. Rawlinson concurs with us in the opinion, which is one we have always expressed. He objects to all the systems of deodorisation and disinfection by chemical re-agents as both costly and, what is more to the point, productive of imperfect and valueless results. Irrigation is the only plan which offers any chance of realising a profit from the utilisation of sewage. There is no doubt some difficulty in obtaining the large area of land required to absorb so enormous a quantity of sewage as that resulting from the drainage of the metropolis, but this is a difficulty only, and not an insurmountable obstacle.

ACCOMMODATION FOR TRAFFIC AT LONDON BRIDGE.

GREATER or less degrees of publicity have been given to a number of schemes for increasing the accommodation for the traffic upon London Bridge, which serves, according to Mr. Haywood's report, a population of nearly a million souls. Notwithstanding the diversion of a great portion of the traffic by the extensions of the Brighton Railway to Pimlico, of the South-Eastern to Cannon-street and Charing Cross, of the London, Chatham, and Dover to Ludgate-hill, the construction of Southwark-street, and the removal of the toll from Southwark Bridge—all which causes should have resulted in greatly reducing the streams of traffic over London Bridge—the contrary has been the case, and the traffic has increased from 13,000 vehicles passing in 12 hours in 1850, and 16,000 in 1860, to considerably over 20,000 at the present time. The crowded state of the thoroughfare along the bridge, especially on the footpath on the east side, is a matter of notoriety, and a cause of great discomfort and even danger to those who have to pass along the bridge on foot, and attention has accordingly been given for some time past to the important question of providing increased space for the accommodation of the traffic. Among the methods proposed for effecting this object, that which first and most naturally presents itself to the mind as the most ready and least costly in execution is that of widening the roadway by removing the present parapets, and providing footways beyond them, to be supported on cantilevers or otherwise, closing in the new footpaths by open parapets, much less massive than those which now exist, and are an important feature in the architectural details, which can scarcely be interfered with without serious detriment to the architectural effect. Several architects and engineers have recommended the extension of the accommodation on the principle referred to.

Another mode of dealing with the work is to widen the bridge from its foundations, on one or both sides, and either in accordance with the present design or by raising lighter superstructures of iron upon the new extended piers and abutments. By the latter mode an elegant design is doubtless practicable, but Rennie's fine work would be lost irrecoverably, a result much to be deprecated. Yet another mode, the most recent we have heard of, has been designed by Mr. T. P. Ivison, C.E., upon the idea of carrying the foot passenger traffic over the vehicular traffic in the manner adopted at the temporary Blackfriars Bridge, but, of course, by a structure of a very different character. By this mode it is proposed to construct a longitudinal platform 25ft. wide and 18ft. high along the centre of the bridge, the platform, of ironwork, to be supported upon groups of Corinthian columns. The approaches would be by four stairs of 13ft. each, for which space would be taken over

the comparatively useless water stairs at the corners of the bridge, which would still be left with 13ft. available for descent to the river. The ascending stairs would enter upon cross platforms, which would afford means of communication between one footpath and another without threading the way amongst the crowded vehicles—no mean advantage to foot passengers who have occasion to cross the road on or near London Bridge. The existing piers of the bridge would, according to this design, be carried up to the height of the proposed footway, this part of the work to be in Portland stone enriched with sculpture. By this plan about 6ft. would be added to the footway, and the two present footways would be thrown into the carriage road, affording space for two extra lines of vehicles. Mr. Ivison has in his proposed design—which we must not be understood as endorsing—adopted the main principle of the steel bridges he has recommended, and of which he has prepared a model, for street crossings by foot passengers.

OUR IRON-CLAD SHIPS.

It has doubtless occurred to many, as it has to ourselves, that up to the present time there has existed a gap in that part of scientific literature which relates to the iron-clad ship question. That gap has been occasioned by the absence of any work containing a connected and comprehensive statement of the whole subject. There has been a difficulty on the part of the public generally in grasping the question in all its multifarious bearings, because they are so multifarious, and because they involve so many profound scientific problems. Moreover, the many phases of the question have been dealt with at so many different times, and under such varying circumstances, as to give a different complexion even to one and the same point. Parliamentary speeches made annually by the supporters of this, that, or the other theory or system; newspaper reports and articles by those whose political opinions, even unwittingly, improve the occasion either for better or for worse; papers read before scientific bodies by authors having individual tendencies to special views—these are the sources from whence information has to be obtained. What wonder, then, if, bewildered and perplexed, some should give up the attempt to realise the whole question in despair? In such a state of things, it is refreshing to find a way out of the complex meshes which circumstances have woven around the subject, and to know that we have a clear and comprehensive statement of all the facts of the question, one in which it is divested of all mystery, and placed before us in a popular and plain-spoken way. And this we possess in the very interesting work on our iron-clad ships* now before us, and with which the public have been favoured by Mr. E. J. Reed, C.B., the Chief Constructor of the Navy. The whole tone and character of the work indicate an honest desire on the part of the author to place the whole matter before his readers in a clear and direct manner, and in this he has succeeded admirably. As he has worked, so he has written—with one single purpose in view, and that, to do his best. Hence we have ships which reflect great credit upon his talent; the more when the essentially transitional character of the times is taken into consideration. Hence also we have a volume which, being written to inform, for fairness and impartiality has not its superior, whilst for intrinsic value upon a special subject it has not its equal.

Having spoken thus strongly of its merits, let us examine a little into the matter it contains, which will soon show that we have not over-estimated its value. We have first a chapter on the varieties of our ironclads, in which Mr. Reed observes that it has often been a matter of reproach that the British navy is composed of such variously built and appointed ships. He, however, goes on to show that the French have particularly distinguished themselves for diversity of design. Russia has gone to greater lengths in this respect than even France, whilst Prussia, Austria, Spain, and America also furnish examples of fleets of very mixed character. Our author proceeds to account for the diverse features in our ships, pointing out the distinction between radical and minor changes, and showing how the latter often result from gradual advance on a settled plan. We then have an interesting summary of the changes which have taken place since the "Warrior" was built, and so many of which have been necessitated by the progress made in armour and guns. Again, the adoption of twin screws and the abandonment of ships of extreme lengths are other causes which have led to variety in construction. But that this variety does not prevent our ships acting together is proved by the trials of Channel squadrons. In the second chapter we have full particulars respecting the armour of our ironclads, as well as details of the armour and backing of French and American ships. The different systems of armour plating and backing are considered, and their merits and demerits pointed out. In the next place Mr. Reed goes into the question of armament. First noticing the armament of the latest wood line-of-battle ships and frigates, he follows with particulars of those of the "Warrior" and other early ironclads. He then proceeds to show the progress made in the gun question during the last ten years, which has resulted in a reduction in the number of guns carried by our ironclads, but in an increase in their power.

Following our author in the order of treatment he has adopted, we next come to a chapter upon the structure of our ironclads. Although these vessels are mostly iron-built they are not all so constructed, and from this chapter we learn the reasons why some are wood-built. These reasons are various, and tend to show that there is a certain amount of value even in wood hulls. It is, however, clearly shown that iron hulls are lighter, stronger, more durable, and—when properly constructed—safer than wood hulls, and, therefore, far preferable. The French, however, for local reasons have not yet discontinued to build vessels with wood hulls. Chapter V. embodies the whole question of the steaming of our ironclads, and into which Mr. Reed has gone at considerable length. In this section we have a large amount of information respecting the steaming capabilities of our ships of war, and the speeds attained by ironclads and unarmoured ships, as well as with some useful comparisons. The speeds of French and American ironclads are also considered and compared. The question of coaling and that of the measured mile trials are gone into in the latter portion of this chapter. The sailing qualities of our ironclads is a matter which appropriately follows the consideration of their steaming, and their performances in this respect are fully and fairly stated in Chapter VI. It is seen from this portion of the work that the capacity for sea-service has not been lost sight of in our ironclads. This is demonstrated by extracts from the reports of the Channel squadron for 1864-66-67 and 68.

The rolling of the ironclads—a question which has been brought much before the public from various standpoints—is considered in the next chapter. Mr. Reed proceeds to point out many erroneous notions which prevail on this matter, and he proves that as a whole ironclads are absolutely steadier than unarmoured ships. The Channel squadron reports already referred to go to show not only that our ironclads do not roll excessively, but that most of them are comparatively steady. The "Hercules" is perhaps the steadiest of all the ironclads; at any rate, she ranks with the best of them. The whole subject of rolling is, however, far from settled, and Mr. Reed suggests the expediency of a series of carefully conducted trials with ships of different types, under varied circumstances of wind and weather, the observations being carefully made and correctly recorded. The three succeeding chapters treat respectively of the dimensions, forms and proportions, and the cost of our ironclads, upon each of which subjects the information afforded is full and complete.

We next come to chapter XI., which is devoted to a full consideration of the turret ship question, which is very fairly discussed. Mr. Reed points out that, although heavy guns can be trained easily through large arcs in turret ships, they can also be worked very easily on the broadside system. The real advantages of a turret system are small port and great training. With reference to the disabling of the turret by the straining of the vessel in a seaway, or by the turret being struck by heavy shot, Mr. Reed observes that this danger does not exist in Captain Cole's system. Here the turret is carried on a set of rollers fixed in a band at the circumference of the turret base, and is simply centred on a spindle. In chapter XII. our author enters upon a description of ironclad rams, and upon a consideration of the general question of ramming. He gives the experience of ramming afforded by American practice in this direction, also the experience gained at Lissa. From this chapter we learn that handiness in the vessel is absolutely necessary to efficiency in a ram, and that qualification is obtained chiefly by moderate dimensions. The various forms of bows are then described and compared, the chapter concluding with some observations on the manœuvering and working of iron-clad rams.

The concluding chapter treats of the conversion of line-of-battle ships into ironclads. Here our author shows that our navy contains several converted ironclads, but he demonstrates that ships completed could not readily be converted in the same way, although they are capable of conversion upon a different principle. Most schemes for conversion have been based upon the principle of turret armament; the "Royal Sovereign," in fact, is an example. The reasons, however, why other vessels have not been converted may be here briefly stated. In the first place, extensive repairs would be required, the hulls would be heavy, and the armour, therefore, inefficient; their speeds, too, are low, their engines worn, and their behaviour at sea would probably be bad. The proposals for turning line-of-battle ships into rigged monitors are objectionable, as the stability of vessels, thus converted, under canvas is extremely questionable. Moreover, this method of conversion does not provide sufficient buoyancy. However, our wooden ships have really constituted a reserve force, that would have been drawn upon if occasion had arisen. The battle of Lissa proved that wooden ships are far from ineffective in engagements where ironclads are present, and there can be little doubt that such vessels, as a reserve, have a special value.

We have thus taken our readers with us through Mr. Reed's last work, and although we have been able only to glance at each subject, yet we have shown what an interesting and important addition our Chief Constructor has made to naval literature. The volume is illustrated by a folding plate, giving views of all our ironclads tastefully arranged in vignette style, and it is also interspersed with wood engravings, which complete the usefulness of the work. We are much pleased with the production, and heartily commend it to public notice, feeling assured that the public will endorse our opinion, and that with them the book will find full favour.

* "Our Iron-clad Ships, their Qualities, Performances and Cost." By E. J. REED, C.B., Chief Constructor of the Navy. London: JOHN MURRAY, Albemarle-street. 1869.

PHOTOGRAPHY.

A NEW ARTIFICIAL LIGHT—TRANSPARENCIES FOR THE MAGIC LANTERN.

A FEW days ago Dr. D. van Monckhoven read a paper before the Photographic Society of London, describing a new artificial light, which he states to be of great actinic power. He said that although magnesium gives such a very actinic light, his audience would be surprised to hear that chromium burnt in a particular way throws off rays of still greater chemical intensity. When dry hydrogen gas is passed through chloro-chromic acid, and afterwards ignited in a current of oxygen, oxide of chromium is produced at a very high temperature and emits light of such extraordinary chemical power that photographic paper blackens under its influence about as quickly as in full daylight. Chloride of titanium burnt in the same way gives similar results, and the flame has a decidedly blue tinge. "Unfortunately," he says, "these chlorides can be manipulated only by persons versed in scientific research, as they become decomposed under the influence of moist gases, and the lamp then emits a considerable amount of vapour, as is the case with metallic magnesium." He found out that the oxides of the metals of the earths, when ignited under the action of the oxy-hydrogen blowpipe, do not give a light so rich in chemical rays as when the oxide is ignited during its actual formation; therefore, the best plan is to subject the chlorides or carbonates of the earths to the fierce action of the flame, the oxide being then formed in the flame itself. Compressed magnesia and zirconia are not so rich in actinic rays as ignited lime. The light patented by Professor Carlevaris, of Genoa, is produced by allowing the oxy-hydrogen flame to play upon a square piece of retort carbon which had previously been saturated with chloride of magnesium and dried. The resulting light is very actinic, but directly the chloride subjected to the influence of the flame is all decomposed, the ignited charcoal throws off a light which is poor in the chemical rays. Dr. Monckhoven found that the most economical way of getting a good actinic light, free from smoke, on the principles just mentioned, was to use a cylinder of very pure carbonate of magnesia (free from soda, baryta, and iron), either alone in a very compressed state or containing titanite of magnesia, obtained by a mixture of chloride of titanium and carbonate of magnesia. The pillars are square at their base, three centimetres in diameter and eight in height; they burn for an hour and a half, and cost less than half a franc apiece. The cylinders are made by purifying chloride of magnesium from every trace of soda, baryta, and strontia, and then precipitating carbonate of magnesia by the addition of carbonate of ammonia. The precipitate is dried at 300deg. Centigrade, and is pressed into little pillars by hydraulic power. To get a light for photographic enlargements, he uses the "blow-through" oxy-hydrogen burner, wherewith common coal gas is used at its ordinary pressure, and a jet of oxygen is blown through it upon the prepared cylinder. He said that after the flame is made to play upon the cylinder "the heat soon indents the pillar, and it is only when a cavity has been formed that the light attains the highest degree of brilliancy; at this stage the hydrogen stopcock is partially closed until the maximum amount of light has been secured. In the luminous hollow the most vividly incandescent particles of magnesia are seen, and these lose their brilliancy as soon as they have become thoroughly calcined, when other particles are made to replace them. At the end of a quarter or half an hour the pillar is raised somewhat, so as to bring a fresh part of its surface into contact with the flame. The stopcocks should not be opened fully until the maximum amount of light is required; for focussing, the oxygen tap should be opened but very little, and the other regulated accordingly." He pointed out that this plan gave a good steady light for the production of photographic enlargements, also that the lens used in enlarging should be made of very white glass, since the greenish tint of most lenses absorbs a large proportion of the chemical rays.

A cheap and very easy method of producing photographic transparencies on glass for the magic lantern has been found out by Mr. W. H. Harrison. No dry plates, toning, or intensification are necessary. When a pyrogallic and citric acid developer is used to bring out any wet plate picture, the colour of that picture is always a tolerably good black. This black colour, however, may be improved by working with a bromo-iodized cadmium collodion containing a larger proportion of bromide than usual, and the result will be the production of pictures of a delicate blue-black colour by transmitted light. A good bromo-iodized cadmium collodion of commerce should be bought, and three or four grains of bromide of cadmium should then be added to each ounce thereof, and allowed to dissolve; the collodion works best if it be then kept a month or two before using. As the proportion of bromide is so large the nitrate bath should be a strong one, and contain about fifty grains of nitrate of silver to one ounce of distilled water. When the plate is sensitised it should be dipped for a minute in another very pure but weak nitrate bath—strength, twenty grains to one ounce, whereby it is covered with a solution which makes the development more manageable. The plate should then be drained, and the picture printed from the negative by superposition, a few folds of blotting paper being placed at the edges between the prepared plate and the negative to prevent them from touching. The source of light should be small and brilliant, and that from a paraffin flame answers very well. At a distance of a foot from such a flame the right time of exposure may vary from one to three minutes. After development fix with cyanide of potassium, and the picture is finished. That there may be no fog in the shadows care should be taken that all the solutions are sufficiently acid.

TELEGRAPHIC NOTES.

ON Tuesday morning, Mr. Hawkshaw, one of the arbitrators appointed by Government to decide on matters relative to the transfer of the telegraph companies, sat at the Westminster Palace Hotel, for the purpose of hearing those of the shareholders of the International and Electric Company interested in the residue of the purchase money to be paid by the Postmaster-General, and for determining the proportion and manner in which such residue shall be distributed to the shareholders of the company in accordance with the provisions of the Act. The Hon. M. Grimston, the chairman of the company, made a statement to the effect that in 1866 the company issued 15,000 shares of £10 each, for the purpose of extinguishing the debenture debts. Those 15,000 shares were allotted to the proprietors according to the different holdings, and nearly all the shareholders took their proportion. The shares were sold at a good premium for the benefit of the company, and as the debentures fell in they were paid off; £8 out of £10 was called up, leaving £2 unpaid. The only question, therefore, which the arbitrator had to deal with was as to what claim the shareholders were entitled to as regarded the £2. It was argued on the one side that the £2 would now be worth £5 had not the Government stepped in, and on the other side it was contended that the £5 would, in the course of time, be worth £8 but for the interference of the Government. Several new shareholders argued their right of compensation on the £2 uncalled, while the stockholders contended that any advantage to be had was due to them. After considerable discussion, the Arbitrator said he had noted all the *pros* and *cons*; but as the question was one of some importance, he should take time to consider before giving his decision. The proceedings then terminated.

The chairman of the British Indian Submarine Telegraph Company has transmitted for publication the annexed letter dated December 13, 1869, from the company's engineers, announcing the completion of their cable, to be laid from Suez to Bombay:—"Sir,—We beg to report that the manufacture of your cable, 3,600 nautical miles in length, was completed at Greenwich on Saturday last, the 11th inst., and we herewith forward you our final daily return of cable manufactured. The manufacture of the outer covering of this cable was commenced at Greenwich on the 23rd of June last; it has, therefore, been exactly 5 months and 18 days in course of manufacture, equal to 147 working days, which gives an average speed of manufacture of 24½ nautical miles per diem. This is probably the greatest average speed of manufacture ever before obtained for such a long and important cable, and it is gratifying to us to be able to state that its electrical condition throughout the entire manufacture has been practically perfect, and we feel that, so far as its mechanical condition is concerned, the cable is well suited for the depth of water and position it is intended for.

"Yours faithfully,
"CLARK and FORDE."

The Malta Correspondent of the "Times" writes under date of Valetta, December 10:—The Telegraph Construction and Maintenance Company's steamer "Hawk," Captain Briscoe, returned on the 7th inst. from Alexandria. She formed part of the flotilla of steamers that successfully traversed the Suez Canal. After replenishing fuel she proceeded on the 8th for England, to bring out the Suez shore end of the Anglo-Indian Telegraph Cable, and meet the expedition which is now on its way out to the Red Sea with the principal portion of the cable, by way of the Cape.

In connection with the transfer of the telegraphs to the Government on the 29th of January, a farewell dinner was given on Saturday evening at the Cannon-street Hotel to Mr. William Andrews, manager of the United Kingdom Telegraph Company, by the officers and staff. A valuable silver epergne, designed for the occasion, with telegraphic emblems, &c., was presented to that gentleman with an address expressing the esteem entertained for him by the whole of the officials.

Mr. A. Brasher, of the Indo-European Government Telegraph Department, writes to say that it has been officially intimated to his department from Constantinople that the Bagdad-Fao line of Turkish Telegraph, which has been interrupted for the last three months, has been provisionally re-established. The repairs, though not quite completed, will, it is believed, admit of permanent re-establishment in about a week.

The following astounding telegraphic feat is reported:—A telegram, dated "Madras, 20th November," actually reached a London firm on Tuesday last, simultaneously with Madras letters of the 23rd November. Thus it appears that the Telegraph Company takes only three days longer than the Post-office.

NOTES ON RECENT DISCOVERIES IN SCIENCE AND THEIR PRACTICAL APPLICATIONS.

ANOTHER REPORTING MACHINE—THE COLOURING MATTER OF EMERALDS.

ANOTHER reporting machine has been brought before the notice of the public in France This instrument is much more complicated than that of M. Gensoul, which we mentioned some time ago, and to our mind is far too much so to answer its purpose. The object is to print a discourse in ordinary characters as it is delivered, which would save all the trouble of transcribing, such as is necessary with M. Gensoul's machine, which, it will be remembered, prints stenographic characters. It, too, consists of a keyboard, something like that of a piano, the keys acting upon branched levers so arranged that the characters are printed in close succession upon a strip of paper which is rolled along by a movement also communicated by the action of the keys. But this machine of M. Bryois is furnished with no fewer than three hundred keys, which print so many syllables representing all the sounds in the French language. To remember the syllables corresponding to all these keys would be no slight effort of memory, while to print them with sufficient rapidity would require no little manual dexterity. To a pianist who could dash off the finale to Weber's concert, Stück, it would be easy enough, and we have known accomplished pianists in the reporters' gallery. But most, we have no doubt, would prefer to use the pen. The stenographic machine we have alluded to might, we believe, be easily adapted for the English language; but it is seldom that verbatim reporting is desirable, and we gain a great deal by having to rely on the reporter's pen and brains.

Precious stones are still objects of study for chemists, the colouring matter of some being yet subjects of dispute. So far as that of the emerald, however, is concerned, the dispute may now be said to be set at rest. On the one hand, it was believed that the colouring matter was a metallic oxide, that of chromium in fact; but Löwy, by

burning an emerald in a stream of oxygen, obtained a good deal of carbonic acid, and hence concluded that some organic substance gave the colour. The researches of Kuhlman and others have indeed shown that organic matters do penetrate the excessively minute fissures in precious stones, and more recently it has been proved by Mr. Sorby that emeralds are sometimes full of cavities containing a liquid. This he conjectures to be the liquid from which the stone has crystallised, the nature of which we do not know, but which is not unlikely to contain a carbonate. M. J. Boussingault has lately analysed the emerald, and found both oxide of chromium and carbonic acid, and from the latter argues the presence of organic matter. But the carbonic acid may be accounted for in another way, while no doubt is left that the colour is given by chromium. The question, however, is of little importance, and does not in the least affect the value of the stones.

THE WILSON SPANNER AND RATCHET BRACE.

MR. WILSON, of Birmingham, whose improvements in small arms are well known to our readers through our columns, has effected some practical improvements in the screw wrench and ratchet brace. We have illustrated these improvements, and at fig. 1 show the spanner, which it will be seen is set with a screw at the back of the jaws. The moving screw is of steel, and from its arrangement is easily and rapidly adjusted to its work. In fig. 2 we show the new single-acting ratchet brace, the advantages of which consist in the improved construction and arrangement of its driving pawl and ratchet wheel, by which greater compactness, strength, and durability are obtained. The pawl being situated in the lever is held firmly to its work, and at the same time is completely protected from external injury, while the ratchet teeth being formed on the side instead of the circumference of the wheel, are equally removed from danger and are stronger and more durable than those of the ordinary construction. The brace shown at fig. 3 possesses, in addition to the improvements above described, the great advantage of being double-acting. It is constructed with double ratchet teeth, pawls, and levers, which, on being moved from and towards each other simultaneously, impart to the ratchet wheel continuous motion, thereby enabling it to effect its work in half the time of a single-acting brace and drill, and hence its adaptability to the working of lifting jacks and other purposes where continuous motion is a desideratum. By connecting the handles and using them as one the brace is rendered single acting. The manifest advantages of these tools combined with their cheapness will ensure for them a wide market. They are manufactured by Messrs. Wilson, Deeley, and Co., 95, Bath-street, Birmingham.

IMPROVEMENTS IN WATCHES.

IN watches and other timepieces acting with a balance wheel and lever escapement, it sometimes occurs that by a greater than ordinary impulse imparted to the balance wheel from any cause the ruby pin after the lever has been moved over into the one position is carried sufficiently far round to cause it to strike the outside of the fork of the lever in the same direction, whereby, as the lever when thrown over is in contact with the one banking pin and cannot therefore yield to such striking of the ruby pin, it sometimes happens that the ruby pin is fractured or the balance wheel or pallet staff pivots broken or bent. Various contrivances have been proposed to obviate these inconveniences, but all have been either too complicated and consequently expensive in their construction, or too uncertain in their action for general adoption. An invention, however, recently patented by Mr. M. G. Cole, of Belvidere House, Bexley Heath, has for its object to provide both an efficient and simple means for preventing the above liabilities. It consists in placing the banking pins at the tail of the lever, and in so forming this tail as to act as a spring instead of making it rigid as heretofore, the spring being sufficiently stiff as in coming in contact with the banking pins to limit the ordinary motion of the lever to the required extent, while it is sufficiently elastic to allow the lever to yield to the second blow of the ruby pin, and to assume its correct position after the ruby pin has passed it. In place

IMPROVED SPANNER AND RATCHET BRACE.

BY MR. H. WILSON.

FIG. 1.

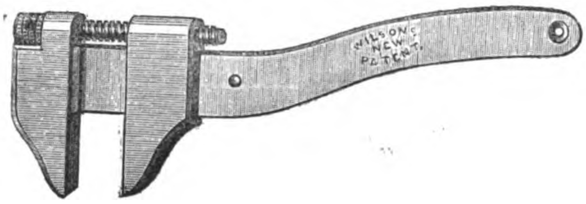
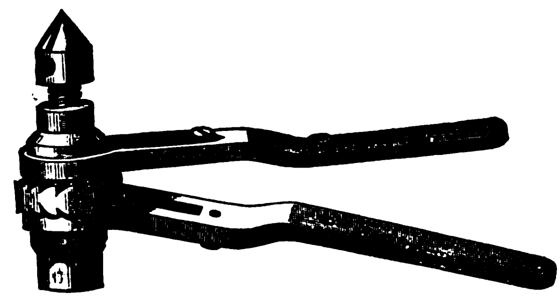


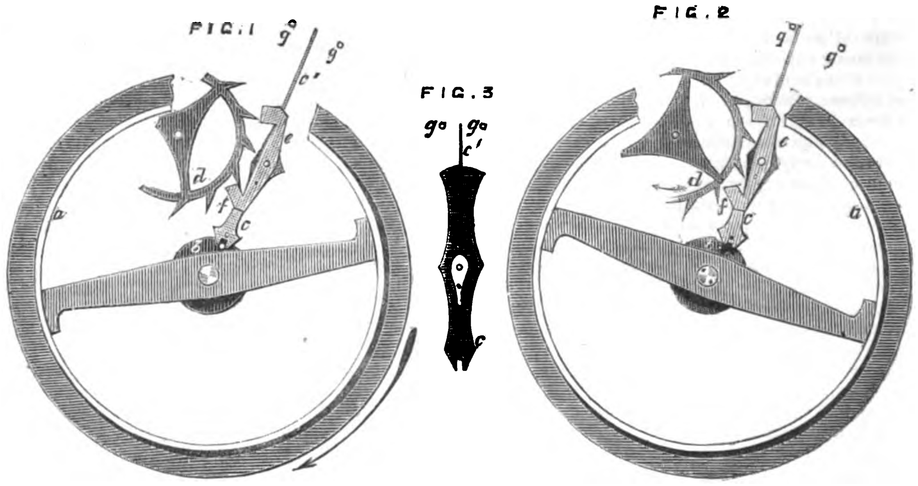
FIG. 2.

FIG. 3.



IMPROVED LEVER ESCAPEMENT.

BY MR. M. G. COLE.



of making the tail of the lever act as a spring, Mr. Cole sometimes fits a spring on to the pallet staff in addition to the ordinary lever, so that the spring shall act on the banking pins and yield to the second blow of the ruby pin.

Fig. 1 of our engraving shows a plan of the escapement of a watch with this invention applied to it. *a* is the balance wheel, with ruby pin *b*, which works in the fork of the lever *c* in the usual manner; *d* is the escape wheel, and *e* are the pallets carried by the pallet staff *f*, and secured to the lever *c*. The tail c^1 of this lever is formed quite thin so as to act as a spring, and works between the banking pins *g g*. If now the balance wheel, having received the impulse given by the action of a tooth of the escape wheel on one of the pallets communicated through the lever, should from any cause be moved so far round that the ruby pin *b* strikes against the outside of the fork of the lever *c*, as shown in fig. 2, the tail c^1 of this lever resting at the time against the one banking pin will, through its spring action and the shape given to the forked end of the lever, allow the ruby pin *b* to pass by, when the spring tail will immediately cause the lever to regain its correct position for the ruby pin to act upon it in the contrary direction. The tail c^1 is, however, made sufficiently stiff to limit the ordinary motion of the lever by coming in contact with the banking pins. Fig. 3 shows a plan of another modification of the lever *c* in which, in place of forming the spring tail c^1 on the lever itself, such spring is formed separate from the lever, and is secured to the pallet staff *f* and to the lever.

We are informed that the patent right of this

invention has been acquired by and belongs to Messrs. E. Dent and Co., of 61, Strand. The escapement has been applied to a number of watches, and is found to answer the object in view most satisfactorily.

INSTITUTION OF CIVIL ENGINEERS.

THE annual general meeting of the Institution of Civil Engineers was held on Tuesday, December 21, Mr. C. H. Gregory, President, in the chair. In reviewing the events of the past twelve months, completing the fifty-second year since the foundation of the Institution, the council stated that the proceedings had furnished corroborative evidence of the sound basis on which the society was established. Referring to the business at the ordinary general meetings, of which there were twenty-two during the past session, attention had been directed by the papers read, and by the discussions upon them, to the use of machinery in lieu of gunpowder for getting coal; to cylinder foundations for bridges and other similar structures; to the Midland line of the Mauritius railways, where exceptionally steep gradients and sharp curves were necessarily adopted; to some of the chief peculiarities of American locomotives and rolling stock; to works carried out in connection with the river Witham and estuary, for the drainage of the fens and the improvement of the navigation; to the past and present condition of the outfall of the river Humber, and of its peculiar feature, Spurn Point; to the New Ferry and the New Brighton piers and landing stages on the river Mersey; to the Low Water Basin at Birkenhead, and the extensive sluicing operations for maintaining the basin at its proper depth; to the lagoons and marshes on certain parts of the shores of the Mediterranean; to the mechanical details of construction of lighthouse apparatus and lanterns; to the Roman Rock lighthouse, Cape of Good Hope; to the standards of comparison for testing the illuminating power of coal gas; and lastly, to an able summary, by a foreign engineer, of the present state of knowledge as to the theory of the strength and resistance of materials of construction. The originality, labour, and ingenuity displayed in these communications had led to the award of Telford medals and Telford premiums of books to Messrs. Jules Gaudard, W. Shelford, T. N. Kirkham, J. Ellacott, and D. T. Ansted, F.R.S.; of a Watt medal and a Telford premium of books to Mr. Z. Colburn; of Telford premiums of books to Messrs. W. H. Wheeler, J. R. Mosse, I. Bell, J. Milroy, S. P. Bidder, jun., and C. J. Chubb, and of the Manby premium of books to Mr. D. M. Henderson. In addition to the ordinary general meetings, there were six supplemental meetings, for the reading and discussion of papers by the students. For the papers read at these meetings, Miller prizes had been awarded to the following students:—Messrs. E. Bazalgette, F. H. Mort, T. J. Ellis, T. R. Gainsford, C. H. G. Jenkinson, and G. H. Roberts. It was stated that during the past year upwards of 700 volumes and pamphlets had been added, either by presentation or by purchase, to the library, which now contained about 5,800 volumes, and 4,300 tracts, on every branch of civil engineering, and in many different languages.

During the last session 30 members and 82 associates had been elected; but as the deceases, resignations, and erasures from the register were double what they had been in any previous year, the actual increase in the gross total of the several classes composing the corporation was only 42, or 2·7 per cent. on the present number. There were on the books on November 30 148 students, as against 133 at the same date last year. If the students were included in the enumeration, as the graduates used formerly to be, it would be found that the gross number of all classes now on the list was more than double what it was twelve years ago—1739 as against 857. The actual numbers of the four classes—honorary members, members, associates, and students—were 16, 655, 920, and 148 respectively.

The following gentlemen were elected to fill the several offices on the council for the ensuing year:—Charles Blacker Vignoles, President; Joseph Cubitt, Thomas Elliott Harrison, Thomas Hawksley, and George Willoughby Hemans, Vice-Presidents; James Abernethy, William Henry Barlow, John Frederic Bateman, Joseph William Bazalgette, Nathaniel Beardmore, Frederick Joseph Bramwell, James Brunlees, John Murray, George Robert Stephenson, and Edward Woods, Members and Edward Middleton Barry and Lieutenant-Colonel Andrew Clarke, C.B., R.E., Associates.

PALLISER CONVERTED GUNS.

THE complete success which has attended the conversion of upwards of 400 cast-iron 8in. smooth-bores into Palliser rifled cannon for the Admiralty has lately attracted the attention of the War Office to the importance of converting the thousands of 68-pounder cast-iron guns which are mounted on our coast defences both at home and abroad. Out of several hundred guns which have now been proved, in no instance has the slightest symptom of weakness presented itself. These conversions are due to the reports and recommendations of General Lefroy and the members of the late Ordnance Committee, and the practical results reflect great credit upon their labours. The recent visit of Colonel Jervois, the Deputy-Director of Fortifications, to Halifax and Bermuda has been the means of further demonstrating the importance of the subject. It appears that at the latter place alone upwards of 300 smooth-bore guns are mounted in the works, and although complete in their carriages, traversing platforms, embrasures, sponges, rammers, &c., they are, in their present smooth-bore state, no better than wooden dummies for opposing a bombardment at long ranges with rifled guns. The Secretary of State for War has, as a preliminary measure, authorised the trial at Shoeburyness of two rifled guns, a 7in. and an 8in., converted from old 68-pounder guns. They are to be fired at the "Warrior" target from a distance of 1,000 yards. The experiment is awaited with great interest, since if the guns penetrate the target at such a range it is expected considerable orders for conversions will follow. An old cast-iron mortar has also been converted, by Mr. Cardwell's directions, into a 9in. rifled mortar, and will be tried at the same time as the guns. It weighs about 6 tons, and it is expected that it will throw its shell of 250lb., containing a bursting charge of 20lb. of powder, upwards of 7,000 yards.

THE SOCIETY OF ENGINEERS.

ON Friday evening last the annual dinner of the Society of Engineers took place at the Westminster Palace Hotel, at which above a hundred members and associates and their friends were present. The chair was occupied by Mr. F. W. Bryant, the president of the society, the two vice-chairs being taken respectively by Mr. William Adams, the president elect for the ensuing year, and Mr. Alfred Williams, the honorary secretary and treasurer of the society. The customary toasts of a loyal and patriotic character were duly given and honoured, after which the toast of the evening —"Success and Prosperity to the Society of Engineers"—was given by the president in an able and practical speech. The President reviewed the early days of the society, and showed how from small beginnings it had risen to a position of influence and importance. Beginning with 55 members in 1854, it now enrolled nearly 500, and speaking on behalf of the council, he promised that they would not relax their efforts to further its continued progress; at the same time he had every reliance on the general body of its members in backing up their endeavour to make the society as successful as possible. The object of the institution was the promotion of engineering science and practice; and he congratulated the society on having, during the past session, had some excellent contributions to their transactions, both with respect to the papers read and the discussions which had followed them. Those discussions had been the means of eliciting much valuable information of which they could not otherwise have become possessed. The members had also had the advantage of making several visits of inspection in the course of the year to a number of great works in and around the metropolis, of great importance to the engineering world, and of having been received on those occasions, by the gentlemen who had the conduct of the works, with the utmost kindness and courtesy. In those visits they were favoured not only with an inspection of the plans, but with the experience of the gentlemen who were engaged in carrying them out. It was worthy of record also that in most cases where these visits had been made, the works were being executed under the direction of members of the Society of Engineers. No better method could be devised for promoting the study of engineering than in making visits to works in progress; for, in so doing, the members not only saw the works, but had the opportunity of disseminating among each other the ideas which might be suggested to them by anything they chanced to see at the time. Then by observation and discussion on the spot a large amount of information was diffused alike amongst the oldest and the youngest members of the institution, and especially the latter, of whom there was a considerable number in the society. The President, in conclusion, coupled the toast with the name of Mr. Alfred Williams, whose health was cordially received.

Mr. Williams, in replying to the toast, gave a *resume* of the financial and general position of the society, together with a statement of the details of its working. He alluded to its success, and pointed out the causes which had led to it. He further indicated how the present satisfactory position of the society could be not only maintained, but improved upon. This was by the combined efforts of the members and associates in reading and discussing papers on engineering and scientific subjects. He concluded by thanking the president for proposing and the company for honouring the toast, assuring them of his continued support and hearty co-operation.

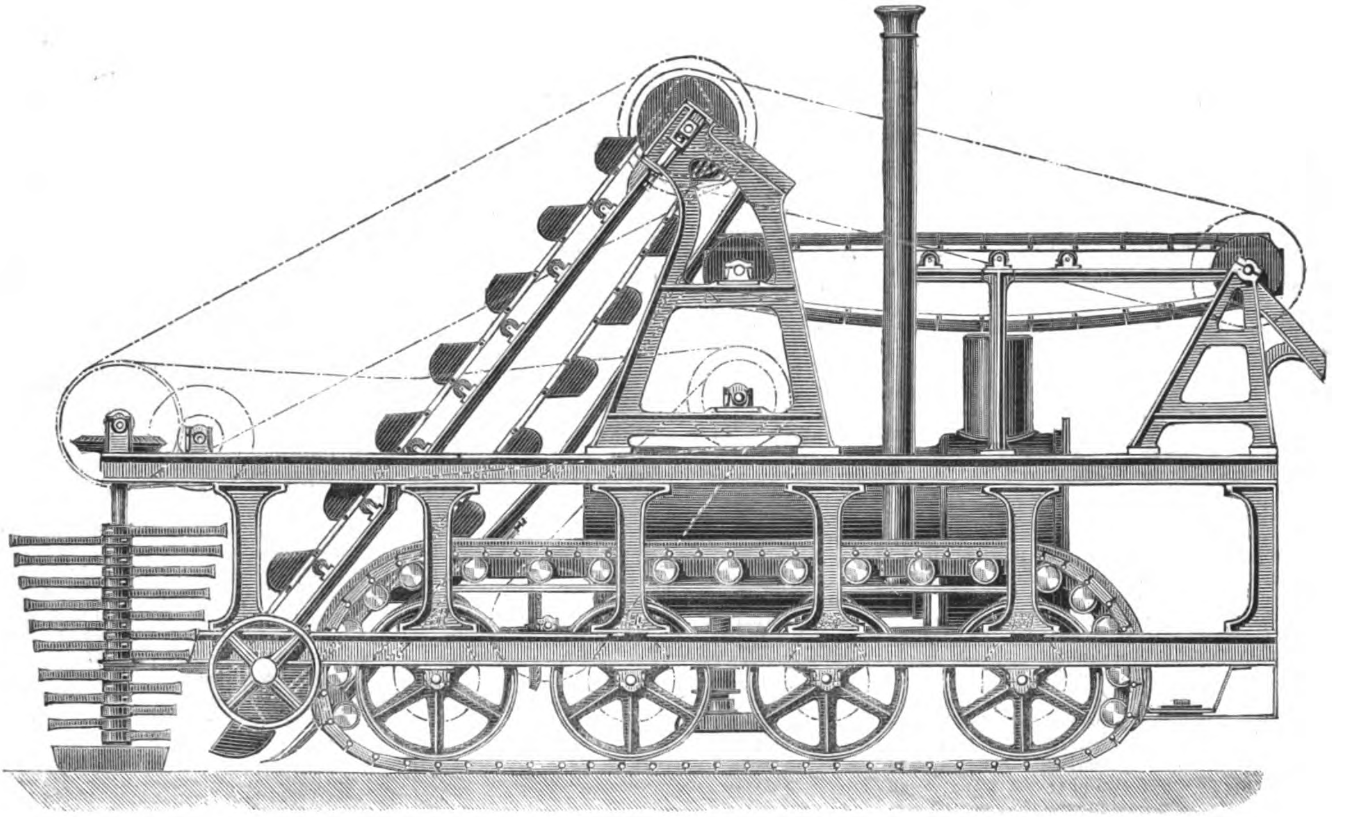
Mr. Olrick proposed the health of the chairman of the evening, Mr. F. W. Bryant (the President of the society), upon whose engineering services in connection with several of our great public works, including pre-eminently the new Blackfriars Bridge, he pronounced a high eulogium. He observed that if the bridge across the Channel was ever to be constructed he would advise the projectors in the first place to avail themselves of the science, experience, and skill of the chairman. Mr. Bryant duly responded to the toast. Several other toasts of a special and complimentary character were proposed and responded to, after which the company retired, a very pleasant evening having been passed. The proceedings were enlivened by music and song.

THE STONE AGE IN EGYPT.

A LETTER has been addressed by Messrs. Hamy and Lenormant to the Academie des Sciences to prove that Egypt has had its age of stone as well as Europe. Their letter is dated from Luxor, and they say to the secretary of the Academy:—"We beg you to communicate to the members a discovery we have just made in the course of a journey to Upper Egypt, undertaken under the auspices of the Khedive, which will not be devoid of interest to that learned body. The existence of an age of stone in Egypt has often been the subject of controversy. The facts we are about to relate will, we think, give some information that will exercise an influence on the opinions entertained hitherto on the question. On the elevated plateau which divides the celebrated valley of Biban-el-Molouk from the escarpments which overlook the Pharaonic edifices of Deir-el-Bahari, we have ascertained the presence of an enormous quantity of wrought flints, lying on the surface of the ground, to the extent of upwards of a hundred square yards. These wrought flints, which are of the well-known type designated arrow-heads, lance-heads, lanceolated axes, knives, scrapers, &c., evidently constitute the remains of an ancient manufactory, according to all probability pre-historic, and exactly resembling those known in France under the denomination of 'Factory of the Neolithic Period.' Messrs. Ballard, Quatrefages, Wurtz, Jamin, Broca, and Berthelot, with whom we had the good fortune to be travelling, were witnesses of the discovery, and authorise us to declare that they verify the origin of the specimens collected by us and their similitude to those found in Europe. The best of them we propose to deposit in the Museum of St. Germain, where they can be inspected by connoisseurs in antiquarian subjects."

A NEW EXCAVATING MACHINE.

BY M. VANDENVINNE.



EXCAVATING MACHINE.

We last week drew attention to a new digging and excavating machine, a working model of which the inventor, M. Florent J. Vandenvinne, of Belgium, is now exhibiting in the Ashburnham Grounds, Chelsea, and promised detail particulars, which we now append. The invention has been patented in England, and the machine, which we illustrate in side elevation herewith, is for the purposes of tilling or ploughing land to a great depth, and also for the execution of all kinds of open earthwork, such as cuttings for railways and canals.

On reference to our engraving it will be seen that the machine consists of a strong iron framework, on the back part of which is fixed a steam engine for giving a forward motion to the machine, and for driving its working parts. A pulley is keyed on the shaft of the steam engine, which drives a second pulley fixed on a horizontal shaft placed in the front of the machine. This shaft carries at each end a bevel pinion, each of which gears into two bevel wheels fixed on two vertical wrought-iron shafts. Around each shaft are keyed the picks or mattocks, arranged screwwise, and turning in opposite directions in such a manner that the picks of one of the shafts pass in spaces between the picks of the other shaft. These picks are curved so as to move the earth, which being struck by them is thrown back and falls into troughs placed to receive it. Curved sheets of iron are arranged so as to prevent the earth thus moved from falling at the sides. The troughs are fixed on an endless chain passing over two drums, one at the bottom and the other at the top of the machine. The shaft of the top drum is driven by a band passing over a pulley fixed on the horizontal shaft already mentioned. The troughs are thus constantly in motion, and carry up the earth to the top of the machine, and turn it over on an endless carrier, which passes over two drums, on the shaft of one of which is a pulley driven by a band from a pulley on the drum shaft of the trough chain. This endless carrier thus conveys the earth to the back of the machine, whence it may if required be carted away. Friction rollers are placed in suitable supports under the endless chain of the troughs, and also under the endless chain carrying the earth to the back of the machine, and at each side of the latter chain sheets of iron are fixed to prevent the earth from falling off, and two iron sheets, moved by a screw, are placed under the troughs on their descending side to prevent any earth falling into the machine.

The forward movement of the machine is effected by means of an articulated endless railway, on the lower part of which rest the wheels of the machine, the upper part being supported and moving on rollers fitted in a framing attached to the machine above and partially around the wheels. On a forward or backward movement being given to the machinery the endless railway lays itself continuously on the ground under the wheels. Arrangements are provided for guiding the machine laterally and also for working it at a dead level or at an upward or downward angle.

We inspected the working model of this machine at Chelsea on the 1st inst., through the introduction of Mr. John Jones, of 94, Stanley-street, Pimlico. Upon that occasion, the machine did its work satisfactorily, although it is only of small size, being of 3-horse power, and weighing 4 tons. It excavated the ground to a depth of 2ft. 3in. in a continuous line, breaking down the earth and carrying it to the rear in good style. It had a steady, although somewhat slow, rate of advance, but this would be increased in a more powerful machine. Mr. Jones informed us that he had seen one of the large-sized machines, weighing 12 tons, at work in Belgium, where it excavated the soil in excellent style. The invention promises to be of practical use in railway and canal works, as it removes the soil and throws it into waggons or upon the bank as required at a very small cost per cube yard.

BALLOT VOTING APPARATUS.

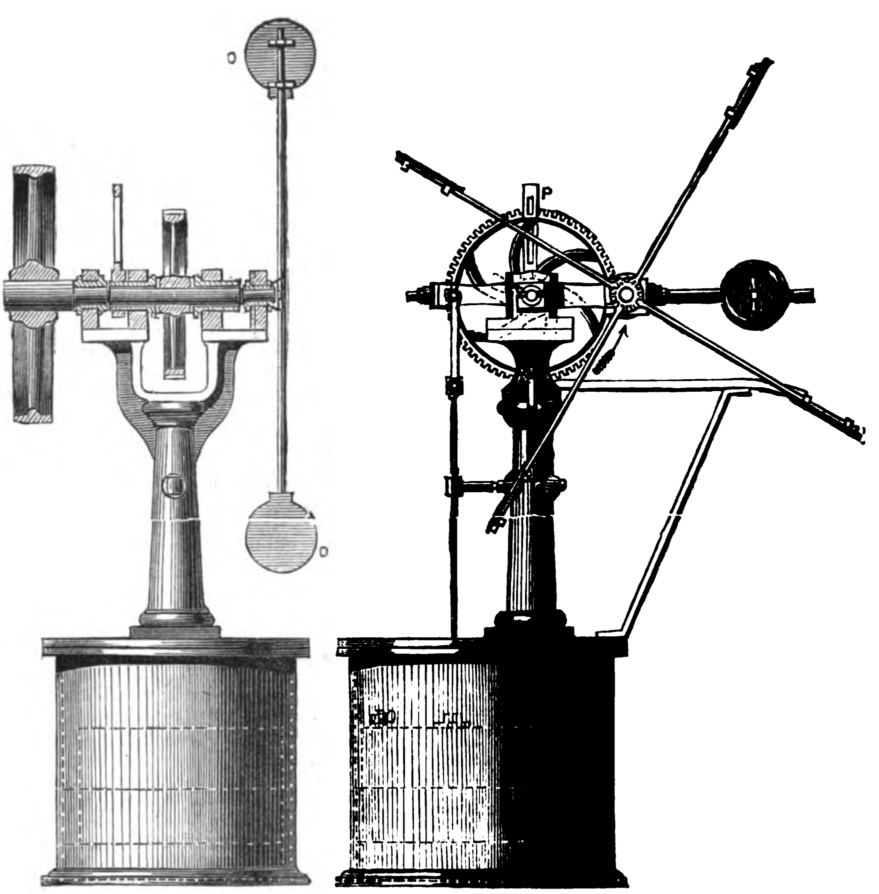
During the latter part of last week and a portion of the present there was on exhibition at the City Terminus Hotel, Cannon-street, a working model of a new ballot voting apparatus, which has been patented by Messrs. Cruttenden and Wells, of Maidstone, through Messrs. Robertson, Brooman, and Co., of 166, Fleet-street, London. A careful inspection of its working leads us to the conclusion that this invention affords a perfectly secure, simple, effectual, and economical means of taking votes by ballot. The voting is with balls corresponding in number to the persons to be elected, without reference to the number of candidates or voters; thus, if one is to be elected, only one ball will be used; if two, two balls; and so on. The apparatus consists of a small chamber, which in practice is made portable, measuring about 10ft. by 6ft., and having an entrance at one end and an exit at the other. The entrance and exit are revolving doors with four leaves, the passing through which registers the number of voters who have passed on the dial and counting apparatus attached to them. Under the flooring is a double-forked lever, actuated by a disc and stops under each door. The passing through the entrance door effectually locks it and renders it immovable both for entrance or exit, and at the same time the exit door is locked against entrance, and is only free to allow the voter to pass out, and his passage out liberates the entrance door for the next voter.

On the inside are a series of holes in compartments to receive the balls, each compartment of a different colour and number, with the names of the candidates. From these holes, corresponding to the size of the ball, are descending tubes or shoots, through which it immediately rolls and falls into a receptacle outside the apparatus in charge of the official, and is ready for the next voter; its passage through the tubes is registered on the dial and counting apparatus attached to each compartment by falling through a rotating drum wheel, which immediately locks itself after the ball has passed through it; and if another ball is by fraud or accident placed in the hole, it passes on down a waste tube, and is registered on a dial fixed for that purpose. The exit of the voter unlocks any drums that have been used, and leaves them all in their normal condition for the next voter. There is also a hole and a compartment for neutral votes. This drum does not lock itself, but like the drum for fraudulent balls registers all that pass, so that the voter can, if he chooses, not vote at all.

The method of using it is simple. The duly qualified voter presents himself to the official in charge of the balls, who gives to him one, two, or three, according to the number of persons to be elected; and these are to be the only balls used. The voter passes in, deposits them for whom he chooses, and leaves by the exit door. The balls immediately return to the official at the entrance; if they do not do so, it is known that the voter has detained them, and this must be punishable. If the voter should fraudulently put more similar balls in, they would merely be recorded on the waste drum, and he would stand convicted by their delivery to the official at the entrance. If any further security be required against wanton or malicious injury to the apparatus, a supplemental lever is attached to the mechanism under the floor,

A NEW REGULATOR.

BY HERR K. REIGERS.



which, on the exit of the voter, reveals the whole system—except the indicators, which are locked,—to the public or officials, and which closes again on the entrance of the next voter, who sees nothing but the holes for the ball in the coloured compartments of the candidates, the dials, tubes, and drums being securely locked and protected from his sight. There are also provided, in the side opposite to the voting compartment, sliding or folding doors, securely locked, for the officials, candidates, or representatives to enter and set the dials at zero before the opening of the poll, and to ascertain the result at the close without disturbing the revolving doors and indicators.

The mechanism is extremely simple, there being no springs which might break or fail, but simply lever movements, the motive power for which is unfailing, being entirely supplied by the passage of the voter into and out of the apparatus, and the passage of the ball down the tubes. The advantages of this apparatus will be at once apparent to those who have followed our description, and are such as commend the invention as embodying the most perfect system of voting extant.

THE REIGERS-KRAFT REGULATOR.

IN the annexed engraving we show two views of the Reigers-Kraft regulator, which is highly spoken of upon the Continent. Professor D. Grotteman, of the Polytechnic, at Delft, amongst others, has stated it to be a very efficient instrument. The following are the principles upon which it is based:—If by means of a pair of wheels, a gyratory motion is imparted to an axle, which has to overcome a certain resistance, the power employed will manifest itself in two ways. It will strive, firstly, to turn the axle; and, secondly, to remove the same in its—the power's—direction. This necessitated a foundation for the apparatus to stand upon, the pressure of which will be greater or less than the power acting upon it. The influence of the latter will manifest itself by the resisting or yielding of the former; but if the pressure be so regulated as to be neither greater nor less, then the apparatus will be held in suspension as long as the power remains the same. A change in the latter will bring about a rising or falling of the foundation. The resistance which the axle has to overcome depends upon the increased or decreased endeavour to remove it, and, moreover, upon the pressure and the power which the axle has to transmit. These principles are jointly used in the instrument before us. The axis N on a movable foundation K would be raised by an increase of power (or the increased resistance of the vane O), and lowered with its diminution; the equilibrium of both effects of the power would hold K in suspension. The pressure of K is affected by the speed of the motion, since the resistance of the same is in proportion to the square of the velocity of its circumference. The suspended weight K can only be retained in its position by the exact normal velocity of the motion; the angle which the lever I may form with a horizontal line will not influence that position as long as both effects of the power upon the axle remain in equilibrium. This, however, can only be the case when the speed of the engine is the normal one, and hence the Kraft regulator will not permit a change of that speed, since the equilibrium of the effects would thereby be interrupted. The gap of the throttle valve may be changed without disturbing that equilibrium.

THE ROYAL POLYTECHNIC INSTITUTION.

PREPARATIONS for the forthcoming season of Christmas, although at the present time universal in the social world, are hardly looked for in the domains of science. Nevertheless, they are to be found there, and nowhere are they more actively carried on than in that home of science—pure and popularised—the Royal Polytechnic Institution. The directors of this favourite place of entertainment and instruction, with Professor Pepper at their head, have prepared a programme in which there is nothing wanting to please all ages, and to edify while it amuses. From a private view which was accorded us last evening, we are enabled to indicate to the public what a marvellous shilling's worth awaits them on their Christmas holiday visit to the old Polytechnic. We of course take it for granted that everyone will visit this establishment. If they do not, theirs be the fault, and not ours. But to proceed, Professor Pepper has prepared a new lecture, entitled "A Shocking Jar," in which the great lightning inductorium, having been thoroughly cleaned and renovated, is made to charge the largest Leyden battery in the world and the largest Gassiott's cascade apparatus is introduced. Immense lengths of wire are also deflagrated, and other startling experiments are shown. A mechanical novelty of great ingenuity has been introduced. It is termed the "Neurocrypt," or, the Woman of Hidden Nerves. It is an automaton of entirely new construction, by Mr. J. S. Cavill, and exhibits by a beautiful figure, the size of life, an almost indefinite series of graceful evolutions and attitudes, the most surprising imitation of spontaneous action we have ever seen produced.

The ghost illusion is as interesting as ever, and will not lose in popularity by its new garb—"The Mysteries of Udolpho." Here Professor Pepper causes innumerable spirits to appear and disappear. Mr. Pichler produces the startling novelty of three spirits emanating from one, and mysteriously returning to their "shadowy homes." The heroine of the romance dresses for a soirée; the spectres of her ancestors watching her movements. The celebrated baths of Homburg are shown. Live black beetles crawl over the dungeon walls, and many other startling appearances are produced. Christmas and Christmas customs are happily introduced in a novel manner by Mr. W. Wardroper, the pictures illustrating the story being highly appropriate; Christmas carols being introduced with excellent effect. Mr. J. L. King gives an instructive lecture on the Tentoonstelling, or international exhibition of Amsterdam, whilst the mysterious hand still pursues its inexorable caligraphic task of writing down all the visitors' names. But we must stop; we have not time to tell of all we saw at the Polytechnic last night, as we are going to press. We have, however, indicated some of the novelties, and leave the rest as a pleasant surprise to our friends the public.

PAPER BLUE.

AN invention which promises well for laundry establishments has been patented by Mr H. B. Binks, and is being practically carried out by Messrs. Forbes, Born, and Co., of No. 2, South-place, Finsbury. It consists in substituting blue coated paper for the ordinary blue bag, and is more economical as well as more convenient. In manufacturing this article the inventor takes indigo of the best quality, and after it is finely ground and sifted he dissolves it in acid in the proportion of 3lb. of acid to 1lb. of indigo, and allows the mixture to stand for three days. After this there is added to every pound of indigo 20lb. of water and 5lb. of cow hair, the whole being boiled for three hours, or until it becomes of a greenish hue. This is then allowed to remain twenty-four hours standing. The hair is then taken out and washed in clear cold water until a beautiful blue colour appears. The hair is then put in 10 gallons of water and boiled, and, whilst boiling, potash is added in the proportion of 10lb. of potash to 1lb. of indigo, thus rendering the indigo solution free from acid. The whole is then strained and evaporated to half its bulk, and allowed to remain thirty-six hours standing. Two fluids are now formed; the upper thin portion, when mixed with size, can be used as a blue writing ink; the lower portion, containing the real indigo-carmine, is then put in a wide but shallow vessel, and some glycerine added in the proportion of ¼oz. of glycerine to 1lb. of indigo. Unsized paper is then dipped in the solution, and in a few minutes the paper takes up the colouring matter. The paper is now dried and pressed, and is then ready for use as a colouring and bleaching agent for use in the laundry, and for manufacturing purposes. Professor Attfield, F.C.S., has had this paper blue submitted to him, and he writes that he has fully examined and tested it, and is of opinion that it contains nothing likely to injure the fibre of linen goods in any way whatever, and that it possesses many advantages over the older forms of blueing.

AN article of colonial production which has for years past, from time to time, attracted public notice, seems now to have some chance of assuming, ere very long, an important place in the exports of Mauritius. This is aloe fibre, which is now being extracted for exportation by several persons; and in Bourbon, where sugar planting has ever been less successful than Mauritius, a still larger amount of attention has been bestowed on this fibre; and machines have been erected in several places, capable of beating out 1,000lb. of it per diem. The aloe (that known as the Yucca) grows wild in immense numbers on these islands; and, like all species of aloes, it is very hardy, being little affected by dry seasons. The fibre is worth £25 to £30 per ton in Europe, and it is believed that it will gradually become an article of considerable importance in the colony.

WEEKLY CHEMICAL, MINERAL, AND METAL REPORT.

(From J. Berger Spence & Co.'s Manchester Circular December 23.)

Since our last report, there is nothing special to note in the chemical market. As previously stated, the greater number of the large manufacturers are well sold forward; but there are yet a few considerable makers who prefer to sell for present consumption, with the hope of improving values next year, but, with the raw material receding in price, there are no present signs of any advance, although a rise in alkalies of 5 is not at all improbable. There has not been much activity displayed in minerals. Oolitic ironstone is commanding more attention in Staffordshire, and some of the Welsh ironmasters are also alive to its importance. In metals a large business has been done both in Scotch and Cleveland pig iron during the week, and a considerable advance has taken place in the prices of each. In manufactured iron there is little doing. Ingot copper is inactive. Manufactured is in pretty good demand for export, and smelters are firm at their quotations. An official reduction of £3 per ton has been declared in English tin. Lead firm at present rates. Spelter is still quiet, and prices remain about the same as last week. Soda: caustic soda finds unwilling purchasers beyond £13 for 60; for soda ash there is more inquiry, at £7 for 48; soda crystals, rather firm, at £4. Salt cake maintains its value; bicarbonate is still inactive, at £9 to £9 5s. Nitrate of soda obtains from £15 to £15 10s. per ton. Potash: muriate is still a short supply, with prices ruling firm at £7 7s. 6d. to £7 12s. Saltpetre: Bengal, 22s. to 23s. 6d.; English refined, 26s. 6d. Alum: a considerable trade has been done, at prices not exceeding £6 5s. for lump, £7 in export barrels, and ground at £7; in London, 10s. per ton above these prices. Ammonia: sulphate is in steady demand, at late rates of £15 10s. to £17; muriate in request at £22 to £28. Copperas: for green and rusty there is less demand; dry remains firm, at 50s.; chloride of iron, 50s. Pyrites: a rather firmer market; calcined in tolerable request at 44s., with 43s. 6d. asked. Lime: in phosphate, there is less doing, at 52s. 6d. on 65; bleaching powder is firm, at £8 for 35; disinfectants sell readily at £5 5s. per ton for the best quality. Manganese shows a falling market, and is without animation. Iron ore: Hematite sells at 15s. to 18s.; oolitic firm, and in great demand at 6s. 6d. to 8s., in Staffordshire. Guano: for best Peruvian £13 10s. is asked.

Metals.—Iron: Scotch pig iron steady at 58s. 6d. to 58s. 9d. Cleveland, firm, at 49s. for No. 4 forge, to 53s. 6d. for No. 1. Welsh bars, £6 5s. to £6 10s.; Staffordshire bars, £7 10s. to £8 10s.; Gas tubes, 60 to 67½ off list; Boiler tubes, 40 to 42½. Copper: quiet; English tough, £71 to £73; Chili slab, £66 5s. to £67 10s. Tin: reduced; English ingots, £117; Straits from £110 to £111. Lead: firm; P. G. best English soft pig lead, £19. Spelter: dull; English, £20 to £20 10s.; Silesian, special brands, £19 10s. to £19 12s. 6d.; hard spelter, for export, £16 10s.

Correspondence.

HYDROSTATIC STEERING APPARATUS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In a recent number of your valuable journal I read a letter signed by Rear-Admiral Inglefield on the subject of his hydrostatic steering apparatus, which was at that time being fitted on board H.M.S. "Achilles." On trial it was reported to have been successful as regarded its action, but was found to be rather slow, especially in giving a "small helm." I am deeply interested in the success of this most valuable invention, as I believe it to be the simplest and most easily applied mechanical arrangement yet devised for steering merchant ships as well as men of war. I shall be glad to learn how the final trial which recently took place off Portland succeeded; also the actual time occupied in moving the tiller through a small and the extreme number of degrees from amidships. I should not have troubled you in this matter but that, as you are well aware, we outsiders have no means of access to the official reports, and we must therefore cast about us as best we may for valid information. I am told that to overcome the difficulty of obtaining a "small helm" in a short time, Messrs. Kittoe and Brotherhood, the engineers who made and fitted the machinery for the Government, proposed to enlarge some part of the apparatus. Can the Admiral or these gentlemen give me, through your columns, a description of these alterations and the results of the final trial. In so doing they will confer a great favour on,—Sir, yours, &c.,

A Seafaring Man of the Modern School.

London, December 20.

AN INVENTIVE PEOPLE.

Sir,—Some of your readers may not have realised the significance of a fact in the paragraph under the above caption in your number of November 19—"Over 40,000 specifications lodged in a year, and this in the States alone." A glance at the current list of English patents in your last impression shows that our own applications during the same period will not aggregate 4,000! As Englishmen, whose very existence depends upon manufactures, is it not ominous of our decadence that we can calmly witness the spectacle of a country, designed by nature mainly for agriculture, showing a patent roll ten times as large? Should it be tolerated that, whilst the cost to an American of a seventeen years' patent, examined by a board, is £18, an Englishman must pay for a fourteen years' uncertified patent considerably over £180?—I am, Sir, yours, &c., Frank Spence.

Manchester, December 20.

[The paragraph in question is quoted from the "Gentleman's Magazine," and it commences by referring to 14,000 patents, so that 40,000 would seem to be a misprint. Fourteen thousand is about the average number of United States patents for the last two or three years, but this shows a great disproportion when compared with our own. During the present year the total number has nearly reached 20,000. The cause is doubtless in some degree attributable to the heavy fees.—Ed. M. M.]

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly payable in advance.

All literary communications should be addressed to the Editor of the Mechanics' Magazine. Letters relating to the advertising and publishing departments should be addressed to the publisher, Mr. R. Smiles, Mechanics' Magazine Office, 166, Fleet-street, London.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to any communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith. Ed. M. M.

Advertisements are inserted in the Mechanics' Magazine, at the rate of 6d. per line, or 5d. per line for 13 insertions, or 4d. per line for 26 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

Received.—G. D. K.—R. E.—A. P. H.—R. W. A.—W. E. F.—L. P. S.—J. T. B.—E. J.—L. H.—J. M'J.—E. F. B.—J. S.—W. W. P.—H. L.—H. W. F.—R. N.—E. G.—C. D.—R. B.—W. H.—J. J.—P. H.—C. and W.—R. L.—E. H. T.—W. T. F.—W. and J. K.—H. T. J.—E. J.—R. S.—J. B.—W. D. and Co.—S. E.—R. G.—E. D. B.—W. H.—L. and C.—A. W.—G. E. P.—L. and Son—H. M.—G. P.

Meetings for the Week.

Tues.—Royal Institution.—Professor Tyndall on "Light" (juvenile lectures), at 3 p.m.

Thurs.—Royal Institution.—Professor Tyndall on "Light" (juvenile lectures), at 3 p.m.

Sat.—Royal Institution.—Professor Tyndall on "Light" (juvenile lectures), at 3 p.m.

Naval, Military, and Gunnery Items.

Captain Jones, of the ship "Victoria-Nyanza," arrived at Liverpool from San Francisco, reports having passed off Cape Horn an enormous iceberg 350ft. high.

The Abyssinian medal has been issued to officers and men proceeding on foreign service; but the one for the New Zealand war, which was virtually over before the attack on the late King Theodore was contemplated, still "hangs fire."

Indications accumulate that the success of the Suez Canal will rapidly bring about a solution of the question of the practicability of a ship canal to unite the Atlantic and Pacific. The Nicaragua route seems at present to attract the most attention.

A telegram has been received in Liverpool which states, on the authority of M. Lavalley, that the minimum depth of water over the Serapeum-rock is 18ft. 5in. A rumour that the Suez Canal was to be closed until April for dredging purposes is officially contradicted.

The Government (the "Broad Arrow" learns) are about spending £25,000 upon improvements at the Royal Military Academy, Woolwich. The improvements contemplated consist of separate rooms or studies for the cadets, and a chapel for their spiritual behoof. It is said that these improvements were suggested by the report of the Royal Commission on Military Education.

An extensive order has been received at the Royal Laboratory, Royal Arsenal, Woolwich, for the manufacture of a quantity of shells for the muzzle-loading rifled guns, which has enabled the department to re-engage the 50 hands in the shell foundry who were discharged last week. This order will, we understand, keep the hands now engaged at the foundry fully employed up to March 31 next.

Most of the gunpowder hitherto stored at Upnor magazines, to the danger of the Government establishments at Chatham, and of a very large population, having now been removed to the magazines at Purfleet, the extensive buildings at Upnor will be made useful for the warehousing of barrack stores, blankets, rugs, &c., a considerable quantity having been already deposited there, removed from the military department at Sheerness.

The official returns for the year 1868 show that in that year there were employed in British ships registered in the United Kingdom 177,239 British seamen (including all capacities expect masters) and 20,263 foreign seamen; the number of apprentices bound and registered in British ships was 4,975. In 1867 the number of foreign seamen was 21,817; in 1865, 20,280. The number of apprentices was 5,638 in 1865, 5,454 in 1866, and 5,444 in 1867.

Four complete machines for the manufacture of Boxer cartridges for breech-loading rifles have been prepared and packed in the Royal Arsenal, Woolwich, for the use of the Ordnance Departments at Bombay, Madras, and Calcutta. The packages are being shipped for conveyance to their destination, and on their arrival the machinery will be put together, and cartridges made in India in sufficient quantities to meet the regular demand, thus saving the expense of the cost of their carriage from England.

Miscellanea.

It is announced that a treaty has been concluded with England, reducing the rate of letter postage after New Year's day to six cents (three pence) per half ounce. Newspaper rates are to remain unchanged.

The number of visitors to the Patent Office Museum, South Kensington, for the week ending December 18, was 2,220. Total number since the opening of the Museum, free daily (May 12, 1858), 1,688,961.

The annual meeting of members of the London Association of Foremen Engineers will take place at the City Terminus Hotel, Cannon-street, on Saturday, January 1, at 8 p.m., when the accounts of the society will be audited, and officers for the ensuing year elected.

A magnificent display of spots is now sweeping across the sun's disc, and which in clear intervals are well defined even in a very moderate telescope. In the northern hemisphere are two groups, extending each over a space of between 140,000 and 150,000 miles, and full of curious and interesting detail.

There is said to be a papier-mache church actually existing near Bergen, Germany, which can contain nearly 1,000 persons. It is circular within, octagonal without. The relievos outside, and statues within; the roof, the ceiling, the Corinthian capitals, are all papier-mache, veneered waterproof by a saturation in vitriol, lime water, whey, or the whites of eggs.

The collection of prints produced by various processes, used to illustrate Mr. Davenport's paper, on prints and their production, read on the 8th inst. before the Society of Arts, will be open for the inspection of members and their friends at the Society's House, Adelphi, between the hours of 10 and 4 o'clock, up to Saturday, January 8, 1870, inclusive.

The number of visitors to the South Kensington Museum during the week ending December 18, 1869, was—on Monday, Tuesday, and Saturday (free), from 10 a.m. to 10 p.m., 8,895; Meyrick and other galleries, 1,148; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 4 p.m., 1,677; Meyrick and other galleries, 78; total, 11,798. Average of corresponding week in former years, 8,295. Total from opening of Museum 9,005,605.

"Abyssinian gold" is the name given to a new metallic combination which has been effected by Messrs. L. and A. Pyke, of 17, Thavies' Inn, Holborn. This new metal very closely resembles, both in weight and appearance, certain qualities of gold. It is, of course, only sold as an imitation, although a most successful one, of the real article. When made up into articles of jewellery, it is coloured, and when this colouring wears off, it developes the material, which for its price is the best imitation gold we have seen. When this material becomes tarnished or dirty—and the best gold is liable to this—soap and water and a brush will restore to it a good appearance. We have seen some excellent examples of jewellery in this new metal, and we shall no doubt astonish our readers when we state that their total cost is only about one-fourth that of the labour cost of the best gold. How the inventors can supply their goods at the merely nominal price they do is a mystery to us.

MESSRS. LETTS and SONS, of the Royal Exchange, whose diaries we noticed last week, have published a large sheet almanack for 1870, which contains a variety of information, and which, for usefulness and low cost, is in keeping with the remainder of their productions. We may also draw attention to their sectional paper, which is ruled in faint lines and will be found very useful in the engineer's or architect's office for plotting upon. Of universal use also are Messrs. Letts' gummed labels, which are ready to be severed from a book and stuck—like postage stamps—on anything requiring them.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subject to which the respective inventions refer, in the following table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved and combined with all the advantages of a division into classes. It should be understood that these abridgments are prepared exclusively for this Magazine from official copies supplied by the Government, and are, therefore, the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgment:—

BOILERS AND FURNACES—1668, 1670, 1701

BUILDINGS AND BUILDING MATERIALS—1689, 1690, 1691

CHEMISTRY AND PHOTOGRAPHY—None

CULTIVATION OF THE SOIL, including agricultural implements and machines—1654

ELECTRICAL APPARATUS—None

FIBROUS FABRICS, including machinery for treating fibre pulp, paper, &c.—1657, 1664, 1673, 1686, 1687, 1707

FOOD AND BEVERAGES, including the apparatus for preparing food for men and animals—None.

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments &c.—1676, 1680, 1681, 1693, 1696

GENERAL MACHINERY—1660, 1672, 1677, 1682, 1699

LIGHTING, HEATING, AND VENTILATING—1675, 1683, 1684, 1694, 1711

METALS, including apparatus for their manufacture—1706

MISCELLANEOUS.—1653, 1655, 1658, 1661, 1665, 1666, 1671, 1678, 1688, 1697, 1700, 1702, 1710, 1712

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1651, 1662, 1663 1667, 1669, 1695, 1703, 1704, 1708

SHIPS AND BOATS, including their fittings—1652, 1459, 1679, 1705, 1709

STEAM ENGINES—1656, 1685, 1692

WARFARE—None

1651 F. BROWN, Luton. *Velocipedes.* Dated May 28, 1869.

The inventor transmits motion from the steerage handle to the brake lever by forming the stem or axis of the steerage handle with a short arm standing out from it, and this arm he connects by a short link to a fork, the prongs of which pass down on opposite sides of the vertical axis upon which the fork carrying the axle of the front wheel of the bicycle is carried.—Patent abandoned

1652 A. T. FAIRGRIEVE, Sunderland. *Coating ships bottoms.* Dated May 28, 1869.

To make 50lb. of the improved composition employed, the inventor takes 36lb. of common resin, and melts it in a pot under a slow fire. As soon as the resin is melted he adds 10lb. of the best Russian tallow, and 10lb. of raw linseed oil; as soon as these ingredients are properly melted together and combined, he mixes together in a separate vessel or pot 4lb. of quicklime, 8lb. of black lead, and 6lb. of flowers of sulphur, all in powder. These are to be well mixed together dry and without heat.—Patent abandoned.

1653 J. FRASER, Liverpool, and L. and R. SIMON, Nottingham. *Cutting pasteboard.* Dated May 28, 1869.

The circular knives are placed between discs of wood for other suitable material) and of various thicknesses, the discs when placed together with the circular knives between them forming the two cylinders, which are fixed in a suitable frame, and actuated or turned by any suitable power.—Patent completed.

1654 J. L. HANCOCK, Sutton Coldfield. *Hay making.* Dated May 29, 1869.

This consists in constructing the apparatus of a plate formed with a point at its front end, and its back end with a series of prongs or bars which are bent upwards and curved in such a manner that they form a surface similar to a mould board of a plough.—Patent abandoned.

1655 J. L. HANCOCK, Sutton Coldfield. *Clipping horses.* Dated May 29, 1869.

This consists in making one of the blades of scissors or shears used for clipping and trimming horses and other animals and for shearing teeth with a series of teeth formed during its manufacture or after it is made, and before being tempered and finished or after reducing its temper.—Patent abandoned.

1656 A. HEMINGWAY, Manchester. *Slide valves.* Dated May 29, 1869.

The inventor forms the back of the valve open, and places in the interior or plate, which rests on one or more rockers linked or toothed to the plate, which plate is kept tight by a shelf of indiarubber or a metallic packing. When there is only one rocker it works on metal in the middle of the exhaust port or passage, and as the valve is moved to and fro, the rocker rocks on the metal and thus the friction is reduced to a very great extent, there being only sufficient valve surface to keep the valve tight to its facing, and when there are two rockers they work on metal at the ends of the exhaust port or passage, and support the plate pressed by the steam or water.—Patent completed.

1657 E. J. HUGHES, Manchester. *Printing cloth.* (A communication.) Dated May 29, 1869.

The inventor prepares the cloth or yarn with acetate of lime or with hyposulphite of calcium, then prints the colours with lactarine dissolved in ammonia or other known processes, and steam as usual.—Patent abandoned.

1658 W. H. TURNER, Blackburn. *Lessening smoke.* Dated May 29, 1869.

When adapting these improvements to the furnace or to each furnace of a steam boiler, the inventor fits a dead plate to the front of the furnace immediately inside the doors thereof, the dead plate being formed with an interior space for the passage of air, and the space being preferably divided by means of horizontal or nearly horizontal or vertical or nearly vertical partitions, or by means of partitions so arranged as to cause the air when passing through the space to take a more or less circuitous course, in order that the temperature of the air may be raised.—Patent abandoned.

1659 J. HUMPHREY, Aberdeen. *Iron keelsons.* Dated May 29, 1869.

The keelson is constructed of T angle iron, and the foundation plate thereof is fitted on planking formed by preference of East India teak. In order to secure the keelson in its position, bolts of yellow metal cast with round heads thereto are driven through the keel and flooring and passed through holes formed for the admission thereof in the keelson.—Patent abandoned.

1660 J. STURGEON, Bolton-le-Moors. *Getting coal.* Dated May 29, 1869.

This relates, first, to certain improved arrangements of valves and valve mechanism in engines, for condensing or compressing atmospheric air to be used as a motive power in connection with the getting of coal and other minerals. Instead of the clack valves employed in such engines, the inventor applies to the induction passages, valves which are actuated by suitable self-acting mechanism directly from the engine itself, or by springs or weights the action of which is controlled and regulated by the engine through suitable mechanism, while the eduction passages are opened and closed in the ordinary way, namely by valves so arranged as to open by means of the air pressure within the cylinder, and to close by the pressure of the air in the receiver or vessel into which it is forced.—Patent completed.

1661 J. M. MUTERSE and H. G. DE VALORY, Guerande, France. *Anti-flame powder.* Dated May 29, 1869.

The component parts of this compound substance are: —Magnesium, aluminous silicates, from salt marshes in a very fine powder, and dried at a heat of 212deg. Fah., 700 parts by weight; chloride of magnesium, in crystals, 200 parts by weight; sulphate of soda, 50 parts by weight; chloride of lime, 50 parts by weight; tartaric acid, 1 part. Total, 1,001 parts by weight.—Patent abandoned.

1662 A. A. SAX, Paris. *Helicoidal railway.* Dated May 29, 1869,

This consists in establishing railways by means of a suitable number of helices connected endwise so as to form one continuous line or way; each helix is formed of one or more bars, or very stout wires of iron, or other suitable metal, and in the interior of the helix or helices are situated one or more cars, which may be caused to move forward or backward by imparting to the helix a rapid revolving motion round its axial line, for which reason the inventor calls this mode of propelling helicoidal propulsion. The periphery of the wheels of the cars is provided with a groove by means of which the wheels are allowed to roll along the wire or bar of the helix, the weight of the cars keeping these latter in the vertical position.—Patent abandoned.

1663 E. DAVIS, Great Mitchell-street. *Velocipedes.* Dated May 29, 1869.

The cranks of the crank axis or the crank pins by which a velocipede is propelled are connected by means of connecting rods with volute, curved, or other springs, and the inventor provides these springs with treadles or handles, or both handles and treadles, by which the velocipede can be propelled with great facility, the springs yielding to some extent and lessening the shock when an obstacle is encountered.—Patent abandoned.

1664 J. SMITH, Loth, Belgium. *Holding bobbins.* Dated May 29, 1689.

This consists in fitting two or more springs in recesses in the stem of the tube or spindle employed in spinning and cap frames; these springs for a portion of the circumference of the tube act upon the inside of the bobbin and hold it thereon by the centrifugal action of the tube or spindle in revolving. In some cases the springs may be fitted to a washer or other appliance on the lifter of common spinning frames in order to regulate the drag of the thread passing on to the bobbin.—Patent completed.

1665 J. F. NICHOLLS, Bristol. *Converting dining into billiard tables.* Dated May 29, 1869.

The inventor affixes by means of clamps around the top of the table ledges of the proper shape and size carrying cushions of indiarubber. The cushions he forms of indiarubber tubing laid in a groove along the front of the ledges and made to adhere thereto, such tubes being allowed to project about three-fourths of their diameter from the grooves; the ledges may be of wood, enamelled slate, marble, or iron. The adjacent ends of the table the inventor connects together by metal segments, the ends of which are bent down to fit into socketed holes in the ends of the ledges, and on these segments are threaded the pockets for the balls.—Patent completed.

1666 J. J. R. HUMES, Deptford. *Brick moulds.* (A communication.) Dated May 29, 1869.

The plungers or pistons are faced with porous wood, the wood being cut across the pores or grain and arranged so that the pores are presented endwise to the brick space of the mould.—Patent abandoned.

1667 J. COCKSHOOT, jun., and H. WEATHERILL, Manchester. *Axles.* Dated May 31, 1869.

This consists in recessing the split washer in order that the back collar of the axle box when received within the recess of the solid flange will allow the split washer and such solid flange to lay in close proximity, giving greater rigidity when bolted up; second, the improvements relate more particularly to the class of axle known in the trade as the "Collinge axle" and consist in enlarging the ordinary recessed collar thereof so as to make it deeper and larger in diameter, so that the inner surface can be tapped with a screw thread for the purpose of receiving a split nut having a number of elongated holes around its circumference.—Patent completed.

1668 P. KIRK, Workington. *Puddling furnaces.* Dated May 31, 1869.

The inventor forms the fire-grate in two portions, namely, an upper and a lower portion. The upper portion is formed by preference of a circular, hexagonal, or polygonal shape on plan, with the sides perforated or slotted and sloping downwards and towards the centre, and is made of a suitable material, as for example of cast iron which material the inventor has formed to be peculiarly suitable.—Patent completed.

1669 H. T. BRAITHWAITE, Cardington-street. *Bicycles.* Dated May 31, 1169.

This consists in the application of a forked rod or slide or system of rods or slides furnished with props, rests, or rollers to either or both wheels of or between the wheels of two-wheeled velocipedes or bicycle worked from above, below, or sideways through bearings parallel to or vertically projecting upon any supposed plane parallel to or meeting the planes of the wheels and forming part of or being attached to the ends, sides, or any other part or parts of the main frame.—Patent abandoned.

1670 J. HANWORTH and H. HORSFALL, Todmorden. *Furnaces.* Dated May 31, 1869.

The inventors make use of a set of stationary tubular gratebars connected to a chamber at the front of the boiler, and to a water pocket near the bridge, which is in communication with the lower part of the boiler, to ensure a free circulation of water through the tubular gratebars; they also employ in combination therewith one or more sets of solid gratebars placed in front of the tubular gratebars, and a sliding plate, to both or all of which to-and-fro motions are given. The sliding plate works under the hopper and carries the coal from the hopper to the sets of solid gratebars, which in like manner deliver it to the tubular gratebars.—Patent completed.

1671 R. S. BARTLETT, Redditch. *Needle cases.* (A communication.) Dated May 31, 1869.

The external part of the needle case or holder is made by preference of an ornamental cylindrical figure. Within the cylindrical part is a series of six or other number of tubular cases of a length greater than that of the longest needles to be stored in the case or holder.—Patent abandoned.

1672 B. LITTLER, Cannock. *Circular saw guard.* Dated May 31, 1869.

This consists in applying to circular saws a guard constructed and arranged in such a manner that the ascending side of the saw is so protected as to prevent anything being brought accidentally in contact with it.—Patent completed.

1673 J. BULLOUGH, Accrington, and C. CATLOW, Burnley. *Looms.* Dated May 31, 1869.

In the space between the healds and the reed an additional heald (which the inventors term "float heald") is suspended from the heald roller bearings, and the lower end is attached by a spiral or blade spring to the cross rail or other convenient part of the loom, the float heald also being connected to the sley beam by a cord or chain. Between the float heald and the reed they place a corse or float reed, to which is attached and working in connection therewith a finger resting on a catch having one or more notches therein. This finger acts on a projection on a stem of the weft fork, when a float occurs and stops the loom.—Patent abandoned.

1675 G. PRESTON and J. PRESTIGE, Deptford. *Lamps.* Dated May 31, 1869.

This consists in making the lens of uncoloured glass, fluted or not, and in fitting the interior of the lamp with thin coloured glasses in a frame which may be movable or not.—Patent abandoned.

1676 R. MATHERS, Leeds. *Mattresses.* Dated May 31, 1869.

The inventor constructs a support for the mattress by placing longitudinally upon the bedstead or other similar frame a series of laths resting at their ends upon helical springs. He supports the middle of the above laths as follows:—He places at suitable distances apart two cross bars, so that they shall carry a series of flat springs (metallic or otherwise) having a corresponding series of small wooden blocks, which connect the springs with the laths and afford them elastic support.—Patent completed.

1677 J. DOCKRAY, Leeds. *Carding engines.* Dated May 31, 1869.

The inventor communicates to the main cylinder a slow lateral reciprocating motion, by which it is made to act against each of the rollers by and upon which the material acts and is acted upon. The inventor effects the lateral motion above named by placing upon the first feeder shaft or other shaft moving at a similarly slow rate a cam which communicates the reciprocating motion required through a lever or levers adjustable so that the amount of oscillation communicated to the main cylinder and feeder respectively may accord with the work to be performed.—Patent completed.

1678 W. E. NEWTON, Chancery-lane. *Locking corks in bottles.* (A communication.) Dated May 31, 1869.

The invention comprises a locking cap, constructed upon the principle of what is known as a letter or combination lock, and is composed in part of a series of internally flanged and notched movable rings, operating in combination with a series of fixed lugs upon the neck of the vessel or upon a collar attached thereto, so that by turning the rings after the cap has been placed upon the neck (over the stopper) the relative position of the notches with that of the fixed lugs will be so changed as to effect the locking of the cap upon the neck and thereby prevent its removal until the relative position of the parts has been again established, when it may be lifted off or displaced so as to allow of the extraction of the cork or stopper.—Patent completed.

1679 D. EVANS, Hackney. *Ships.* Dated May 31, 1869.

In constructing ships the inventor employs plates of iron or steel, flanged at the edges on one or both sides, and he welds the flanges of the plates together. Or he

causes the plates to meet with a butt or a lap joint. He covers the joint with a flangeless plate or wide bar either at the front or back or on both sides, and he welds the whole together.—Patent abandoned.

1680 J. KING, Norwich. *Cinder sifter.* Dated May 31, 1869.

This consists in forming it somewhat like an ordinary dust pan, such as is used by housemaids, with the difference that, instead of making the bottom thereof solid, the inventor proposes to form it as a sieve, beneath which he fits a sliding drawer to catch the dust, or he forms a chamber beneath with a small door at one side to discharge the dust therefrom after it has been separated from the cinders. The front is formed inclined or sloping, and of a piece of solid sheet metal, up which the cinders and ashes are to be swept on to the open bottom.—Patent abandoned.

1681 S. BIRCH, Belfast. *Handkerchief boxes.* Dated May 31, 1869.

This consists in uniting the two halves of handkerchief, glove, and other similar fancy boxes by means of an elastic band or bands of india-rubber fixed at each end, and so arranged as to form hinges for the box, which hinges at same time have a constant tendency to close and hold the box in the closed position.—Patent abandoned.

1682 W. R. LAKE, Southampton-buildings, Chancery-lane. *Propelling machinery.* (A communication.) Dated May 31, 1869.

This consists, principally, in combining with a rotary shaft and with a wheel or wheels located and fixed thereon a double set of spring pawl levers and pawls or clutches, each lever being hung and rocking loosely upon the shaft, and bearing a feed pawl or clutch which grasps or impinges against the periphery of the wheel as the pawl arm of the lever is moved in one direction, thereby rotating the wheel, the pawl arm being carried in the opposite direction into normal position by a suitable spring, and each lever and pawl working independently of the other, so that the shaft may be driven by one pawl alone or by both together, or both alternately, and without regard to extent of movement, there being no cranks and no dead centres to require a certain fixed play of the pawl lever.—Patent completed.

1683 H. HOLDREGE, New York. *Making gas.* (A communication.) Dated May 31, 1869.

This consists in the manufacture of heating and illuminating gases by decomposing highly heated and finely divided jets of steam by means of anthracite coal. In the combination of the decomposing retort having a channelled, grooved, or flued flooring of perforated tiles of fire-clay or other suitable material, with a steam superheater and steam dryer for the purpose of drying and superheating and distributing the steam or vapour of water.—Patent completed.

1684 J. H. JOHNSON, Lincoln's Inn-fields. *Stoves.* (A communication.) Dated May 31, 1869.

The back of the improved stove is built by preference of firebrick, and the front is composed of three movable grates of which two usually remain in a vertical plane, whilst the third is normally a horizontal plane, and joins at its front edge the lower portion of the lower one of the two vertical grates. The fuel for the main portion of the cooking is contained within these three grates, but a smaller supplementary fixed horizontal grate is also provided for use in minor operations, such as warming milk and the like, when the main fire need not be used.—Patent abandoned.

1685 F. A. CALVERT, Manchester. *Engines.* Dated June 1, 1869.

This relates to a previous patent dated October 17, 1864 (No. 2,555). According to the present invention the cylinders are open at the top and closed at the bottom by the foot valves, and are secured at each end of the cistern or tank, to which are fixed the standards supporting the journals of the flywheel shaft, at each end of which is a disc in which the crank pins are secured. Within each cylinder is a piston connected to the crank pins by the rods. Between each piston and its foot valve is the float. The pistons and floats are provided with spring and other packings of any suitable description.—Patent completed.

1686 T. R. CLARKE, W. BYWATER, T. LAWSON, and O. L. LISTER, Leeds. *Felted fabrics.* Dated June 1, 1869.

This consists, first, in the manufacture of felted fabrics by employing bats or slivers made with their fibres crosswise, or at right or other angles to the direction of the length of the batt or sliver combined with other batt or batts or slivers having fibres thereof laid in the direction of its length of such other batts or slivers.—Patent completed.

1687 A. RUSHWORTH, Nottingham. *Circular knitting machines.* Dated June 1, 1869.

The inventor employs a circular knitting machine which may be of the usual construction, but in the circle of needles he forms a space by taking away one needle and also the lead in which it is cast, and instead, inserting a piece of brass or other suitable material with a slit cut in it or a hole drilled through it vertically in such wise that the stem of a needle is free to turn in this slit or hole, such needle having its head or bearded end made of a shape and gauge corresponding with the other needles, but the stem is made somewhat longer, and is passed down the hole in the piece above named, and also into a hole drilled to receive it in the upper end of a short rod, the needle being held fast in the rod by means of a short screw, so as to enable the needle to be adjusted as required, or a new one to be inserted; this needle does not slide up and down, or horizontally, when at work, but revolves one way during one revolution of the circular head and the reverse way the next succeeding revolution.—Patent completed.

1688 C. H. GARDNER, West Harding-street, E.C. *Lubricator.* Dated June 1, 1869.

This consists in a chamber, vessel, or receiver closed on all sides, or nearly so, except at the bottom, where a small aperture is provided through which passes a rod, wire, bar, or pin, grooved, furrowed, or channelled on its external surface. This rod, wire, or pin reaches up to or into the interior of the vessel or chamber through a suitable guide block or surrounding piece in which it may be held preferably by a bent wire. The lubricating agent trickles down the furrows or channels of the rod, bar, or pin, on to the shaft journal.—Patent completed.

1689 O. BARRETT and G. P. WHEELER, Mitcheldean. *Mortar.* Dated June 1, 1869.

For 1 ton of this improved mortar the inventors grind and otherwise prepare by suitable machinery the following materials:—283lb. of lime, either caustic or hydrate, 1,728lb. of slag, *i.e.*, the vitreous mass which covers fused metal in the smelting hearths, and is known as dross slag or scoriæ, and in chemical terms by the names of silicate of lime and silicate of alumina, and 224lb. of calcined coal shale clay. Total, 2,240lb., equal 1 ton.—Patent completed.

1690 J. WARHURST, Whaley Bridge. *Preventing door draughts.* Dated June 1, 1869.

The inventor closes openings or apertures by means of a bar of wood, metal, or other suitable material arranged to work in a rebate formed in an outer casing, mould, or skirting applied to the bottoms of doors and connected to metallic plates, to which spiral springs are affixed, so that as a door thus provided closes, the end of such bar comes in contact with a projection formed in the door jamb, and is thereby pushed forwards and downwards by the action of the metallic plates, which act in the same manner as cranks, and in turning wind up the spiral springs.—Patent completed.

1691 H. BROWNING, Limehouse. *Varnish or paint.* Dated June 1, 1869.

The inventor prepares a solution which may be used either mixed with "ground colour," as a "paint," or by itself as a "varnish or preservative solution," and in either form is equally applicable to stonework, woodwork, or iron. The ingredients are a gum resin, by preference, "gum dammar," spirit and sugar of lead, to which may be added, especially for stonework, a little wax and corrosive sublimate. The spirit preferred is any one of the various rectified spirits of coal tar or petroleum, such as benzine and benzoline, now so largely manufactured.—Patent completed.

1692 J. S. STUBBS, Lincoln. *Steam engines.* Dated June 1, 1869.

The inventor dispenses with cylinder covers and bolts, slide bars, front glands, slide blocks, gudgeon column, and bolts, and he employs a cylinder of the common form, but with a partition in the centre, and with two pistons instead of one. The engine receives the steam from the centre of the cylinder instead of at each end, as in the old form, so that it has not to be conveyed by passages the length of the cylinder.—Patent abandoned.

1693 C. F. WALDO, Bread-street, Cheapside. *Sewing machines.* (A communication.) Dated June 1, 1869.

The first part of this invention relates to what is called and known as the "tension." The second relates to what is known as the "threading of the machine." The third relates to the adjustment of the needle to the shuttle race. The fourth relates to guarding the needle against breakage by the shuttle nose. The fifth relates to the raising and to the turning the presser foot. The sixth relates to what is called and known as the feed.—Patent completed.

1694 J. A. BINDLEY, Burton-on-Trent. *Attemperators* Dated June 1, 1868.

This consists in employing instead of the ordinary attemperator or pipe and casing a pair of tubes laid side by side and coiled together into a large tapered spiral roughly approximating in form to that of the cask in which they are to be employed, but of smaller diameter than the interior of the cask. The inventor connects one of these pipes with the inlet nozzle and the other with the outlet nozzle, usually employed with the ordinary attemperators, and he connects the extremities of the pipes themselves at the termination of the spiral, so that the course of the water shall be along one and back by the other throughout the entire spiral.—Patent completed.

1695 M. WRIGLEY, Oldham. *Railway accident preventor* Dated June 2, 1869.

This consists principally of a fence or railing that can be raised at the edge of the platform when required to prevent persons from crossing the line or entering or leaving the carriages, and lowered again when not required.—Patent abandoned.

1696 R. B. COOLEY, Nottingham. *Hats.* Dated June 2, 1869.

When forming a hat or other covering for the head from one thickness of elastic fabric only the inventor applies a proofing to such fabric. He next takes the pieces of fabric of suitable form and prepared as above described and steams them, after which they can be shaped or blocked into a seamless hat or other covering for the head.—Patent completed.

1697 J. FLETCHER, Ashton-under-Lyne. *Union cocks* Dated June 2, 1869.

This consists in so arranging a steam or other cock that it not only answers the ordinary purpose of a cock for opening and shutting off the supply, but it also forms a union joint which may be readily uncoupled if required.—Patent completed.

1699 A. WATT, New Cross, and T. KNOWLES, Edgbaston. *Printing surfaces.* Dated June 2, 1869.

The inventors first construct a roller by casting or drawing a flat surface, as may be required, of any suitable cheap metal or alloy, but they prefer to employ steel or iron of a tough quality with about one to two per cent. of lead mixed therewith just previous to casting. This mixture of iron and lead or steel or other suitable metal or alloy forms the body of the printing surface, or the body or base may be composed of iron or steel alone and may either be cast or drawn, and the inventors prefer to employ this surface in the slightly roughened state in which it leaves the moulds used in its production if produced by casting, or the surface may be specially roughened by any convenient means. Hitherto, when it has been attempted to deposit metals upon metallic or other surfaces by electro-deposition they have undergone a special preliminary treatment for the purpose of rendering them smooth, but it is found that this preliminary preparation is positively injurious to the purpose to be attained, namely, permanent adhesion of the deposited metal. The inventors insert or cast into the surface of the base or body of the roller or other surface thus obtained, and which surface is intended to receive the copper deposit, a number of copper screws or copper-headed screws having expanded heads, or they insert or cast into such surface, at intervals of a few inches, ribs or strips of copper, the surfaces of such screw heads or inserted ribs or strips of copper being left flush with the face of the body or base of the cylinder or other surface.—Patent completed.

1700 G. V. TURNBULL, C. SALVESEN, and R. IRVINE, Leith. *Lubricants.* Dated June 2, 1869.

The inventors take a certain proportion of heavy oil and subject it to heat in any suitable vessel, and when so heated they add to it resin or other suitable substances, such as gum, in various proportions, which are dissolved in the same. The result is an oil holding resin, gum, or other substances in solution.—Patent completed.

1701 B. J. B. MILLS, Southampton-buildings. *Alarm for boilers.* (A communication.) Dated June 2, 1869.

This apparatus is provided with a water chamber or reservoir, located externally of the boiler above the water line and communicating with the interior of the boiler through a pipe at the lowest level to which the water in the boiler can properly be allowed to descend.—Patent completed.

1702 N., G., and E. SMITH, Thrapston. *Cutting leather.* Dated June 2, 1869.

This consists, first, in so cutting the material into the lengths and widths required that the skiving is effected at the same time and by the same instrument which effects the cutting, whereby the material, which has been heretofore lost by skiving, is saved and time is considerably economised.—Patent abandoned.

1703 J. H. SMITH, East-road. *Velocipedes.* Dated June 2, 1869.

The guiding handle is made to turn on a socket fixed to the frame, and a spring is adapted to the front wheel to prevent vibration of the guiding handle and riders' arms in going over rough or uneven roads. Another improvement consists in forming the fork of the front wheel cranked, whereby the front wheel always inclines to a straight line with the back wheel.—Patent abandoned.

1704 E. BEMELMANS and A. VAN VOLXEM, Brussels. *Working railway signals.* Dated June 2, 1869.

The inventors employ a series of longitudinal bars (having notches or grooves cut in them of different forms and dimensions) and connected with the levers of the switch mechanism, and also with that of the signals. These bars are connected (and give motion by means of elbow or bell-crank levers) to a series of transverse bars, which also have cut in them notches or grooves which work into and correspond with the notches or grooves on the longitudinal bars, so that the whole system of bars and levers is connected together.—Patent abandoned.

1705 F. R. A. GLOVER, M.A., Brading, Isle of Wight. *Anchors.* Dated June 2, 1869.

The inventor fixes in the sides of the shank of the anchor, and at or near the centre of gravity of the anchor, a pair of studs or centre pins, to which he adapts a pair of tumbling arms, either of which will extend from below the shank or to outside of the palm, both inclusive. The outer ends of these arms are connected together by curved or straight bars arranged on each side of the anchor, and as the tumbling arms are arranged to turn easily on their centre pins, it will be understood that when one of the palms of the anchor enters the ground the lowermost tumbling arm will be thrust back, and will thus carry the arm under and beyond the upper palm of the anchor, and thereby prevent the cable from passing under the palm and fouling the anchor.—Patent completed.

1706 H. LARKIN, Leighton-road, W. WHITE, Thurlow-road, Hampstead. *Magnesium.* Dated June 2, 1869.

According to this invention the inventors add the hydrochloric acid in such proportion relatively to the carbonate of magnesia that in the solution obtained the acid shall be considerably in excess; they then partially dry the acid solution in thin layers in covered dishes at a temperature of about 110deg. Cent., taking care that there shall be sufficient aperture for the ready escape of the heated acid vapour. The vessels used may be of glazed earthenware or porcelain. When the acid solution is thus made as dry as can conveniently be done at such a temperature, the inventors remove the residue from the evaporating dishes and place it in plumbago or other suitable crucibles or vessels in which they rapidly fuse it at a red heat under as close cover as is practicable.—Patent completed.

1707 T. B. WORTH, Stourport. *Carpets and coach lace.* Dated June 2, 1869.

In the manufacture of terry fabrics, the terry loops are usually formed with yarns or threads of worsted or silk. The inventor now substitutes for these threads in parts of the fabric threads of gold or silver or other metal, or rather threads covered with such metals.—Patent abandoned.

1708 C. FRANCOIS, Austin Friars. *Goods waggons.* (A communication.) Dated June 2, 1869.

The body of the waggon, instead of being built of wood and secured to a wooden framing, is constructed of plain or corrugated iron or steel plates, and is preferably made of a cylindrical form or some such shape, so as to present no sharp angles. This wrought iron or steel body or shell is let down between the wheels, recesses being made in the bottom or under side to allow the axles to pass. A considerable portion of the body or shell, and, consequently, the load carrier therein, will thus be below the level of the platform of ordinary waggons, and the head stocks or buffer beams to which it is securely fastened. The closed ends of the cylindrical body or shell are by preference convex, and suitable entrance doors are provided in the sides of the body in some position convenient for obtaining access to the interior.—Patent completed.

1709 C. FRANCOIS, Austin Friars. *Moorings.* (A communication.) Dated June 2, 1869.

The inventor constructs a mooring with wings radiating out from it in such manner that it may readily penetrate the ground, and when it has penetrated to the required depth by slightly raising it the wings may expand and grip or hold by the soil that has not been disturbed.—Patent abandoned.

1710 A. L. SIMPSON, Stowmarket. *Composition for cleaning sheep.* Dated June 9, 1869.

The inventor takes bichloride of mercury or corrosive sublimate from 64 to 128 parts; creosote, carbonic acid, or phenol, 1 to 3; sugar, 96; starch, 8; gum, dextrine, gelatine, or isinglass, 32; and he melts and mixes these materials with water with a small quantity of colouring matter.—Patent abandoned.

1711 C. OSTLUND, Stockholm. *Lamps.* Dated June 3, 1869.

The peculiar feature in these lamps is the arrangement of the air or draught tube, which passes through the body of the oil chamber, thus keeping the oil cool. The wick

fits on the outside, and may be raised and lowered in any convenient and well-known manner, such as for instance by turning a small pinion pressing with its teeth into the meshes of the wick.—Patent completed.

1712 B. F. WEATHERDON, Chancery-lane. *Safety despatch box.* (A communication.) Dated June 3, 1869.

This consists in forming the boxes or bags with one or more airtight compartments (in which the various articles are placed) hermetically closed by grooved joints furnished with india-rubber and tightened by screws or otherwise, by which air is retained within the said compartments, sufficient for floating the bag with its contents till picked up or secured.—Patent abandoned.

APPLICATIONS FOR LETTERS PATENT.

Dated December 14, 1869.

3608 T. Moore, Aston, near Birmingham. Certain improvements in castors for tables, sofas, pianos, and other purposes.

3609 J. Barlow and E. Pilkington, Bolton, Lancashire. Certain improvements in looms for weaving.

3610 B. B. de Morell, Chancery-lane. An improved method of raising navigable vessels or other heavy bodies above the surface of the water.

3611 W. Hepple, Low Walker, near Newcastle-on-Tyne, and M. Stainton, South Shields, Durham. Improvements in furnace bars and furnaces.

3612 W. and W. M'Gee, Paisley, Renfrewshire. Improvements in machinery for doubling and winding fibrous materials.

3613 R. Morton, Stockton-on-Tees, Durham. Improvements in refrigerators or apparatus for cooling liquids, which improvements are also applicable to distillation and surface condensation.

3614 P. Parkes, West Bromwich, Staffordshire. Improvements in machinery for cutting or shaping screw nuts and the heads of bolts, and for other like purposes.

3615 W. E. Newton, Chancery-lane. Improvements in harness for looms.

3616 W. E. Newton, Chancery-lane. Improvements in rotary engines.

3617 G. W. Honeyman, Gateshead-on-Tyne, Durham. An improved preparation for the removal and prevention of incrustation in steam boilers.

Dated December 15, 1869.

3618 W. C. Homersham, Willes-road, Kentish Town. Improvements in pipes and conduits, and in the joints thereof.

3619 N. P. Burgh, Waterloo-road, Lambeth. An improved double or single acting pump.

3620 W. R. Lake, Southampton-buildings, Chancery-lane. Improvements in apparatus for making and breaking electro-magnetic circuits, chiefly designed for governing short or local circuits for operating signals on long telegraphic lines.

3621 E. Moss, Winchester House, Old Broad-street, City. Self-acting malt drying apparatus.

3622 E. Johnson, Manchester. Improvements in the arrangement and construction of granaries, and in machinery or apparatus for drying, renovating, elevating, and distributing grain.

3623 W. K. Stock, Darlington, Durham. Certain improvements in looms for weaving.

3624 J. Hamer, White Horse-yard, High Holborn. Improvements in steam engines, which are called Hamer's patent revolving and oscillating cylinder, with cup and ball joint for steam engines.

3625 J. Askew, Hampstead-road. A globular refrigerator for cooling brewers' and distillers' wort.

3626 J. Outram, Sevenoaks, Kent. Improvements in propelling vessels.

3627 J. H. Sams, Bon Accord Works, Aberdeen. Improvements in seed-sowing machines and manure distributors.

3628 E. T. Hughes, Chancery-lane. Improvements in wood moulding and panelling machines.

3629 T. Parry, Balham, Surrey, and J. M'Hardy, Edinburgh. An improved drag or brake applicable to waggons, omnibuses, carriages, and other wheeled vehicles.

3630 A. Hall, Quarmby, Huddersfield. A new or improved fabric, which is called Tartan reversible Astrachan, and in the means of producing same.

3631 G. Seymour, Lime street, City. Improvements in the construction of ships and vessels to facilitate the steering and propelling the same.

3632 J. S. Battye, Stirling, North Britain. Improvements in mechanism for spinning woollen and other yarns.

3633 J. H. Johnson, Lincoln's Inn-fields. Improvements in means or apparatus for reducing friction.

Dated December 16, 1869.

3634 J. Heap, Hampstead-road. Improvements applicable to earth closets or commodes and urinals.

3635 E. Tomlinson, Manchester. Improvements in furnaces for preventing the formation of smoke or effecting its combustion.

3636 J. W. Greenwood, Sussex-road, Upper Holloway. An improved fastening for buckles, called a screw strap holder.

3637 W. T. Henley, Leadenhall-street, City. Improvements in protecting telegraph wires and cables.

3638 S. Johnson, West Croydon. Improvements in velocipede carriages and vehicles.

3639 J. O. Butler and J. Nicholls, Leeds, and W. Heslop, Doncaster, Yorkshire. Improvements in the manufacture of wheels and pulleys.

3640 G. Wilson, Field Head, Sheffield. Improvements in railway wheels.

3641 W. Richards, Birmingham. Improvements in breech-loading firearms and cartridges.

3642 J. Outram, Sevenoaks, Kent. Improvements in steam motive-power engines.

3643 S. A. Buirat, Boulevard de Strasbourg, Paris. An improved process for producing engraved metallic plates for commercial indications.

3644 F. E. Duckham, Millwall. Improvements in hydrostatic weighing machines, applicable also for testing chains and other similar purposes.

3645 A. M. Clark, Chancery-lane. Improvements in the manufacture of superphosphate of lime.

Dated December 17, 1868.

3646 J. Ghisi, Lodi, Italy. A new and useful system of spherical ship, with circular steam engine, for the use of marine locomotion, and application of the machine to land locomotion, also of same system to other motive-power engines.

3647 A. R. Stocker, Thomas-street, Horselydown. Improvements in stoppers for infants' feeding and other bottles, and in the manufacture, construction, combination, and employment of the whole or part of the articles to be used.

3648 H. Willett, Arnold House, Brighton, Sussex. Improvements in the construction of groynes and breastworks.

3649 L. Sterne, Great Queen-street, Westminster. Improvements in buffers, also applicable to bearing and other springs.

3650 G. Weir, Glasgow. Improvements in slide valves.

3651 W. Foulds, Paisley, Renfrewshire. Improvements in feed-water heaters.

3652 W. Barrs, Manchester. Improvements in the manufacture of elastic webbing.

3653 R. Idle and G. Naylor, Earls Heaton, near Dewsbury, Yorkshire. Improvements in apparatus for consuming smoke.

3654 E. A. Inglefield, Grove End-road, St. John's Wood. Improvements in hydraulic apparatus to be used on shipboard for utilising the pressure of the external water.

3655 J. L. Hancock, Ley Hill, Sutton Coldfield, Warwickshire. Improvements in apparatus for crushing or breaking bones for domestic and other purposes.

3656 T. C. March, Ambassadors' Court, St. James' Palace. Improvements applicable to the ornamentation of articles of furniture and to the interior decoration of houses.

3657 G. Rhodes, Lincoln. Improvements in apparatus for actuating the valves of steam engines.

3658 A. M. Clark, Chancery-lane. Improvements in jacquard apparatus.

Dated December 18, 1869.

3659 W. Carver, Manchester. Improvements in sewing machines.

3660 R. C. Goddard, Stockport, Cheshire. An improved portable cooking apparatus.

3661 J. C. Martin, High-street, Barnes, Surrey. An improvement in the manufacture of finings as a substitute for isinglass for clarifying wine and beer.

3662 W. E. Gedge, Wellington-street, Strand. An improved system of pessary.

3663 W. Hargreaves, Soho Ironworks, Bolton, Lancashire. Certain improvements in steam boilers.

3664 W. Foulds, Paisley, Renfrewshire. Improvements in apparatus to promote circulation in steam boilers.

3665 J. Smiles, Birmingham. Improvements in breech-loading firearms.

3666 W. Potts, Handsworth, Staffordshire. An improved apparatus for effecting or promoting the ventilation of rooms or buildings and for preventing down-draught in chimneys.

3667 R. Nevill, Wern Ironworks, Llanelly, Carmarthenshire. Improvements in the manufacture of retorts and annealing pots and stands.

3668 J. C. Ramsden, Bradford, Yorkshire. Improvements in looms for weaving.

3669 J. M. Shiels, Preston Pans, Haddingtonshire. Improvements in preparing malt or grain for brewing or distilling, and in the means or apparatus employed there for.

3670 S. Butler, Nottingham. Improvements in the manufacture of lace in twist lace machines.

3671 S. Giles, Borough. Improvements in apparatus to be used in the fermentation of worts and other fermentable liquids.

3672 D. W. Bailey, Chelsea, Suffolk, Massachusetts, U.S.A. A new and useful process of laying composite pavements for streets, &c.

3673 H. Kinsey, Robin Hood Works, Nottingham. Improvements in the manufacture of surface condensers, hot-water apparatus, and in steam boilers and water heaters for the same.

3674 L. Woodward, Arkwright-street, Nottingham. Improvements in knitting frames.

3675 G. T. Bousfield, Loughborough Park, Brixton Improvements in the treatment of aromatic secondary monamines for obtaining colouring matter.

3676 W. L. Wise, Chandos Chambers, Adelphi, Westminster. An improved instrument for levelling and for measuring angles.

Dated December 20, 1869.

3677 J. Robertson, Glasgow. Improvements in machinery for treating and shaping metals.

3678 G. and G. A. Ermen, Manchester, and W. Foster, Pendlebury. Improvements in the construction of brushes for polishing yarns or threads, and for other purposes.

3679 M. Henry, Fleet Chambers, Fleet-street, City. Improvements in the mode of, and apparatus for, typographical composing and printing.

3680 F. Ellershausen, Ellershause, Novia Scotia, and T. Wehle, Southampton-buildings, Chancery-lane. Improvements in the means and apparatus for utilising the force of the waves.

3681 G. Newsum, Hunslet, Leeds. Improvements in means or apparatus for pumping.

3682 G. T. Livesey, South Metropolitan Gas Works, Old Kent-road. Improvements in apparatus used in the manufacture of gas.

3683 W. Morris, South Hackney. Improvements in permanent way.

3684 E. T. Hughes, Chancery-lane. Improved garments to be worn next the skin for sanitary purposes.

3685 J. Wild, Rochdale, Lancashire, and J. Smith, Halifax. Improvements in the manufacture of pile fabrics.

3686 J. H. Richardson, Poultry, City. Improvements in boxes or cases for packing and carrying eggs.

3687 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in ploughs and cultivators for tilling the soil.

3688 T. Shakespear and G. Illston, Birmingham. Improvements in sewing machines.

3689 A. M. Silber, Wood-street, Cheapside, City, and F. White, Camberwell. Improvements in apparatus for indicating time, partly applicable to revolving apparatus for other purposes.

3690 W. Galloway, Francis-street. Improvements in joints or couplings for pipes, rods, and other like articles, which improvements are also applicable for stopping pipes, bottles, casks, and similar receptacles.

3691 G. C. Fraser, Bromley-by-Bow. Improved means of disinfecting or drying clothes, bedding, or other articles, also apparatus in connection therewith.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the "London Gazette," December 21, 1869.

2344 J. U. Fairbairn
2353 T. Leach
2382 W. R. Lake
2388 C. W. Zenger, C. L. Strube, and L. Merlett
2390 J. E. Holmes
2391 T. S. Blair
2392 T. S. Blair
2399 A. H. Brandon
2405 G. White
2414 W. E. Newton
2415 J. Deas and R. C. Rapier
2417 H. House
2422 T. Beckwith
2424 J. Cowan
2433 T. Coad
2446 H. H. Trenor
2456 M. H. Jacobi
2480 W. N. Hutchinson
2482 F. Braby
2506 L. D. Girard
2513 J. Williams
2521 W. J. Cockburn-Muir
2549 S. C. Lister
2576 W. Glover
2577 W. E. Newton
2639 H. B. Barlow
2640 S. Ody and R. Nuttall
2685 W. E. Newton
2698 A. V. Newton
2793 S. G. Archibald
2811 W. E. Newton
2855 W. E. Newton
3372 G. and J. Ritchie
3395 J. B. Paddon
3400 J. Downs
3413 J. Keats
3423 B. Wood
3433 G. Bertram and M. Patterson
3437 J. Howard and E. T. Bousfield
3442 B. Oldfield
3457 W. Parham
3471 R. Hornsby and J. E. Phillips
3479 F. N. Target
3484 R. N. Slight and W. F. Denholm
3496 W. Tatham
3497 J. Smith and T. Eastwood
3564 R. A. Ballou
3597 W. R. Lake

LIST OF SEALED PATENTS.

Sealed December 17, 1869.

1879 W. R. Lake
1885 A. S. Harington
1886 H. Bauerrichter
1894 W. Pidding
1895 A. J. Glas
1897 A. Manbre
1922 H. A. F. Duckham
1945 F. Wohlgemuth
1959 C. L. V. Yon
1977 A. Walker
2064 H. H. Murdoch
2218 G. T. Abbey
2997 N. Washburn
2999 E. Roe
3009 J. W. Robinson and T. Murray

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

68 J. Silvester
3199 V. Vandroy
3276 J. H. Grell
3289 A. V. Newton
3290 A. Woods
3291 T. Berney
3305 W. Campion
3307 C. E. Brooman
3321 J. M'F. Gray
3331 G. Davies
3337 S. and J. J. Perry
3354 W. E. Newton
3357 C. Lungley
3428 F. Leonhardt

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3392 S. C. Lister
3394 I. Holden
3397 W. S. Longridge

PROVISIONAL PROTECTION FOR SIX MONTHS

Has been granted upon Specifications bearing the following numbers:—

3183	3480	3493	3504	3514	3526	3539	3549
3347	3482	3494	3505	3516	3528	3540	3550
3380	3484	3495	3506	3517	3530	3541	3551
3431	3486	3496	3507	3518	3532	3543	3552
3442	3487	3497	3508	3519	3533	3544	3554
3469	3488	3498	3510	3520	3534	3545	3558
3472	3489	3499	3511	3521	3535	3546	3560
3474	3490	3500	3512	3524	3536	3547	3562
3476	3491	3502	3513	3525	3537	3548	3566
3478	3492						

LIST OF SPECIFICATIONS PUBLISHED

For the week ending December 18, 1869.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s d.		s. d.		s. d.		s. d.		s. d.
1166	1 0	1358	0 10	1400	0 6	1418	0 4	1440	0 4	1470	0 4
1265	0 10	1364	0 8	1401	3 10	1419	0 4	1447	0 4	1473	0 4
1298	1 2	1365	1 6	1402	0 10	1420	0 4	1450	0 4	1474	0 4
1318	2 2	1369	1 2	1403	0 6	1421	0 4	1453	0 4	1476	0 4
1322	0 10	1373	0 8	1407	1 0	1423	0 4	1454	0 6	1478	0 4
1332	0 10	1374	1 6	1409	1 0	1424	0 6	1459	1 0	1481	0 4
1333	1 0	1377	1 4	1412	0 4	1426	0 4	1460	0 4	1483	0 4
1335	1 4	1382	0 10	1413	0 4	1428	0 8	1461	0 4	1487	1 4
1338	0 8	1384	0 6	1414	0 4	1430	0 6	1462	0 4	1488	1 8
1341	2 6	1386	1 6	1415	0 4	1437	0 4	1463	0 4	1516	0 4
1345	1 4	1394	1 4	1416	0 4	1439	0 4	1464	0 4	1641	0 4
1352	5 6	1399	1 8	1417	0 10						

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